E.T.

38th INTERNATIONAL CONGRESS of MEAT SCIENCE and TECHNOLOGY

August 23 - 28, 1992
Clermont Ferrand, France

ABSTRACTS

NOTE TO PARTICIPANTS

In each session the abstracts are classed by the first author in alphabetical order.

This booklet presents the abstracts as they were received. We are sending you this booklet in preparation for the Congress. We remind you that this will be the only distribution and you are asked to bring it along with you to the Congress.

CONTENTS

Session 2 - GROWTH AND MEAT QUALITY

- P.T. GARCIA, J.J. CASAL (Argentina)
  Lipids in longissimus muscles from grass or grain fed steers.

- P.T. GARCIA, J.J. CASAL (Argentina)
  Intramuscular vs dissected body fat in grass fed steers.

- P.T. GARCIA, A. CASTRO ALMEYRA (Argentina)
  Lipids in argentine beef cuts

- P.T. GARCIA, J.J. CASAL (Argentina)
  Compensatory growth and zeranol implants : effect on steer body fats.

- G.J. GARSSEN, A.H. HOVING-BOLINK, J.C. VERPLANKE (Netherland)
  Effects of clenbuterol and salbutamol on carcass and meat quality of veal calves.

- D.E. GERRARD, AL.L. GRANT, M.D. JUDGE. (USA)
  Serum-induced myoblast proliferation and gene expression during the development of double muscled and normal cattle.

- S. HARTMANN, W. OTTEN, M. KRATZMAIER, A. BERRER, H.M. EICHINGER (Germany)
  Effects of breed, halothan-genotype and sex on the lipid composition of two skeletal muscles and adipose tissue in swine.

- K. LUNDSTRÖM, I. HANSSON, M. JOHANSSON, L. ANDERSSON, K. ANDERSON, J. HARANSSON (Sweden)
  Carcass and meat quality of F_2-crosses between european wild boars and domestic pigs.

- C.A. MARGARIA, P.T. GARCIA (Argentina)
  Effect of dietary energy level on free fatty acid composition in bovine Longissimus dorsi muscle.

- P. MARINOVA, Z. SHANDARSKA, V. BANSKALIEVA (Bulgaria)
  Deposition and composition of muscular tissue in lambs under different feeding level and clenbuterol participation

- D. MICOL, Ph. BERGE, D. DOZIAS, J. LEPETIT, G. LIENARD, B. PICARD, M. RENERRE, J. ROBELIN, C. TOURAILLE, Y. GEAY (France)
  Effect of pregnancy and calving on muscle characteristics in cattle.

- J. MOJTO, V. KARTUSEK, O. PALANSKA (Czechoslovakia)
  Carcass and meat quality of fallow deer.

- L. MULLER, Z. PEROBELLI, G.L. FEIJÜ, C. GRASSI (Brazil)
  Cull cow physiological maturity and its effect on carcass and meat quality.

- F. NICASTRO, W.G. MOODY (Italy/USA)
  Effect of management system on histological characteristics of lamb muscles.

- M.A. OLIVER, M. GISPERT, P. GOU, DA. DIESTRE (Spain)
  Pig meat quality in crossbreed experiments in the mediterranean area.

- W. OTTEN, A. BERRER, S. HARTMANN, T. BERGERHOFF, H.M. EICHINGER (Germany)
  Effects of a magnesium fumarate supplementation on meat quality in pigs.

- T. OSHIDA, R. SAKATA, T. INOMATA, T. FUKUYASU, K. KOHZAKI, K. KUWANO (Japan)
  Effects of enzyme feed additives on pig production for environmental protection in livestock industry.

- C.A. PAYNE, M.C. HUNT, K.E. WARREN, J.M. HAYDEN, J.E. WILLIAMS H.B. HEDRICK (USA)
  Histochemical properties of four bovine muscles as influenced by compensatory gain and growth impetus.

- B. PICARD, C. BARBOIRON, RD JAILLER, RT JAILLER, C. DAMERGI, J. ROBELIN, Y. GEAY (France)
  Effect of postnatal feeding regime and castration on muscle fiber types in cattle.

- Ch. REHFELDT, I. FIEDLER, R. WEIKARD, K. SPITSCHAK, K. ENDER (Germany)
  Effects of pST administration to pregnant sows on developmental stage and Semitendinosus muscle cellularity of the newborn piglets.

- F. SCHWÄGELE, C. HASCHKE, G. KRAUSS, K.O. HONIKEL (Germany)
  Isoenzyme pattern of pyruvate-kinase from PSE-pork and meat of normal characteristics.

- D. SKORJANC, M. CEPON, M. ERJAVEC (Slovenia)
  Characteristics of muscle fibers in bulls regarding growth intensity and fate rate in carcasses.

- M.B. SOLOMON, V.G. PURSEL, E.W. PAROCZAY (USA)
  Lipid composition of carcass tissue from transgenic pigs.

- A. SUURMAA, V. KANGRO (Estonia)
  Sources and quality of beef produced in Estonia.

- T. VAN VOOREN, J. VAN HOOF, D. VEREECKE, L. ISTASSE, I. DUFRASNE, A. DESWYSEN (Belgium)
  Influence of nutrition on meat quality in double-muscled bulls.

- C. WINKEL (Australia)
  The effect of breed on the colour of the muscle Longissimus dorsi in cattle.

Session 3 - PRESLAUGTHER AND SLAUGHTER

- P. BARTON GADE, L.BLAABJERG, L.CHRISTENSEN (Denmark)
  New lairage system for slaughter pigs-effect on behaviour and quality characteristics.

- M.C.BRESSAN, P.O.V.CULAU, J.M.R.OURIQUE, S.NICOLAIEWSKY (Brazil)
  Effect of time interval between bleeding and the entry of carcasses in to the chilling chamber and chilling rates on pork quality.

- G.A. ELDRIDGE, R.D. WARNER (Australia)
  Influence of previous experience and pre-slaughter behaviour on pig meat quality.

- A. FORTIN, S.A. POMMIER, A. HOUDE (Canada)
  PSE in pork: The genotype as determined by the restriction endonuclease assay, and the environment.

- B. FOSTIER (France)
  Reduction of DFD carcass percentage by supply of sorbitol in cattle before slaughtering.

- T. GRANDIN (USA)
  Double rail restrainer system for holding large beef cattle during stunning.

- N.G. GREGORY, L.J. WILKINS, C.A. JONES (U.K.)
  Cardiovascular function in stress sensitive pigs.

- T.L. HALD, L.RAMSGAARD JENSEN (Denmark)
  pH variations and carcass bruising in beef carcasses from two slaughter houses.

- S.I. KHVYLYA, A.A. BELOUSOV, T.G. KUZNETSOVA, V.V. AVILOV (Russia)
  The study of microstructure of slaughter animals meat under conditions of ecological disbalance

- L. KOVAC, R.LAHUCKY, J.MLYNEK (CSFR)
  Stress sensitivity and meat quality valuation from sows by bioptic method.

- H. MARIBO (Denmark)
  Time from last feed to slaughter in relation to skatole level of entire male pigs.

- A.C. MURRAY, S.D.M. JONES (Canada)
  The effect of mixing, fasting and genotype on carcass shrinkage and pork quality.

- G. PIVA, A. PRANDINI, M. MORLACCHINI, L. DI RENZI (Italy)
  Effect of adding nicotinic acid and nicotinamide in pigs diets a few days prior to slaughtering on muscle glycogen content.

- S.A. POMMIER, A. HOUDE (Canada)
  Use of the DNA based restriction endonuclease assay to determine the relationship between malignant hyperthermia and pork quality.

- M. REI, V. KIRIKALL (Estonia)
  The influence of some antistressors to technological characteristics of pork.

- R.D. WARNER, G.A. ELDRIDGE, J.L. BARNETT, R.H. KING, C.G. WINFIELD (Australia)
  Pre-slaughter behaviour and meat quality of pigs fed excess dietary tryptophan.

Session 4 - ASSESSMENT OF CONSUMER PREFERENCES (CONCURRENT SESSION)

- H. AHMAD (Pakistan)
  Status of meat science and technology in Pakistan and South Asia

- J. ARNAU, L. GUERRERO, P. GOU (Spain)
  Effect of pH and genetics on texture characteristics of dry cured ham.

- M. ANDERSSON (Denmark).
  Yield and market quality in pigs in relation to sex, slaughter weight and meat content.

- P. ALBERTI, C. SANUDO, P. SANTOLARIA, C. TOURAILLE (Spain/France)
  Sensory evaluation of meat in young bulls fed with different diets.

- M.T. BARGE, G. DESTEFANIS, A. BRUGIAPAGLIA (Italy)
  The usefulness of some chemical-physical analyses to predict the sensorial quality of beefmeat.

- R.G. CASSENS, R.G. KAUFFMAN, A.SHERER, D.L. MEEKER (U.S.A.)
  Variations in pork quality : A 1991 U.S.A. SURVEY.

- F. LEON CREPSO, H. GALAN SOLDEVILLA, N. CIUDAD GONZALEZ, A. PERALTA FERNANDEZ, B. BALDERAS ZUBELDIA, L. MARQUEZ PRIETO, A. MOLINA ALCALA (Spain)
  Sensory evaluation of Spanish ham with different salting periods.

- A. GORANSSON, G. von SETH, E. TORNBERG (Sweden)
  Influence of intramuscular fat on the eating quality of pork.

- J. HAMILTON, D. OBERLEAS, M.HARDEN (U.S.A.)
  Study of the effect of three protein sources to provide satiety in humans.

- M. KAMAL, E. YOUSSEF, MOHAMED R.A. RASHWAN, S.I. EL-SYIAD (Egypt)
  Assesment of Egyptian beef and buffalo nutrtive meat quality

- HIROTAKA KOHATA, MAKI KAWAGUTI, MASAHIRO NUMATA, TOYOO NAKAMURA (Japan)
  The effect of microcomponents in salt on sensory and physicochemical properties of proscuitti.

- V.I. IVASHOV, Y.V. TATULOV, T.M. MITTELSTEIN, O.A. LYAPIN (Russia)
  Beef quality and factors influencing it.

- C. LAGAERT, S. DE SMET, A. VERPLAETSE, D. DEMYER, J. VIAENE (Belgium)
  Influence of halothane and of meat quality on the sensory evaluation of cooked ham.

- P. MAINSANT, G.De FONTGUYON (France).
  The competition among different types of meat consumed is still and especially a question of price.

- F. PALMIA , C. NEGRINI (Italy)
  Common salt replacement by modified potassium chloride in Italien salami and Martadella sausages.
  Influence on composition and sensory properties.

- QING-XIAN NAN, WEN-JI LI, XUI-FANG PU (China)
  The ratio of various parts of the goose carcass and determination of their nutrients.

- S. ROUSSET, I. WAKELING, J.F. MARTIN, H. MACFIE, C. TOURAILLE (France/U.K.)
  Sensory profile and acceptability scores of different restructured steaks.

- C. SANUDO, P. SANTOLARIA, I. SIERRA, M.J. ALCALDE, C.TOURAILLE (France/Spain)
  Sensory meat characteristics from light lambs carcass.

- M.L. SCIPPO, G. DEGAND, P. GASPAR, G. VANVINCHT, G. MAGHUIN-ROGISTER (Belgium)
  Progress in the strategy of discrimination of meat producing animals treated with growth promoters.

- N. SHARMA (India)
  Indigenous meat products of India.

- M. SKVARCA, B. ZLENDER (Slovenia)
  Sensory quality of pickle-cured, vacuum packed and cooked DFD and normal beef.

- J. SOHOLM PETERSEN, O.K. PEDERSEN, M. ANDERSSON (Denmark)
  Assessment of backbacon quality.

- S. SPECHT-OVERHOLT, J. ROMANS (USA)
  Pork liver : the forgotten variety meat in the US.

- C.TOURAILLE (France)
  Consumer evaluation of meat quality criteria.

Session 5 - MUSCLE BIOLOGY, POST MORTEM CHANGES AND MEAT QUALITY ; AN INTEGRATED APROACH OF THE MEAT TENDERNESS PROBLEM

- E.J. ABDUL WAHANB, Y. BRIAND (Iraq/France)
  Activity of sarcoplasmic reticulum of fast and slow rabbit skeletal muscles.

- F. ARCHER, R. LABAS, E. ROCK, X. VIGNON (France)
  Abnormal calcium regulation in cultured cells from normal and halothane susceptible pigs.

- G. ARTIGAS, M. GIL, C. SARRAGA (Spain)
  Kinetics of cathepsins from different porcine muscles.

- A. BASTIAENS, C. DEROANNE (Belgium)
  The slaughtering age effect on the physico-chemical properties of broiler chickens intramuscular collagen.

- M. BERRI, P. ROUCHON, M. ZABARI, T. SAYD, J. SIBOULET, A. OUALI (France)
  Purification and characterisation of intermediate Mr proteinase inhibitors from bovine skeletal muscle.

- G. BIELICKI, J.P. DONNAT, L. FOUCAT, S. BENDERBOUS, J.P. RENOU (France)
  Effect of brine injection on energy catabolism : P-31 NMR studies on Biceps brachii muscle of rabbit.

- P. CENA, J.A. BELTRAN, I. JAIME, P. RONCALES (Spain)
  Electrophoretic and immunological assessment of degradation by calpains of large lamb muscle proteins.

- M. ESTRADE, X. VIGNON, C. BAZIN, G. MONIN (France)
  Observation of abnormal mitrochondria in white muscle fibres of RN^- carrier pigs.

- X. FERNANDEZ, R. GUEBLEZ (France)
  Relationships between metabolite contents and pH values in post mortem longissimus muscle of the pig.

- A. V. FISHER, G.R. NUTE, G.A.J. FURSEY, A. CUTHBERTSON (U.K.)
  The relative effects of animal production and carcass processing factors on beef tenderness.

- F. GUIGNOT, C. TOURAILLE, M. RENERRE, G. MONIN (France)
  Relationships between ultimate pH and meat quality in veal.

- H. YINFENG, Y. ZHIHUA, W. ZHAOPENG, L. JIMING (China)
  The studies of tenderization of beef.

- E.J . HUFF, F.C. PARRISH Jr, R.M. ROBSON (U.S.A)
  Changes in myofibrillar cytoskeletal proteins of bovine longissimus muscles differing in tenderness.

- A. KARLSSON, B. ESSEN-GUSTAVSSON, K. LUNDSTRÖM (Sweden)
  Muscle glycogen depletion pattern at exanguination of pigs fed high or low protein diet.

- L.B. KURTH, R. KUYPERS, D.J. HORGAN (Australia)
  Lateral crosslinks, polymeric collagen and meat texture.

- P. MARINOVA, Y. GORINOV, M. RENERRE, A. LACOURT (Bulgaria/France)
  Effect of castration on some muscular characteristics in calves and buffalo calves.

- MING TSAO CHEN, CHIH PING LEE, DENG CHENG LIU (China)
  Differential scanning calorimetric studies on thermal properties of muscle proteins in normal and PSE pork.

- MING TSAO CHEN, CHIH PING LEE, DENG CHENG LIU (China)
  Studies on 2,3-Diphosphoglycerate, pyruvate kinase and mitochondrial ATPase activities in PSS pig.

- G. MONIN, C. BRARD, P. VERNIN, J. NAVEAU (France)
  Effects on the RN^- gene on some traits of muscle and liver in pigs.

- U. OLSSON, E. TORNBERG (Sweden)
  The interrelationship between myofibril fragmentation and tenderness for beef meat.

- H. OSTAL, L.M. LARSEN, A.J. MOLLER (Denmark)
  Lactic acid treatment of pre rigor beef and distribution of cathepsin B+L activity.

- A. OUALI, A. TALMANT, G. GEESINK, F. SMULDERS, C. VALIN (France/Netherlands)
  Muscle type and meat tenderness : possible relationships.

- M.N. POUCH, G. BOISSONNET, Y. BRIAND, H.P. SCHMID (France)
  Isolation and characterization of proteasomes (prosomes) from rabbit muscles

- QING XIAN NAN, HONG QOU LIANG, XIAN RONG WU, FA ZHENG REN, XING MIN LI (China)
  Effects of application of papain on the muscle protein of livestock and poultry.

- H. RHAISSI, S. MORDIER, A. OBLED, D. BECHET, M. FERRARA (France)
  Cathepsin B gene structure and expression.

- P. RONCALES, P. CENA, J.A. BELTRAN, I. JAIME (Spain)
  Ultrasonication of lamb skeletal muscle fibres enhances post mortem proteolysis.

- P. ROUCHON, M. ZABARI, M. BERRI, T. SAYD, J. SIBOULET, A. OUALI (France)
  Purification of high molecular weight proteinase inhibitors from bovine skeletal muscle.

- K. SAMEJIMA, T. KASHIWAKURA, M. ISHIOROSHI (Japan)
  Effect of divalent cations on heat-induced gelation of myosin.

- W.R. SHORTHOSE, P.V. HARRIS, I. LOXTON (Australia)
  Relationaships between ultimate pH and tenderness of beef.

- L.A. SOKOLOVA, B.V. KULISHEV, I.T. TOCHILOVA (Russia)
  The study of the dynamics of broiler meat ageing.

- A. SUZUKI, Y. IKEUCHI, M. SAITO (Japan)
  Pressure effects on the texture, ultrastructure and myofibrillar protein of beef skeletal muscle.

- R. TANABE, H. NAKAI, K. TAKAHASHI (Japan)
  Post mortem changes in skeletal muscle connectin.

- A.A. TAYLOR, L. MARTOCCIA (U.K.)
  The effect of low voltage and high voltage electrical stimulation on pork quality

- A.A. TAYLOR, G.R. NUTE, C.C. WARKUP (U.K.)
  The effect of chilling, electrical stimulation and conditioning on pork eating quality.

- A.A. TAYLOR, A.M. PERRY, C.C. WARKUP (U.K.)
  Improving pork quality by electrical stimulation or hip suspension of carcasses.

- L. UYTTERHAEGEN, E. CLAEYS, D. DEMEYER (Belgium)
  Effects of in situ injection of exogenous protease effectors in beef meat.

- M. VADA KOVACS (Hungary)
  Significance of consistency of porcine semimembranosus muscle in processing properties.

- P. VERNAZ, J. LEPETIT (France)
  Effect of variation of ante rigor temperature on meat ageing.

- O.A. YOUNG, T.J. BRAGGINS, G.J. BARKER (New Zealand)
  The effects of collagen characteristics on sensory assessment and shear values of cooked sheep semimenbranosus muscles.

- M. ZABARI, M. BERRI, P. ROUCHON, T. SAYD, A. OUALI (France)
  Purification and characterisation of low Mr proteinase inhibitors from bovine skeletal muscle.

Session 6 - MICROBIOLOGY AND HYGIENE

- T. ATANASSOVA (Bulgaria)
  Effect of irradiation and packaging on the survival of campylobacter jejeuni in chilled poultry meat.

- S. BARBUTI, E. MANGANELLI E., M. GHISI, M. CAMPANINI (Italy)
  The microbiological quality of pork carcasses in italian slaughterhouses.

- A.S. BARRETO, M.F. MARILIA, J.S. OUAKININ, A.M.R. RIBEIRO (Portugal)
  A specific hazard analysis critical control point plan for the quality assurance of portuguese pork chorizo to warrant an african swine fever virus-free condition.

- S.E. BIRKELAND, T. AUKRUST, H. BLOM (Norway)
  An essay for scoring of plasmid encoded bacteriocin effect in fermented food.

- K. BOSCHKOVA, G. MARUDOV (Bulgaria)
  Effect of starter cultures on the degradation of organochlorine pesticides.

- M. CAMPANINI, I. PEDRAZZONI, S. BARBUTI, P. BALDINI (Italy)
  Control of liseria monocytogenes in meat products by a strain of L. Plantarum.

- P. CARTIER (France)
  Sampling plans to monitor microbial quality of commercial beef carcasses.

- H. CHRISTENSEN, R. SORENSEN, H. LUTHJE (Denmark)
  Yersinia enterocolitica 0/3 and salmonella SSP on fresh pork collar

- L. CINTAS, W. MOREIRA, J. RODRIGUEZ, O. SOBRINO, M. FERNANDEZ, B. SANZ, P. HERNANDEZ (Spain)
  Antimicrobial activity of lactic acid bacteria from meat origin against selected indicator microorganisms.

- P. GUSTAVSSON, E. BORCH (Sweden)
  Detection of spoilage bacteria during beef processing using conductance technique, plate count and proliferation index.

- M. HEBRAUD, E. DUBOIS, P. GARRY, J. LABADIE (France)
  Low molecular weight proteins from psychrotroph Pseudomonas are overexpressed at low temperature.

- D.G. HOMANN, C.L. KNIPE, E.A. MURANO, R.E. RUST (USA)
  Evaluation of spoilage microorganisms on pork carcasses during slaughter and fabrication in 3US pork packing plants.

- A. INES, L. PATARATA, C. MARTINS (Portugal)
  Study of a traditional portuguese blood sausage "moura".

- M. KARAPINAR, S.A. GÖNÜL (Turkey)
  Survival of yersinia enterocolitica in minced meat stored at different temperatures.

- M.K.B. KEMNER, H.J. SEIDEL NIELSEN (Denmark)
  Influence of competitive flora and storage conditions on growth of listeria

- P. KITZMAN (Poland)
  Total screening, in vitro, of inhibitory and stimulatory effects of natrium chloride, natrium nitrite and tripoliphosphate on pathogenic and saprophytic meat microflora.

- J. LABADIE, M. HEBRAUD (France)
  Purification and partial characterization of a secreted collagenase from the phyto pathogenic bacterium clavibacter michiganense.

- I. LEGRAND (France)
  Effect of packaging on fresh lamb cuts shelf life.

- R.H. LUCHESE, J.F.P. MARTINS, W.F. HARRIGAN (U.K.)
  Aflatoxin production in a meat mix model system in the presence of Pediococcus and Lactobacillus : levels of glucose necessary to induce production.

- E.M. MAURER, A.B. CHILDERS (USA)
  Effect of time lenght of frozen storage and vacuum packaging on survival of Vibrio vulnificus.

- M.O. MASANA, J.A. LASTA (Argentina)
  Microbial lipolysis in beef adipose tissue under refrigeration

- A.J. MILLER, J.E. CALL, R.C. WHITING (USA)
  Comparison of organic acids for Clostridium botolinum control in an uncured turkey product.

- P.C. MOERMAN (Netherlands)
  Chilling and transport of pork.

- H. NISSEN, R. DAINTY (Norway)
  Identification of some lactic acid bacteria from CO_2 packed meat by 23S RRNA targeted oligo nucleotides probes

- H. W. OCKERMAN, J. GAB KIM (USA)
  Pseudomonas growth as influenced by autoclaving of sterile beef extract.

- H. W. OCKERMAN, J. GAB KIM (USA)
  Influence of previous bacterial growth on the biochemical and microbiological properties of beef extract medium

- H.W. OCKERMAN, H.R. RODRIGUEZ, N.A. PENSEL (USA/Argentina)
  Lactic acid and nisin effect on beef spoilage bacteria attachment

- H.W. OCKERMAN, H.R. RODRIGUEZ, N.A. PENSEL (USA/Argentina)
  Attachment of spoilage bacteria to beef muscle tissue.

- R.B. PASSOS DE OLIVEIRA , P.R. MASSAGUER (Brazil)
  Effects of the addition of acetilated monoglyceride on the microflora, weight losses and color bloom of vacuum packaged beef.

- E. PETAJA (Finland)
  Heat resistance of two streptococci isolated from the core of cooked meat products made of coarsely ground pork.

- J.P.G. PIETTE, J.Y. POSTEC (Canada/France)
  Bacterial adhesion to cooked sausages : development of a model experimental system.

- B. RAY, R.A. FIELD (USA)
  Antibacterial effectiveness of a pediocin AcH-based biopreservative against spoilage and pathogenic bacteria from vacuum packaged refrigerated meat.

- H.R. RODRIGUEZ, J.A. LASTA (Argentina)
  Beef slaughter hygiene monitored by carcass bacterial condition.

- H.R. RODRIGUEZ, J.A. LASTA, C.A. MARGARIA, M.M. GALLINGER, C. ARTUSO (Argentina)
  Combined processes to inhibit Clostridium botulinum toxine production in a beef product stored at room temperature.

- M. SERDAROGLU, S.O. TOMEK, A. BULGAY (Turkey)
  Effect of using sorbic acid on the shelf life of chilled turkey meat.

- N.F.A. SILVEIRA, E.T.F. SILVEIRA, M.K. BARBIERI, I. SHIROSE, V.C.A. JUNQUEIRA, M.T.E.L. GALVO (Brazil)
  Microbiological stability of vacuum packed poultry liver paté.

- J.N. SOFOS, G.R. SCHMIDT, N. BOONMASIRI, L. YEN (USA)
  Thermal destruction of listeria monocytogenes in meat products.

- M.G. SEYDI, A.L. KONE, A.N. BA (Sénégal)
  Hygienic quality of frozen beef imported in senegal.

- E.T.F. SILVEIRA, D.C.P. JARDIM, N.F.A. SILVEIRA,, M.K. BARBIERI, H.K. ARIMA, I. SHIROSE (Brazil)
  Hurdle technology applied to the production of canned poultry liver paté.

- N.N. TERRA, R.V. MELLO (Brazil)
  Extension of poultry shelf life by aqueous chlorine and organic acids.

- H. YOUSSEF, A. LOFTI, S. FATHI and G. ALI.(Egypt)
  Incidence of bacillus cereus in some selected meat products.

- J. ZAPATA, V. MATOS, F. TELLES, Z. GUEDES, M. VASCONCELOS (Brazil)
  Microbial behaviour of fresh sausages containing lamb or goat meat.

Session 7 - FERMENTED PRODUCTS

- J.L. BERDAGUE, C. MONTEL, R. TALON, P. MONTEIL (France)
  Influence of starter cultures of the volatile content and aroma of dry sausage.

- D. DEMEYER, S. ÖTLES, L. CARON (Belgium)
  Effect of meat species on proteolysis during dry sausage fermentation.

- O. DIAZ, M. FERNANDEZ, G.D. GARCIA de FERNANDO, L. DE LA HOZ, J.A. ORDONEZ (Spain)
  Effect of the addition of the Aspartyl proteinase from Aspergillus oryzae on dry fermented sausage proteolysis during ripening.

- S. EEROLA, R. MAIJAL, P. HILL (Finland)
  The influence of nitrite on the formation of biogenic amines in dry sausages.

- J.J. HINRICHSEN, H.A. ANDERSEN (Denmark)
  Effects of 3 bacteria isolated from danish curing brines in a sterile meat model system.

- M. HUGAS, M. GARRIGA, T. AYMERICH, J.M. MONFORT (Spain)
  Biochemical characterization of lactobacilli from dry fermented sausages.

- V.H.KURI, E.A. PONCE, I.L. GUERRERO, F.E. GALLARDO (Mexico)
  Effect of starch addition in the quality of fermented sausages.

- A. LANDVOGT (Germany)
  Predictive microbiology : targeted control of fermentation processes.

- B. MARCHESINI, W. GAIER, R. MORETON (Switzerland)
  Bacteriophages in commercial meat fermentations.

- J.F.P. MARTINS, W.F. HARRIGAN (UK)
  Meat based model system for fermentation studies.

- M.C. MONTEL, R. TALON, M. CANTONNET, J. CAYROL (France)
  Peptidasic activities of starter cultures.

- H. NAES, B.O. PEDERSEN, A.L. HOLCK, L. AXELSSON, V. HOLTEN, H. BLOM (Norway)
  Fermentation of dry sausage - The effect of added proteinase and lipase from lactobacilli.

- P. PIPEK, F. BAUER, G. SEIWALD (Austria)
  Formation of histamine in vacuum packed fermented sausages.

- R. RADOVANOVIC, D. CAVOSKI, P. BOJOVIC, M. PERUNOVIC, D. VELICKOVIC, G. CARAPIC (Yugoslavia)
  Study of a "Uzice bacon" - Traditionnal fermented meat product : processing and characteristics.

- N. SHARMA, R. MUKHOPADHYAY (India)
  Processing of fermented sausage using starter cultures.

- M. SKRINJAR, T. HOVART-SKENDEROVIC (Yugoslavia)
  Ochratoxin a production in dry sausage by penicillium verrucosum var. cyclopium strains.

- L. STAHNKE and P. ZEUTHEN (Denmark)
  Identification of volatiles from italian dried salami.

- R. TALON, M.C. MONTEL, M. CANTONNET (France)
  Lipolytic activity of Micrococcaceae.

- R. TALON, M.C. MONTEL J.L. BERDAGUE, M. CANTONNET (France)
  Biochemical characteristics of dry sausages in relation with starter cultures.

- M.J. TSOU, W.C. BRIDGES, R.L. DICK, J.C. ACTON (USA)
  Comparison of the rates of pH reduction and lactic acid accumulation during glucose fermentation in beef sausage.

- A. VERPLAETSE, S. GERARD, E. BUYS, D. DEMEYER (Belgium)
  Endogenous and bacterial proteolysis in dry sausage fermentation.

Session 8 - THE BIOCHEMISTRY OF MEAT AND MEAT PRODUCTS SHELF LIFE (concurrent session)

- M. ANTON, Ph GATELLIER, M. RENERRE (France)
  Non enzymic catalysis of microsomal lipid peroxidation by activated-MetMb. detection of myoglobin-derived radicals by ESR spectroscopy.

- S. BUSCAILHON, G. GANDEMER, G. MONIN (France)
  Evolution of intramuscular lipids during processing of dry cured ham.

- S. BRANDON, P.A. MORRISSEY, D.J. BUCKLEY (U.K.)
  The effect of dietary α tocopherol and sunflower oil on the oxidative stability of chicken tissues.

- A.D. CAMPO-FERNANDEZ, J.A. PEREZ-ALVAREZ, M.E. SAYAS-BARBERA, M.J.V. ARANDA-CATALA (Spain)
  Spanish dry cured ham : physical and physicochemical study.

- C. CHEN, A.M. PEARSON, J.I. GRAY (USA)
  Effects of some food additives on mutagen formation during frying of ground beef.

- M.A. GAGO-GAGO, J.A. PEREZ-ALVAREZ, M.E. SAYAS-BARBERA, M.J. PAGAN-MORENO, A. RODRIGUEZ-LOPEZ, A. BALLESTER, V. ARANDA-CATALA (Spain)
  Physical and physicochemical study of spanish "salchicon" during ripening.

- C. GARCIA, J.J. CORDOBA, M.A. ASENSIO, E. BERMUDEZ, T. ANTEQUERA , J. VENTANAS (Spain)
  Heme pigments evolution during ripening of dry cured iberian ham.

- C. GARCIA, J.J. CORDOBA, M.A. ASENSIO, L. MARTIN, A. FALLOLA, T. ANTEQUERA (Spain)
  Factors affecting protein and lipid extractibility in meat products.

- L. GASPERLIN, B. ZLENDER, F. BUCAR (Slovenia)
  Oxygenation of rare and medium roasted normal and DFD beef.

- Ph. GATELLIER, M. ANTON, F. CHRAITI, M. RENERRE (France)
  Study of colour stability and lipid oxidation in raw beef meat during storage ; importance of antioxidant enzymes.

- C. GENOT, B. METRO, M. VIAU, A. MEYNIER, G. GANDEMER (France)
  How to prepare liposomes to study oxidation of muscle phospholipids ?

- S. GIGLI, F. NAPOLITANO, A. CARRETTA, S. FALLIA, M. FIORETTI, D. CENNAMO (Italy)
  Conservation of meat samples for physical analysis.

- A. JARMOLUK, Z. DUDA, A. MAJEWSKA-KAWINSKA (Poland)
  Influence of blood plasma acidification on haeme pigment nitrosation and cured colour development in plasma gel/livex/.

- J. KANNER, S. HAREL, R. GRANIT (Israel)
  Oxidative processes in meat and meat products.

- L.H. KOMISSAROWA, E.G. ROZANTSEV, G.W. GURINOVICH (Moscow)
  The use of some antioxidants for the stabilization of meat products color.

- D. KROPF, H. WANG, M. HUNT, C. KASTNER (USA)
  Causes and solutions of iridescence in precooked meat.

- M.C. LANARI, R.G. CASSENS, D.M. SCHAEFFER, K.K. SCHELLER (USA)
  Effect of dietary vitamin E on lipid and color stability of frozen beef from Holstein steers.

- C.J. LOPEZ-BOTE, E. GOMAA, J.I. GRAY, C.J. FLEGAL (USA)
  Stabilization of broiler lipids (included cholesterol) through dietary supplementation with spice extracts.

- M.O. LOPEZ, L. de la HOZ, M.I. CAMBERO, D. LOPEZ, G. REGLERO, J.A. ORDONEZ (Spain)
  Iberian pig dry ham volatile compounds from different ham depths.

- H.L.MADSEN, L.H. SKIBSTED, G. BERTELSEN (Denmark)
  Spices as antioxidants in cooked, minced pork meat.

- A. MEYNIER, D.S. MOTTRAM (France/U.K)
  The effect of lipid of the Maillard reaction between methionine and ribose : a model system to investigate the formation of meat flavour.

- M. MITSUMOTO, R.G. CASSENS, D.M. SCHAEFER, R.N. ARNOLD, C. FAUSTMAN (USA)
  Improvement of pigment and lipid stability in beef with vitamin C mix, spread and dip treatments.

- F.J. MONAHAN, A. ASGHAR, J.I. GRAY, D.J. BUCKELY, P.A. MORRISSEY (Ireland/USA)
  Influence of dietary vitamin E (α tocopherol) on the colour stability of pork chops.

- M. MOULOUD, J.P. DUMONT, R. GOUTEFONGEA (France)
  Fat, nitrite and the flavour of cured cooked ham.

- H.J.S. NIELSEN, A.L. HENSEN, H.V. LUDVIGSEN (Denmark)
  Natural antioxidants in a minced meat products.

- H.W. OCKERMAN, N.A. PENSEL, H.R. RODRIGUEZ (USA/Argentina)
  Influence of the sequence of treatments on oxidation of pork muscle tissue.

- W. OTTEN, J. BENEDIKT, S. HARTMANN, H.M. EICHINIGER, K. SÖLLNER (Germany)
  Phospholipids and cholesterol in two skeletal muscles and erythrocytes of three different malignant hyperthermia genotypes of swine.

- M.J. PAGAN-MORENO, J.A. PEREZ-ALVAREZ, M.E. SAYAS-BARBERA, M.A. GAGO-GAGO, A. RODRIGUEZ-LOPEZ, A. BALLESTER, V. ARANDA-CATALA (Spain)
  Chorizo : colour and physicochemical parameters evolution during ripening.

- A.M. PEARSON, C. CHEN, J.I. GRAY (USA)
  Effects of different antioxidants on formation of meat mutagens during frying of ground beef.

- S. RAHARJO, J.N. SOFOS, G.R. SCHMIDT (USA)
  A modified thiobarbituric acid-C_{18} (TBA-C_{18}) method for measuring lipid peroxidation in meat.

- N. RAMARATHNAM, L.L. DIOSADY, L.J. RUBIN (Canada)
  Composition of the flavour volatiles of cooked pork, beef and chicken and of "cured meat".

- D.H. REID, T.J. BRAGGINS, O.A. YOUNG (New Zealand)
  Sulphide evolution during the cooking of beef and mutton.

- A. RODRIGUEZ-LOPEZ, J.A. PEREZ-ALVAREZ, M.E.SAYAS-BARBERA, M.J. PAGAN-MORENO, M. A. GAGO, V. ARANDA-CATALA (Spain)
  Colour and colour stability of dry-cured ham.

- R. SAKATA, T. OSHIDA, Y. NAGATA (Japan)
  Effects of freezing temperature on physicochemical and processing quality of pork.

- V. SANTE, M. RENERRE, A. LACOURT (France)
  Effect of vitamin E supplementation dietary on colour stability and lipid oxidation in turkey meat.

- F.J.G. SCHREURS, T.G. UIJTTENBOOGAART, T.L. TRZISZKA, H.G.M. REIMERT (Poland)
  The effect of cryoprotectants during frozen storage of myofibrillar protein isolates obtained from mechanically deboned chicken meat.

- F. SHAHIDI, P.J. KE, Z. ZIANDGDA, Z. YANG, J. WANASUNDARA (Canada/China)
  Antioxidant activity of green and black tea in meat model systems.

- B.J. SHAY, A.F. EGAN, B.A. BILL (Australia)
  Storage of carcasses, cuts and consumers portions of lamb in atmospheres of carbon dioxide.

- SHIU-LAN GUO, DENG-CHENG LIU, MING-TSAO CHEN (Taiwan)
  Effects of spices on color stability of chinese-style sausage.

- TIAN AI JIA (China)
  Investigations on the processing of both frozen and chilled porks.

- F. TOLDRA, M.J. MOTILVA, M.C. ARISTOY, J. FLORES (Spain)
  Lipase, esterase and aminopeptidase activities in raw pork adipose tissue.

- Z. VELJIC, L.J. NEDELJKOVIC, G. VOJINOVIC, I. VELJIC (Yugoslavia)
The influence of antioxidants on wholesomenes and shelf-life of mechanically deboned poultry meat (MDPM).

Session 9 - OBJECTIVE MEASUREMENTS OF CARCASSES AND MEAT QUALITY TRAITS

- S. ABOUELKARAM, P. LAUGIER, M. FINK, J. CULIOLI (France)
Ultrasonic measurement of meat heterogeneity due to connective tissue.

- S. ALRAHEEM, N. RASHID, D. AZIZ, J. ALKASS, K. ABOUD (Iraq)
Evaluation of urea dilution for estimating carcass composition of fat tailed awassi sheep.

- M. BARTLE, B.B. CHRYSTAL.(New Zealand)
A novel, noninvasive method to measure fat content of boneless meat.

- F. BECHEREL, G. EIKELENBOOM, M. RENNERRE, J.R. ANDERSEN (France)
Comparison of various instruments for on line assessment of the colour of veal carcasses.

- G.A. BECK, R. DURR, H.M. EICHINGER (Germany)
Predictability of sensoric properties in beef by physiochemical measurements.

- J. BUDIG, I.INGR (Czechoslovakia)
Comparison and application of quality criteria for PSE of pork.

- U. Ch. CHOMANOV, A.U. KAMERBRAYE (Russia)
Some problems of the evaluation of the water - binding capacity and water activity of a muscle tissue.

- G. DAUMAS, T. DHORNE (France)
Sex influences on pig carcasses grading.

- G. DAUMAS and T. DHORNE (France)
How to normalize the methods for grading pig carcasses in the community ?

- S. DE SMET, I. VERVAEKE, D DEMEYER, H.PAUWELS, W. EECKOUT, J. VAN HOOF (Belgium)
Influence of halothane sensitivity and of meat quality on yield and quality of cooked ham.

- D. DIMITRIJEVIC, M. POLIC, G. VOJINOVIC (Yugoslavia)
TLC method of quantitative determination of amoniun compound residues in animal tissue.

- G. EIKELENBOOM, W. ZHANG, A.H. HOVING-BOLINK, G.J. GARSSEN, P. STERRENBURG.(Netherlands)
Use of different methods to assess veal colour and pigment content.

- D.M FERGUSON, G.W. JOHNSON, I.J. EUSTACE, P. CABASSI, R.J. CHANDLER, R.J.W. LAKE, R.BRADBURY (Australia)
Estimation of beef carcass composition using velocity of sound and electromagnetic scanning.

- P. FREUDENREICH (Germany)
Rapid simultaneous determination of fat, water, protein and color in beef by a nit-analyzer.

- D. GARRIDO, J. PEDAUYE, S. BANON, A.D.PEREZ, J. LAENCINA (Spain)
  Detection PSE meat and influence of haem pigment concentration .

- D. GARRIDO, E. MARIA DOLORES, B. LOPEZ, A.MUNOZ, J.LAENCINA (Spain)
  Characteristics and composition of lean and fat in pork carcasses.

- J. HANSEN-MOLLER, J. RUD ANDERSON (Denmark)
  Alternative methods for assessment of boar taint.

- E.R. JOHNSON, D.G. TAYLOR, R. PRIYANTO (Australia)
  The contribution of eye muscle area to the objective measurement of carcase muscle.

- S.D.M. JONES, D. LANG, A.K.W. TONG, W. ROBERTSON (Canada)
  A commercial evaluation of video image analysis in the grading of beef carcasses.

- H. KANDA, T. KANECHIKA (Japan)
  Some properties of abnormal porcine muscles (PFE, PFD) differed from PSE and DFD.

- J. LEPETIT (France)
  Rigor onset in rabbit muscles monitored by vibrations.

- R.S. LIN, J.C. FORREST, M.D. JUDGE, R.P. LEMENAGER, A.L. GRANT (USA)
  Application of electromagnetic scanning for prediction of beef carcass composition.

- G. LORENZ (Germany)
  Future classification systems - requirement specification from a management perspective.

- V. LUTS, V. KANGRO, H. KOPPEL (Estonia)
  Quality of beef produced in Estonia.

- G. MALMFOR (Sweden)
  Introduction of a new method for predicting fat content in lamb carcasses.

- L. MIOCHE, M.A. PEYRON, J. CULIOLI (France)
  The role of the bite force in hardness reception.

- G.S. MITTAL, M. ZHANG, S. BARBUT (Canada)
  Test conditions for measuring water holding capacity of beef products by centrifugal method.

- H. NAKAI, R.TANABE, S. ANDO, T. IKEDA, M. NISHIZAWA (Japan)
  Development of a technique for measuring tenderness in meat using a "Tensipresser".

- K. PERSSON, E. TORNBERG (Sweden)
  The sensory, structure and fracture properties of heated sausage batters.

- D.M. PHILLIPS (New Zealand)
  A new technique for measuring meat texture and tenderness.

- V. SARAFIS (Ausralia)
  Confocal microscopy - A new tool in the investigation of muscle and muscle food products.

- M. SEVERINI, M.TREVISANI, A.R. LOSCHI, A. VIZZANI (Italy)
  A trial to define factors affecting pigmeat quality.

- F. SHAHIDI, R.B. PEGG (Canada)
  Applications of colorment in muscle food quality evaluation.

- V. SVINTSOV, B. IVANOV (Russia)
  Theoretical and practical aspects of the express - method of meat products quality control.

- D.G. TAYLOR, E.R. JOHNSON, R. PRIYANTO (Australia)
  Alternative positions for measuring fat thickness on beef carcasses.

- G.R. TROUT (Australia)
  Evaluation of techniques for monitoring pork quality in Australian pork processing plants.

- K. VHULKOVA, T.S. OBRETENOV, S. DANTCHEV (Bulgaria)
  An adapted method of isolating aromatic substances from meat products.

- C. VIALLON, J.L. BERDAGUE, C. DENOYER, N. TRAN, M. BONNEAU, M. LE DENMAT (France)
  Analysis of volatile components from backfat of pig and relations with androstenone content.

- R.D. WARNER, G.A. ELDRIDGE, C.I. BALL, E. NANTHAN (Australia)
  Evidence of anisotropy in probe measurements of pork muscle colour.

Session 10 - MEAT PRODUCTS AND HUMAN NUTRITION AND HEALTH

- M.A. ABD ALLAH, F.M. ABU SALEM, N. F. GAMAL, N.M. ABD ELMAGUID (Egypt)
  X-Ray analysis and infrared spectrum of beef sausage and chicken patties manufactured with and without protease inhibitor.

- F.M. ABU SALEM, M.A. ABD ALLAH,, N. F. GAMAL, N.M. ABD ELMAGUID (Egypt)
  Histological structure of beef sausage and chicken patties manufactured with and without protease inhibitor.

- K. AMIRKHANOV, M. SMINORV, O. AKULOVA, E. TULEUOV, U.ILYASOV (Russia)
  Possibilities of using wool by products in the production of sausages items.

- L.J. BASTIC, D. LAZIC, M. BASTIC, S. SEKIS, M. SARATLIC (Yugoslavia)
  Quality standardization of industrialy produced "Cevapcici" - national ground meat products.

- N.J. BERAQUET, M.T.E.L. GALVAO, R.M.Z. da SILVA (Brazil)
  Influence of using mechanically separated chicken meat from different parts and levels on the chemical, physical and sensory properties of bologna type product.

- E. BIANCHI, E.M. ZAMBINI, P. MASIOLI (Italy)
  The determination of carbos simethyl-cellulose as a micro ingredient in sausages such as wurstel.

- E. BIANCHI, A. CANTONI, F. LODI RIZZINI (Italy)
  Optimization of the use of animal and vegetable proteins in mortadella mixtures.

- C. BOYER, A. OUALI, J. CULIOLI (France)
  Heat Gelation of myosin : influence of purification, muscle type and ionic strength.

- D. GARRIDO, J. PEDAUYE, S. BANON, A.D.PEREZ, J. LAENCINA (Spain)
  Detection PSE meat and influence of haem pigment concentration .

- D. GARRIDO, E. MARIA DOLORES, B. LOPEZ, A.MUNOZ, J.LAENCINA (Spain)
  Characteristics and composition of lean and fat in pork carcasses.

- J. HANSEN-MOLLER, J. RUD ANDERSON (Denmark)
  Alternative methods for assessment of boar taint.

- E.R. JOHNSON, D.G. TAYLOR, R. PRIYANTO (Australia)
  The contribution of eye muscle area to the objective measurement of carcase muscle.

- S.D.M. JONES, D. LANG, A.K.W. TONG, W. ROBERTSON (Canada)
  A commercial evaluation of video image analysis in the grading of beef carcasses.

- H. KANDA, T. KANECHIKA (Japan)
  Some properties of abnormal porcine muscles (PFE, PFD) differed from PSE and DFD.

- J. LEPETIT (France)
  Rigor onset in rabbit muscles monitored by vibrations.

- R.S. LIN, J.C. FORREST, M.D. JUDGE, R.P. LEMENAGER, A.L. GRANT (USA)
  Application of electromagnetic scanning for prediction of beef carcass composition.

- G. LORENZ (Germany)
  Future classification systems - requirement specification from a management perspective.

- V. LUTS, V. KANGRO, H. KOPPEL (Estonia)
  Quality of beef produced in Estonia.

- G. MALMFOR (Sweden)
  Introduction of a new method for predicting fat content in lamb carcasses.

- L. MIOCHE, M.A. PEYRON, J. CULIOLI (France)
  The role of the bite force in hardness reception.

- G.S. MITTAL, M. ZHANG, S. BARBUT (Canada)
  Test conditions for measuring water holding capacity of beef products by centrifugal method.

- H. NAKAI, R.TANABE, S. ANDO, T. IKEDA, M. NISHIZAWA (Japan)
  Development of a technique for measuring tenderness in meat using a "Tensipresser".

- K. PERSSON, E. TORNBERG (Sweden)
  The sensory, structure and fracture properties of heated sausage batters.

- D.M. PHILLIPS (New Zealand)
  A new technique for measuring meat texture and tenderness.

- V. SARAFIS (Ausralia)
  Confocal microscopy - A new tool in the investigation of muscle and muscle food products.

- M. SEVERINI, M.TREVISANI, A.R. LOSCHI, A. VIZZANI (Italy)
  A trial to define factors affecting pigmeat quality.

- F. SHAHIDI, R.B. PEGG (Canada)
  Applications of colorment in muscle food quality evaluation.

- V. SVINTSOV, B. IVANOV (Russia)
  Theoretical and practical aspects of the express - method of meat products quality control.

- D.G. TAYLOR, E.R. JOHNSON, R. PRIYANTO (Australia)
  Alternative positions for measuring fat thickness on beef carcasses.

- G.R. TROUT (Australia)
  Evaluation of techniques for monitoring pork quality in Australian pork processing plants.

- K. VHULKOVA, T.S. OBRETENOV, S. DANTCHEV (Bulgaria)
  An adapted method of isolating aromatic substances from meat products.

- C. VIALLON, J.L. BERDAGUE, C. DENOYER, N. TRAN, M. BONNEAU, M. LE DENMAT (France)
  Analysis of volatile components from backfat of pig and relations with androstenone content.

- R.D. WARNER, G.A. ELDRIDGE, C.I. BALL, E. NANTHAN (Australia)
  Evidence of anisotropy in probe measurements of pork muscle colour.

Session 10 - MEAT PRODUCTS AND HUMAN NUTRITION AND HEALTH

- M.A. ABD ALLAH, F.M. ABU SALEM, N. F. GAMAL, N.M. ABD ELMAGUID (Egypt)
  X-Ray analysis and infrared spectrum of beef sausage and chicken patties manufactured with and without protease inhibitor.

- F.M. ABU SALEM, M.A. ABD ALLAH,, N. F. GAMAL, N.M. ABD ELMAGUID (Egypt)
  Histological structure of beef sausage and chicken patties manufactured with and without protease inhibitor.

- K. AMIRKHANOV, M. SMINORV, O. AKULOVA, E. TULEUOV, U.ILYASOV (Russia)
  Possibilities of using wool by products in the production of sausages items.

- L.J. BASTIC, D. LAZIC, M. BASTIC, S. SEKIS, M. SARATLIC (Yugoslavia)
  Quality standardization of industrialy produced "Cevapcici" - national ground meat products.

- N.J. BERAQUET, M.T.E.L. GALVAO, R.M.Z. da SILVA (Brazil)
  Influence of using mechanically separated chicken meat from different parts and levels on the chemical, physical and sensory properties of bologna type product.

- E. BIANCHI, E.M. ZAMBINI, P. MASIOLI (Italy)
  The determination of carbos simethyl-cellulose as a micro ingredient in sausages such as wurstel.

- E. BIANCHI, A. CANTONI, F. LODI RIZZINI (Italy)
  Optimization of the use of animal and vegetable proteins in mortadella mixtures.

- C. BOYER, A. OUALI, J. CULIOLI (France)
  Heat Gelation of myosin : influence of purification, muscle type and ionic strength.

- T.V. BUROVA, N.D. KOZLOVA, V. Ya. GRINBERG, A.D. NEKLUDOV, V.B. TOLSTOGUZOV (Russia)
Thermal denatuation of albumin of bovine blood plasma.

- J. CARBALLO, S. COFRADES, M. CARECHE, J. JIMENEZ COLMENERO (Spain)
Functional and physical-chemical parameters of actomyosin from pork muscle of different characteristics.

- F. CHRAITI, M. de LAMBALLERIE, A. OUALI, J. CULIOLI (France)
Gelation properties and binding ability of bovine myofbrillar proteins.

- L. CUERPO, A. PIZI, L.A. ROMERO, D.A. DAMEN, N.J. LATIMORI (Argentina)
Evaluation of bipyridylium herbicides residues in animal food.

- J.C.M. DELLA TORRE, H.K. ARIMA, E.T.F. SILVEIRA, E.A. YAMADA, E.E.M. MORI, I. SHIROSE (Brazil)
Buffalo meat in frankfurter type sausages.

- S. DRAGOEV, K. WASSILEV, S. DANCHEV, M. MILANOVA, S. GEORGIEV (Bulgaria)
Preparation from skins of steam pigs to put into the production of sausages.

- N.L. FAIVISHEVSKY, T.D. LISINA, S.I. KHVYLYA, T.G. KUZNZTSOVA (Russia)
New extruted combination products.

- K. HAMMADI, S. LATIF, A. DAWOOD, S. AFIFI (Egypt)
Quality and nutritional assessment for three canned recipes processed from rabbit meat.

- S. HOSSEINI, M. MIZANI (Iran)
Development of sea food patties from underutilized fish species.

- S. JOANDEL, C. TASSY, J. CULIOLI (France)
Heat gelling properties of rabbit myofibrillar proteins : influence of muscle type.

- V.I. IVASHOV, A.D. NEKLUDOV, V.P. ILYUKHINA, M.I. BABURINA, R.A. KHROMOVA (Russia)
Certain macro kinetic approaches to the quantitative description of blood proteins hydrolysis of beef cattle.

- J.C.M. DELLA TORRE, P.E.de FELICIO (Spain)
Effects of prerigor beef and sodium tripoliphosphate on the characteristics of Frankfurter-type sausage.

- S. KARAKAYA, A. KAVAS, S. MEHIR EL (Turkey)
Comparative study on nutritive value of meat (semi tendinosus muscle) using microwave and conventional cooking.

- K. KATSARAS, K.D. BUDRAS (Germany)
Effects of soy proteins on technological and morphological properties of bologna type sausage.

- D. KÜHNE, F. WIRTH, H. WAGNER (Germany)
Iodate as iodizing agent in curing salt.

- K. LADSTEIN, E. SLINDE (Norway)
Swelling properties of isolate myofbrils from PSE and normal pork meat.

- MIN LIAN JI, LI SU LONG, MAXING SHENG (China)
Research on stabilization of blood pigment for replacement of nitrite cured meat color of sausage products.

- G.S. MITTAL, S. BARBUT (Canada)
Role of fat in breakfast sausages.

- A.D. NEKLUDOV, V.P. ILYUKHINA, M.I. BABURINA (Russia)
Improvement of thermostability of pancreatin - Enzyme of beef cattle pancreas.

-T. NGAPO, B. WILKINSON, R. CHONG, D. HAISMAN (New Zealand)
Gelation of bovine myofibrillar protein induced by 1,5 gluconolactone.

- NI CHEN, ZHANG GENSHENG, MIN LIANJI (China)
A study on processing technology of children nutritious sausage.

- A. PIZZA, R. PEDRIELLI (Italy)
Effects of tumbling and cooking methods on the yield and acceptability of cooked ham from thighs with different characteristics.

- J.P. RENOU, G. BIELICKI, G. MERMAN (France/Germany)
Na-23 NMR images of salted hams.

- R.E. RUST, M.W. WESTENDORF, J.J. MITOLO (USA)
Levels effects of modified food starch on physical and sensory properties of sectioned and formed cooked and smoked ham.

- K. SAMEIJIMA, T. KASHIWAKURA, M. ISHIROSHI (Japan)
Effect of divalent cations on heat-induced gelation of myosin.

- F. SHAHIDI, J. SYNOWIECK, J. BALEJKO (Canada)
Utilization of seal meat by products.

- R. SOILDLA, M. REI (Estonia)
Tabloids of blood and milk protein for sportsmen.

- T. SZMANKO, I. GORSKA, G. KRASNOWSKA (Poland)
An attempt to utilize beef gullet meat tissue in technological processing.

- G. RAVASINI, E. DILBERT, VAN GRIETHUYSEN (Switzerland)
The influence of temperature on protein extraction of salt treated pig muscle.

- J.N. SOFOS, A. BA JABER, G.R. SCHMIDT (USA)
Extrustion cooking of mechanically deboned turkey meat with soy protein, kappa-carrageenan and oat fiber.

- S.O. TOMEK, M. SERDAROGLU, A. BULGAY (Turkey)
Utilization of meat and edible offals of turkey in sucuk type product.

- E.T. TULEUOV, ZH.Z. URAZBAEW, O.G. AKULOWA, U. ILYASOW, M.A. MYRZABAEW (Russia)
The use of horse blood in the manufacture of medicinal and food products.

- E.T. TULEUOV, N. ASPALYAMOV, S. BAKTAZHAROV, A. FIHTNER, A. BATYRGALIEV (Russia)
Improvement of production technology of meat products.

- A. TYBURCY, B. KOWALSKI, A. PISULA (Poland)
Properties of freeze textured concentrate of myobrillar proteins as affected by sodium chloride addition.

- M.T.E.L. GALVAO, N.J. BERAQUET (Brazil)
Recovery of protein mechanically separated chicken residue using different methods of extraction.

- A.M. GAROUT, R.G. BELL (Saudi Arabia)
Product life of vacuum packaged beef imported into Saudi Arabia by sea.

- C. HAGDRUP (Denmark)
Application of datanetworks and databases to the slaughterline.

- T.L. HALD, S. KLASTRUP (Denmark)
Local electrical stimulation of longissimus dorsi muscle in beef.

- M.C. HUNT, R.E. CAMPELL (USA)
Lean, fat, and connective tissue from beef shanks processed with a baader^{tm} desinewer.

- S. KIEN (Poland)
Industrial experiments with low voltage electrical stimulation of beef carcasses in Poland

- L.H. KOMISSAROWA, A.A. KUZNETSOV, L.K. KASARINA, A.D. NECLUDOV, S.L. BARSEGIAN (Moscow)
The use of magnetic sorbents for the manufacture of globin and heme from bovine blood.

- G.S. MITTAL, E. HUANG (Canada)
Heat and mass transport modelling during meat ball cooking.

- P. SALE, J.L. DAMEZ, P. TOURNAYRE, A. LASTEYRAS (France)
Automatic extraction of a muscle from a beef forequarter.

- V.Y. SVINTSOV (Russia)
Study of electrical method of atomizing food products.

- S. TYSZKIEWICZ, M. PANASIK (Poland)
Kinetic studies on sausages smoking processes.

- M. KAMAL E. YOUSSEF, S.H. ABOU-el-HAWA, M.N. RIFY, A.H. KHALIFA (Egypt)
Influence of certain processing methods on the essential amino acids content of rabbit meat.

- M. KAMAL, E. YOUSSEF, S.H. ABOU-el-HAWA, M.N. RIFY, A.H. KHALIFA (Egypt)
Effect of certain processing methods on phospholipid components in rabbit meat.

- D. ZHAILAUBAYEV, . OSPANOV, K. KUSMANOV, G. TUMENOVA (Russia)
Principles of the theory and the development of intensive drying processes with grinding of biological products.

- S. UALIEV, M. SMIRNOV, A. BOLSHAKOV, E. TULEUOV, N. APSALYAMOV (Russia)
The technology for improvement of fresh smoked sausage quality.

- A. VIZZANI, A.R. LOSCHI, M. TREVISANI, M. SEVERINI (Italia)
Quality aspects of a low fat line of typical italian pig meat products.

- K. VHULKOVA, D. POPOV (Bulgaria)
A technology for meat products enriched with assimilable iron.

- WANG WEI (China)
Chinese traditional meat products and their processing.

- K. WASSILEV, K. VHULKOVA, S. DANCHEV (Bulgaria)
Modification of the fatty acid composition of cooked non durable sausages.

- Y.L. WU, Y.X. YANG (China)
Evaluation of nutritive and edible value in sichuan sausage of pork rabbit meat .

- YANG YAO HUAN (China)
The technological researches in some traditional meat products of China.

- G.A. YERESKO, I.T. TIMOSCHUK, E.A. KOSYUK, L.M. RUDIK (Russia)
Usage of texturated milk proteins in meat products.

- ZHANG GENSHENG, NI CHEN, MIN LIANJI (China)
The application of sodium caseinate in poultry sausage.

- ZHANG YONGFU, MENG XIAMIN, HAOLIN, MA LIZHEN, JIANG FUHU (China)
Research on young chicken serial products and the products' storage period.

- P. ZEUTHEN, B. MIKKELSEN (Denmark)
Use of carrageenan as a curing ingredient in hams.

Session 11 - ADVANCED TECHNOLOGIES IN THE MEAT INDUSTRY

- S. AHMETOV, A. GORBATOV, V. KOSOJ, S. TUMENOV, O. VORONOV (Russia)
Evaluation of barostatic method for meat raw material processing

- J.W. BUHOT, A.F. EGAN, R.A. WHARTON, K.D. BOWTELL (Australia)
An automated system for the slaughter and dressing of bovines.

- A. COLLIGNAN, A.L. RAOULT WACK (France)
Dewatering through immersion in sugar/salt concentrated solutions at low temperature. An interesting alternative for meat stabilisation.

- J.L. DAMEZ (France)
Preliminary probe measurements of dielectric properties in biological tissues at microwave frequencies.
- J.D. DAUDIN, A. KONDJOYAN, J. SIRAMI (France)
Water and salt transfers analysis in drying of sausages.

- J.D. DAUDIN, V. BOUTON, G. PROD'HOMME, J.L. MOURLHON DALLIES
Air flow characteristics in a chiller for pork offals and cooling consequences.

Session 2

GROWTH AND MEAT QUALITY

QUANTITY AND FATTY ACID COMPOSITION OF VARIOUS DEPOT FATS IN CASTRATED AND NONCASTRATED HOGGETS FED CLENBUTEROL

V. BANSKALIEVA, A. ANGELOV, Z. SHINDARSKA, P. MARINOVA
Institute of Animal Science, 2232 Kostinbrod, Bulgaria

A trial has been conducted on male castrated and noncastrated hoggets fed diets containing energy and protein - 4.1 MJ and 130 g per kg of feed, respectively. The effect of long-term treating (6 months) with Clenbuterol (1 mg/kg diet) on both quantity and fatty acid composition of lipids from different adipose tissues (perirenal, tail, caul, breast, intermuscular) has been studied.
A decrease of lipid amounts was established in adipose tissues in treated (castrated and noncastrated) animals compared to control groups.
Clenbuterol leads to some changes in the size of adipocytes and composition of adipose tissue triacylglycerols. Changes observed are associated with physiological state of animals and localisation of fat depots.

VALUATION OF CARCASS DISSECTIONING AND CHEMICAL PROPERTIES OF MEAT FROM TURKEY BREEDING IN TURKİYE.

·BULGAY, S.O.TÖMEK and M.SERDAROĞLU

ge University, Food Engineering Department, Bornova, İzmir, Türkiye.

n Türkiye, there are some problems about the poultry meat production and consumption. Turkish people have on abitude to eat red meat. So there isn't sufficient research about chemical properties of turkey meat and lso using in the meat industry. For this reason this subject must be investigated. In this research 16 rkey were slaughtered and dissected to a breast, thigh, skin with underskin fat, edible offals and rimmings. Carcass and meat yield were determined for each part the protein, water, ash and fat content, pH d the TBA number were determined in thigh, breast and the skin. The total viable count was determined on igh and breast. As a result, carcass yield and meat yield of carcass were found 75% and 73% respectively. ligh, breast, trimmings, skin and bone percentage were 18,22,18,17 and 25 respectively. Oil content are tween 3-6% for thigh, 1-3% for breast and 21-61% for skin water content are between 70-77% for thigh, 73-% for breast and 22-77% for skin. TBA number changes between 0.16-0.51 for thigh, 0.08-0.44 for breast and 2-0.6 mg malonaldehyde/1kg for skin and fat pH are 6.47 for thigh and 5.78 for breast. Total viable counts e $39x10^4$ total cell/gr for thigh and $43x10^4$ total cell/gr for breast.

INFLUENCE OF GROWTH INTENSITY AND CARCASS WEIGHT ON CARCASS AND MEAT CHARACTERISTICS OF BROWN BULLS

S. ČEPIN, M. ČEPON, D. ŠKORJANC

University of Ljubljana, Biotechnical Faculty, Zootechnical Department, 61230 DOMŽALE, Slovenia

Influence of growth and carcass weight on carcass quality and physical-chemical and sensory meat characteristi has been studied in case of 64 brown bulls cross-breed with Brown Swiss (40 % of B.S. blood), fattened med intensively to average weight 575 kg. Phenotypical correlations and regressions between certain carcass and me characteristics have also been studied.

The results of the research show that increase of weight hasn't significantly affected any of the important carcass or meat characteristics. But weight of finished animals or carcass weight has significantly affected most of the important carcass and meat characteristics. In this way carcass weight was in significant positiv correlation with subjective evaluation of carcasses (r = 0,42), with % of fat in carcasses (r = 0,47), with meat : bones ratio (r = 0,28), with flavour of meat (r = 0,34) and with % of fat in meat (r = 0,38). Carcass weight was in negative correlation with % of bones (r = -0,45), with % of more valuable carcass parts (r = -0,31), with meat : fat ratio (r = -0,44) and with % of water in meat (r = -0,27).

CHANGES IN BOTH QUALITY AND COMPOSITION OF MEAT IN CASTRATED AND NONCASTRATED HOGGETS FED CLENBUTEROL

Z. CHINDARSKA, V. BANSKALIEVA, P. MARINOVA, T. DARDJONOV

Institute of Animal Science, 2232 Kostinbrod, Bulgaria

The effect of Clenbuterol (1 mg/kg diet) on both quantitative and qualitative carcass characteristics in castrated and non-castrated male hoggets fed diets contained 4.1 MJ energy and 130 g protein/kg feed, respectively.

Clenbuterol intake induces a growth of pre-slaughter weight, slaughter carcass and dimensions (weight and surface) of m.Longissimus Dorsi in both castrated and non-castrated hoggets.

A protein increase was established in the meat and m.Longissimus Dorsi, regardeless of physiological condition. Mioglobin decrease as well as some changes in pH, colour, water binding capacity show that Clenbuterol makes worse tha quality of meat produced. Drastic reducing of fats in animals treated (about 5 times in m.Longissimus Dorsi and about 2 times in mean meat samples) is not accompanied with changes in their fatty-acid composition.

EFFECTS OF A RESTRICTED GROWING DIET AND/OR A FAT SUPPLEMENTED FATTENING DIET ON FATTY ACID COMPOSITION IN CARCASSES OF BULLS

A. CLINQUART, C. VAN EENAEME, L. ISTASSE, P. BALDWIN, J.L. HORNICK and J.M. BIENFAIT
Nutrition, Faculté de Médecine Vétérinaire, Université de Liège, B43 - Sart Tilman, 4000 LIEGE, BELGIUM

It is interesting to increase the unsaturated fatty acid proportion (UFA) in carcasses of fattening bulls, if replacement of saturated by unsaturated fatty acids lowers the incidence of coronary heart disease. The present experiment was designed to examine the effects of protein and energy restriction during growth associated or not with a fat supplement during the fattening period on fatty acid composition in the carcasses.

Twelve Belgian Blue - dual purpose type - bulls were used in a 2 x 2 factorial design. During a 202 days growing period they received a conventional diet (80% concentrate, 20% hay) or a restricted diet (RD)(20% concentrate, 20% hay and 60% straw). During the fattening period, they were given a sugar beet pulp based diet supplemented or not with extruded soya bean (SB). Fatty acid composition of intermuscular (IM) and intramuscular (M) fats of Longissimus dorsi and perirenal fat (PR) was determined by gas chromatography.

The effects of RD on IM fatty acid proportions were a reduction of C18:0 (21.7% vs 29.9%, P≤0.01) and increase of C18:1 (38.0% vs 31.4%, P≤0.01) and C18:2 (6.4% vs 3.9%, P≤0.05) resulting in a increased UFA (47.2% vs 38.3%, P≤0.001). Similar trends were observed in M but these differences were not significant (48.7% vs 46.6% UFA) except for the C18:1 (37.8% vs 35.6%, P≤0.05). By contrast PR fatty acid composition was not affected by the RD. The effects of SB were quite similar since UFA was increased in IM (44.5% vs 40.9%, P≤0.05) but not in M (48.1% vs 47.2%) and PR (40.3% vs 38.6%).

In conclusion RD during growth and SB during the fattening period produced similar effects on fatty acid composition, varying effects being observed according to the fat location.

RABBIT MEAT FATTY ACIDS AS AFFECTED BY DIET FAT

A. COBOS, M.I. CAMBERO, J.A. ORDOÑEZ and L. de la HOZ.

Departamento de Nutrición y Bromatología III (Higiene y Tecnología de los Alimentos), Facultad de Veterinaria, Universidad Complutense, 28040 Madrid (Spain).

Rabbit meat is a popular food in Mediterranean countries. Important features of this meat are a high content of protein, phospholipids and PUFAs. Thus, this meat is being well considered in human dietetics. The objetive of this study was to investigate if it is possible to reduce the rabbit meat fatty acid saturation to produce a healthier food.

A total of 24 rabbits, consisting of male and female, were used to determine the effects of diets with different fat composition on meat quality. A control diet (CD) containing alfalfa hay (30%), barley (22%), cereal straw (20%), soy bean meal (11%), cereal bran (8%), sunflower meal (7%), salt, vitamins and minerals, was compared with three experimental diets. The composition of these diets was that of the control diet added with 3% tallow (TD), or with 3% oleine (OD), or with 3% soy bean oil (SD).

Animals were slaughtered with a live weight around 2.0 kg. Moisture, protein, fat and fatty acid composition were determined in a meat homogenate from each animal. Statistical analysis was performed using analysis of variance.

Significative differences ($p \leq 0.05$) were found for the chemical composition of the rabbit meat in batch CD *versus* SD, TD *versus* OD, and TD *versus* SD for dry matter; and TD *versus* SD for fat content. Fatty acid composition showed significative differences in the fatty acids: C-14:0 in batches CD and TD *versus* OD and SD; C-16:0 in batches OD and SD *versus* CD and TD, and CD *versus* TD; C-18:1 in batch TD *versus* CD, OD and SD; C-18:2 in batches OD and SD *versus* CD and TD; and C-18:3 in batch SD *versus* CD, OD and TD.

The amounts of C-18:1 and C-18:2 found on the rabbit meat fatty acids were directly related with the diet fatty acid composition.

THE INFUENCE OF THE GENOTYPE OF SIRE AND PHYSIOLOGICAL TYPE ON CARCASS COMPOSITION

J.F. DE BRUYN, R.T. NAUDÉ, J.H. HOFMEYR, H.H. MEISSNER* AND C.Z. ROUX*

Irene Animal Production Institute, Private Bag X2, Irene, 1675, Republic of South Africa

*Department of Animal Production, University of Pretoria, Pretoria, 0002, Republic of South Africa

The primary concern of this genotypic evaluation study was to evaluate the production and product (carcass, meat leather) characteristics of certain sire (Afrikaner-A, Brahman-B, Charolais-C, Hereford-H & Simmental-S) and dam (A Bonsmara-Bo and BA, CA, HA & SA two-way crosses) genotypes of different physiological types, when fed under inten ive production systems. Weaner steers of these respective purebreds and crosses were intensively fed (average: ME 10,50 MJ/kg and CP = 11,86 %) in individual feeding pens and slaughtered immediately post weaning (~210 kg) and 340, 380 and 440 kg live masses respectively for a complete slaughter animal, carcass, meat quality and hide/leather quali evaluation. All carcasses were dissected into subcutaneous fat (SC fat), meat and bone in order to determine the physic carcass composition. Carcass composition in terms of total fat + muscle + bone was determined by combining t physical composition of the carcass with the chemical composition of a representative cut (prime rib: 11, 12 & 13 ribcu Carcass composition was evaluated at an equal SC fat basis (analysis of covariance), while carcass mass at an equal SC (%) was used as the basis for the grouping of the 34 genotypes in five different physiological groups (early to late).

A significant ($P<0,05$ & $P<0,01$) sire and physiological group effect was evident for bone, meat and total fat (and muscle:bone ratio, with the effect on muscle (%) being non-significant (equal SC fat %). The late maturing C- a S-sired genotypes and medium-late and late physiological groups had a significantly ($P<0,05$) lower bone (%) and high meat and total fat (%) and muscle:bone ratio, compared to the early maturing B- and H-sired genotypes and mediu early and early groups. The carcass composition of the early maturing A-sired genotypes tended to be intermediate.

Comparing animals of different genetic backgrounds and physiological status at an equal SC fat (%), resulted in s nificant differences in carcass composition. Thus, carcass classification systems based on SC fat (%) will fail to separ dissimilar carcasses on the market in terms of composition, primarily due to physiological differences.

HISTOLOGICAL STUDY OF SOME ORGANS IN ORGANISM OF LAMBS FED CLENBUTEROL

LILIA DICHEVA

Institute of Animal Science, 2232, Kostinbrod, Bulgaria

In three groups of lambs fed low- concentrated, moderately-concentrated and high-concetrated, the effect of Clenbuterol has been studied on histostructures of some organs Lambs received at 10 mg/kg feed of Clenbuterol daily for 42 days. In each group of fou animals samples for histologic analyses of duodenum, jejunum, rennet, liver, lung and kidneys have been taken.

Results of the study show that Clenbuterol supplement has influenced somwhat on some histostructures in duodenum, jejunum and rennet only the group of lambs under high-concentrated feeding. In all three groups of animales were established stagnatio and distrofic effects in liver, as well as a series of changes in their kidneys, concerning mainly Malpigic corpuscles. In lungs inflammatory processes observed in pulmonary parenhim with a predominant heamoragic character occur mainly in animales of experimental groups but the presence of those processes in some animales of control groups does not give sufficient grounds for categorical inferences.

PORK PRODUCTION EFFICIENCY OF CROSSBRED AND INDIGENOUS INDIAN PIG

C.V.DUBEY,

Piggery Development Officer, Animal Husbandry Department, Govt. of Bihar, Ranchi, India.

Cross breeding of local pigs with exotic ones has been started in India for increasing the production. Therefore the present study has been undertaken at organised farms as well as surrounding villages of Ranchi. Five genetic groups Landrace, Large white yorkshire, Local, Landrace x Local and Large white yorkshire x Local were studied for growth, reproduction and feed conversion efficiency.

The study conducted in village condition indicated the superiority of Large white yorkshire x local crosses over other. Landrace cross was found superior in organised farm condition. For grading up of local pigs it will be desirable to deploy Large white yorkshire among the farmers in village condition.

COMPOSITION DATA OF PORK FROM A NEW GENOTYPE BRED NATURALLY AS COMPARED TO THE PORK FROM LARGE SCALE FARMING

E. DWORSCHÁK[x] - A. LUGASI[x] - É. BARNA[x] - A. GERGELY[x] - M. TEKES[x]
- Ö. GAÁL[x] - RADNÓTI[x] - L. JUHÁSZ[xx] - J. KALTENECKER [xxx] - G. BÍRÓ[x]

[x]National Institute of Food Hygiene and Nutrition, Budapest, Hungary
[xx]Meat Trade Company of Budapest
[xxx]Hungamang Ltd. Budapest

A new pig genotype of Hungarian Big White (75 %) and mangalica (pigs with curly bristles, 25 %) was bred and then the pigs were kept in a small farming system, with all possibilities of a natural lifestyle. They did not receive either antibiotics or yield increasing hormones. The pigs were sacrified at a bodyweight of 160 kg or so.

Control pigs of genotype Hungarian Big White were kept in a large-scale farming and sacrified at 100-120 kg of bodyweight. The two groups (12 animals each) received practically the same feed.

Lipid peroxidation characterized by the malondialdehyde level was significantly decreased in the spare rib, chop and ham samples of the new genotype. Superoxide dismutase activity, referring to the enzymic defence against free radicals, was much higher in the hams and chops of new genotype than in the control samples.

Iron and zinc levels were much higher in the pork samples of the new genotype. In this group an increase of thiamin concentration could be observed, too.

Arachidonic acid highly elevated in the liver of the new genotype compared to the control.

There was no marked difference in the protein and fat content between the samples of the two pig groups.

Research work is in progress to find the reason for the differences in the composition data.

THE INFUENCE OF THE GENOTYPE OF SIRE AND PHYSIOLOGICAL TYPE ON CARCASS COMPOSITION

J.F. DE BRUYN, R.T. NAUDÉ, J.H. HOFMEYR, H.H. MEISSNER* AND C.Z. ROUX*

Irene Animal Production Institute, Private Bag X2, Irene, 1675, Republic of South Africa

*Department of Animal Production, University of Pretoria, Pretoria, 0002, Republic of South Africa

The primary concern of this genotypic evaluation study was to evaluate the production and product (carcass, meat & leather) characteristics of certain sire (Afrikaner-A, Brahman-B, Charolais-C, Hereford-H & Simmental-S) and dam (A & Bonsmara-Bo and BA, CA, HA & SA two-way crosses) genotypes of different physiological types, when fed under intensive production systems. Weaner steers of these respective purebreds and crosses were intensively fed (average: ME 10,50 MJ/kg and CP = 11,86 %) in individual feeding pens and slaughtered immediately post weaning (~210 kg) and 340, 380 and 440 kg live masses respectively for a complete slaughter animal, carcass, meat quality and hide/leather quality evaluation. All carcasses were dissected into subcutaneous fat (SC fat), meat and bone in order to determine the physical carcass composition. Carcass composition in terms of total fat + muscle + bone was determined by combining the physical composition of the carcass with the chemical composition of a representative cut (prime rib: 11, 12 & 13 ribcut). Carcass composition was evaluated at an equal SC fat basis (analysis of covariance), while carcass mass at an equal SC fat (%) was used as the basis for the grouping of the 34 genotypes in five different physiological groups (early to late).

A significant ($P<0,05$ & $P<0,01$) sire and physiological group effect was evident for bone, meat and total fat (%) and muscle:bone ratio, with the effect on muscle (%) being non-significant (equal SC fat %). The late maturing C- and S-sired genotypes and medium-late and late physiological groups had a significantly ($P<0,05$) lower bone (%) and higher meat and total fat (%) and muscle:bone ratio, compared to the early maturing B- and H-sired genotypes and medium early and early groups. The carcass composition of the early maturing A-sired genotypes tended to be intermediate.

Comparing animals of different genetic backgrounds and physiological status at an equal SC fat (%), resulted in significant differences in carcass composition. Thus, carcass classification systems based on SC fat (%) will fail to separate dissimilar carcasses on the market in terms of composition, primarily due to physiological differences.

HISTOLOGICAL STUDY OF SOME ORGANS IN ORGANISM OF LAMBS FED CLENBUTEROL

LILIA DICHEVA

Institute of Animal Science, 2232, Kostinbrod, Bulgaria

In three groups of lambs fed low- concentrated, moderately-concentrated and high-concetrated, the effect of Clenbuterol has been studied on histostructures of some organs. Lambs received at 10 mg/kg feed of Clenbuterol daily for 42 days. In each group of four animals samples for histologic analyses of duodenum, jejunum, rennet, liver, lung and kidneys have been taken.

Results of the study show that Clenbuterol supplement has influenced somwhat on some histostructures in duodenum, jejunum and rennet only the group of lambs under high-concentrated feeding. In all three groups of animales were established stagnation and distrofic effects in liver, as well as a series of changes in their kidneys, concerning mainly Malpigic corpuscles. In lungs inflammatory processes observed in pulmonary parenhim with a predominant heamoragic character occur mainly in animales of experimental groups but the presence of those processes in some animales of control groups does not give sufficient grounds for categorical inferences.

PORK PRODUCTION EFFICIENCY OF CROSSBRED AND INDIGENOUS INDIAN PIG

C.V.DUBEY,

Piggery Development Officer, Animal Husbandry Department, Govt. of Bihar, Ranchi, India.

Cross breeding of local pigs with exotic ones has been started in India for increasing the production. Therefore the present study has been undertaken at organised farms as well as surrounding villages of Ranchi. Five genetic groups Landrace, Large white yorkshire, Local, Landrace x Local and Large white yorkshire x Local were studied for growth, reproduction and feed conversion efficiency.

The study conducted in village condition indicated the superiority of Large white yorkshire x local crosses over other. Landrace cross was found superior in organised farm condition. For grading up of local pigs it will be desirable to deploy Large white yorkshire among the farmers in village condition.

COMPOSITION DATA OF PORK FROM A NEW GENOTYPE BRED NATURALLY AS COMPARED TO THE PORK FROM LARGE SCALE FARMING

E. DWORSCHÁK[X] - A. LUGASI[X] - É. BARNA[X] - A. GERGELY[X] - M. TEKES[X]
- Ö. GAÁL[X] - RADNÓTI[X] - L. JUHÁSZ[XX] - J. KALTENECKER [XXX] - G. BÍRÓ[X]

[X]National Institute of Food Hygiene and Nutrition, Budapest, Hungary
[XX]Meat Trade Company of Budapest
[XXX]Hungamang Ltd. Budapest

A new pig genotype of Hungarian Big White (75 %) and mangalica (pigs with curly bristles, 25 %) was bred and then the pigs were kept in a small farming system, with all possibilities of a natural lifestyle. They did not receive either antibiotics or yield increasing hormones. The pigs were sacrified at a bodyweight of 160 kg or so.

Control pigs of genotype Hungarian Big White were kept in a large-scale farming and sacrified at 100-120 kg of bodyweight. The two groups (12 animals each) received practically the same feed.

Lipid peroxidation characterized by the malondialdehyde level was significantly decreased in the spare rib, chop and ham samples of the new genotype. Superoxide dismutase activity, referring to the enzymic defence against free radicals, was much higher in the hams and chops of new genotype than in the control samples.

Iron and zinc levels were much higher in the pork samples of the new genotype. In this group an increase of thiamin concentration could be observed, too.

Arachidonic acid highly elevated in the liver of the new genotype compared to the control.

There was no marked difference in the protein and fat content between the samples of the two pig groups.

Research work is in progress to find the reason for the differences in the composition data.

MEAT QUALITY TRAITS EFFECTED BY THE USE OF PORCINE SOMATOTROPIN (PST)

K. ENDER, K. NUERNBERG, CH. REHFELDT

Research Institute for Biology of Farm Animals, Dummerstorf 2551, Germany

The objective of this paper is to investigate the effects of PST administration on slaughte parameters, carcass composition, meat quality, fatty acid composition, the cellularity of skeletal muscle and to compare the effects of various sexes with different final weights. Two hundred twenty eight (228) Landrace barrows, gilts, boars and heavy barrows were assig within sex group to one of three treatment groups (0,2, 4 mg PST for 75 days and 2 increa sing to 4 mg PST for 102 days to the heavy barrows). The slaughter weights were 90 to 100 for barrows, gilts and boars and about 120 kg for heavy barrows. One half of each carcass used for the measurements. The results indicate that long time treatment with PST improves carcasses without negative effects on the meat. The PST administration to barrow slaughter at normal weights improves the meat attributes by 14 to 27 %, decreases the fat by 37 to 4 that means 58 to 63 % controls. The effects in the different sexes are similar in the dire tion but in barrows higher than in femals and boars. Heavy meaty carcasses are possible. An increase of unsaturated fatty acids in treated pigs was investigated. The backfat con sistency was a softer texture. The increased lean growth is achieved by enhanced hypertrop of skeletal muscle fibres.

INTRAMUSCULAR AND INTRACELLULAR FAT CONTENT IN MUSCLES OF PIGS FED HIGH OR LOW PROTEIN DIET RELATION TO MEAT QUALITY

B. ESSEN-GUSTAVSSON[1], A. KARLSSON[2], K. LUNDSTRÖM[3] and A.-C. ENFÄLT[2]

[1] Dept. of Medicine and Surgery, [2] Dept. of Food Science, [3] Dept. of Animal Breeding and Genet Swedish University of Agricultural Sciences, S-750 07 UPPSALA, Sweden

It is well known that intramuscular fat content (IMF) is important for meat quality. M information is needed, however, about the relation between the lipid stored between mus fibres and that stored within fibres, as IMF reflects both stores. The aim of this work was study the relationship between intramuscular and intracellular fat content and meat quality slaughter pigs of halothane-gene-free Swedish Yorkshire (entire males and gilts) fed a h (HP) or a low protein diet (LP). Immediately after exsanguination, samples from M. longissi dorsi (LD) and M. biceps femoris (BF) were taken. IMF was analysed using Soxtec System equipment. Triglyceride content (TG), was analysed on muscle samples that were freeze dried dissected free from blood, fat and connective tissue. The myosin-APTase stain was used identify type I, IIA and IIB fibres. Lipid content within fibres was evaluated using his chemical stains. Meat colour was measured as reflectance (EEL), ultimate pH and drip loss 24h post mortem. Shear force values (SF) were measured on cooked muscle samples of LD using Warner-Bratzler apparatus. IMF values were higher in both LD and BF of LP-pigs compared to pigs. TG did not differ between diets in BF but was twice as high in LD of LP-pigs compared HP-pigs. In LD a positive correlation was found between IMF and TG. TG showed no relation fibre type distribution. High stain intensity for lipid was only seen in type I fibres. M quality did only differ between groups for SF which was higher in HP than in LP-pigs. SF and correlated negatively in LD of LP-pigs. This study shows that lipids are mainly stored in t I fibres and that the differences seen in IMF is only to a minor extent related to TG wit muscle fibres. The result indicate that high triglyceride content in muscle fibres may related to low shear force values.

MEAT QUALITY OF ZEBU CROSS-BREEDS: SENSORY AND MECHANICAL EVALUATION.

M. M. GALLINGER, M. MARCELIA and J. LASTA

Instituto de Tecnología de Carnes, CICV-INTA CC 77 (1708) Morón, Buenos Aires, Argentina

The present study is an attempt to estimate the maximal percentage of Zebú, in Zebú cross-breed, that will not produce changes in meat quality and to evaluate the effect of postmortem meat ageing. All steers (n= 70) of known percentage Angus(AA) and Brahman(B) breeding (AA=14; 3/4A:1/4B=14; 1/2A:1/2B=14; 3/8A:5/8B=14) were reared in Buenos Aires Argentina, from the weaning up to slaughter with high pasture quality. Steers were slaughtered at equivalent outside fat thickness visually monitored by trained evaluators. After chilling (36 hs) the right carcass muscles **semitendinosus**(ST), **gluteus medius**(GM) **longissimus dorsi**(LD) and **biceps femoris**(BF) were sent to INTA-ITC for sensory and mechanical evaluation (Warner Bratzler Shear, WBS). The same muscles of the left carcass were vacuum packaged and aged seven days at 1°C prior to evaluation. Results showed that the AA meat without ageing was more tender than the meat from other groups. Ageing improved tenderness and juiciness in LD of all analyzed cross-breeds. Tenderness of the four analyzed muscles of AA and 3/4A:1/4B cross-breed did not show statistical differences. Measurementes obtained by WBS and sensory panel showed less tender meat as the B percentage was increased. CONCLUSION : meat quality in steers is not affected from AA to 3/4A:1/4B cross-breed. Postmortem ageing improve meat quality in beef animals with different percentage of Brahman.

CARCASS FAT AND INTRAMUSCULAR FAT DISTRIBUTION IN PIGS.

GARCIA, P. T. Y CASAL J. J.
Instituto Tecnologia de Carnes. CICV. INTA.
CC 77. 1708 Morón. Buenos Aires. Argentina.

The quality and quantity of intramuscular fat (IMF) was determined in 31 muscles from eight Duroc Jersey barrows of each of two lines, lean (L) and fat (F) at similar live weight(80.2+-3.18 and 81.2+-3.44 kg for L and F lines respectively), but different carcass fat (32.9+-2.95 and 52.9+-4.50 % for L and F lines respectively). The right side of the carcass was kept at -15°C and the muscles were dissected as soon as possible. The muscles were weighted, minced and aliquot samples extracted with the method of Folch et al.(1957). Aliquot portions from the chloroform extract were used to determine the total weight of chemical fat and for compositional lipid analysis. TLC and GLC were used for lipid separation and methyl ester analysis respectively. Differences in IMF distribution were detected between L and F pigs.The total amount of IMF was almost identical (.43 and .41 kg for L and F respectively) in spite of big differences in body fatness between L and F pigs. The highest correlation coefqficient between IMF% and TDF% were found for **Biceps femoris**(.74) **Rectus femoris**(.73) **Psoas major**(.72) **Extensor**(.74) and **Rectus abdominis**(.72).The IMF% was high in the F pig muscles compared with the L except for **Mm Vastus lateralis, Semi-membranosus, Adductor, Sartorius, Obliquus internus abdominus** and **Transversus abdominis**. The fatty acid composition of IMF lipids shows a strong tendency for a higher percentage of saturated fatty acid in muscles from the F line.

LIPIDS IN LONGISSIMUS MUSCLES FROM GRASS OR GRAIN FED STEERS.

GARCIA, P. T. AND CASAL, J.J.
Instituto Tecnologia Carnes. CICV. INTA.
CC 77 Moron 1708. Buenos Aires. Argentina.

Sixty four Angus steers fed ad libitum on natural grass up to 340 kg live weight were ran dom allocated to two treatment of 32 animals each. T1: The steers were fed ad libitum o natural grass gaining 0.589+-kg/day and T2: The steers were fed ad libitum with sorghu grain and corn silage gaining 0.651+- kg/d. At similar degree of finishing appraised b trained livestock evaluators the steers were slaughtered (465 and 436 kg live weight fo T1 and T2 respectively) and classified in two grading of carcass fat(GCF), 1 and 2, accord ing to Argentine Meat Board regulations. Subcutaneous fat thickness at 10-12 th rib was als recorded. After chilling 24 hs at 4°C samples of Longissimus Dorsi at 10-12 th ribs wer sampling(+- 200g) and kept at -25°C until the analysis were performed. In aliquot sample total intramuscular fat(IMF), fatty acid composition and total cholesterol(C) were es timated. IMF was determined with the Soxhlet method, fatty acid whit GLC and total C with a enzymatic and colorimetric method. Data were analyzed using the program of variance an covariance of the Systat 1987. T1 steers had more body fat (78.2% of the steers in GCF2 com pared with 68% in T2) and more subcutaneous fat thickness (9.2 vs. 7.6 mm, p<.05) than T steers but less IMF (2.9 vs. 3.9%) and C (66 vs. 73 mg % g, p<.05). The T1 LD IMF had mor n-3 fatty acid less n-6 fatty acid and a higher relation n-6/n-3(2.1 vs. 1.6, p<0.05). N important differences between the other fatty acid were detected.

INTRAMUSCULAR VS DISSECTED BODY FAT IN GRASS FED STEERS.

GARCIA, P. T. AND CASAL, J.J.
Instituto de Tecnologia de Carnes. CICV. INTA.
CC 77. 1708 Morón. Buenos Aires. Argentina.

The relation between intramuscular fat (IMF) in **Longissimus dorsi** (LD), **Psoas major** (PM and **Semitendinosus** (ST) muscles and body dissected fat was study in 340 grass fed Angu and crosses of Angus with several breeds. The total amount of dissected fat (TDF) was calcu lated as the sum of the weights of the different fat depots and the values went from 7.2 t 54.1 kg in the left side carcass(5.8 to 34.3 TDF% in the carcass). Two aliquot samples o 10g each from the minced muscles were dried and extracted with hexane for 16 hs to determi the total weight of chemical fat. The data were processed statistically by the NWASTATPA Program. The allometric equation proposed by Huxley(1932) was used to estimate the growt coefficients.The average IMF were 2.9+-1.4; 4.1+-1.6 and 1.7+-0.7 % in LD, PM and ST muscle respectively. The growth coefficients (b) for IMF content relative to TDF were .976; .70 and.483 for LD; PM and ST respectively. The IMF in LD and PM grow at faster rates (p < .05 relatively to TDF than in ST muscle. The simple correlation coefficients between IMF% an TDF% were .62; .61 and .64(p<.05) for LD, PM and ST respectively. In spite of big dif ferences in body fat 62% of St muscles had less than 3% of IMF and 82% of LD less than 4% o IMF.

LIPIDS IN ARGENTINE BEEF CUTS.

GARCIA, P. T. AND CASTRO ALMEYRA, A.
Instituto de Tecnologia de Carnes. CICV. INTA.
CC 77. 1708 Morón. Buenos Aires Argentina.

The intramuscular fat(IMF) content, total cholesterol(C) and fatty acid composition(FAC) were determined in twelve cuts from forthy, fat grading 1(FG1)and fat grading 2(FG2), Angus steers selected at random from a commercial explotation. The cuts were dissected and aliquot samples from the lean part, were analyzed. The muscles studied were **Adductor externus**(A), **Biceps femoris** (BF), **Gluteos superficialis and medious** (G), **Infraspinosus** (I), **Longissimus** (LD 10-12 th and Ld 5-6 th ribs), **Psoas major** (P), **Rectus femoris** (RF), **Semimembranosus** (SM), **Semitendinosus** (ST), **Supraspinatus** (SS) y **Tensor fascia latea** (TFL). Total IMF was determined with the Soxlhet method, fatty acid composition with GLC and total cholesterol with an enzymatic-colorimetric method. The data were analyzed with the SYSTAT 1987 Statistical program. The IMF% were 3.0; 1.1; 2.2; 3.6; 2.2; 2.4; 3.8; 3.8; 1.0; 1.6; 4.6 and 1.9% in Fat level 1 and 3.0; 1.1; 2.2; 3.6; 2.4; 3.8; 3.8; 2.6; 1.0; 1.6; 4.6 y1.9% in Fat level 2 for A, BF, G, I, LD 5-6th ribs, LD 10-12th ribs, P, RF, SM, ST, SS and TFL muscles respectively. The average SD and CV % were .8+-.35 and 30+-5.70 in FG1 and 1.2 and 34+-9.41 in FG2. The cholesterol contents were between 46.3 and 58.9 and between 47.7 and 60.3 mg % g for FG1 and FG2 respectively.The average SD were respectively 8.7+-2.81 y 6.0+-2.51. A high negative correlation was founded between the content of IMF and the levels of C in a given muscle but not important diferences among muscles in C content. The FAC in the muscles BF and PM shows important diferences (42,7-50.3% total saturated fatty acid; 8.5 and 5.0% PUFA; 5.1 and 3.3% n-6 fatty acid; 3.4 and 1.7% n-3 fatty acid).

COMPENSATORY GROWTH AND ZERANOL IMPLANTS: EFFECT ON STEER BODY FATS.

GARCIA, P.T. AND CASAL, J. J.
Instituto Tecnologia de Carnes . CICV. INTA.
CC 77 Moron 1708. Buenos Aires. Argentina.

This study was undertaken to examine the influence of Zeranol implants on intramuscular fat(IMF) of four muscles and in the fatty acid composition of dissected fat from 40 Angus steers under a management program "ad libitum" in a high energy diet(HED) or making compensatory growth with the (HED) after a low energy diet (LED) . The 4 groups with 10 animals each were: ROZO (HED); ROZ1(HED-36mg Zeranol); R1ZO(LED-HED) and R1Z1(LED-HED-36 mg Zeranol). At 400 kg the steers were slaughter and the Mm **Biceps brachii** (BB), **Longissimus dorsi** (LD), **Psoas major** (PM) and **Semitendinosus** (S) dissected. Samples from subcutaneous(SB), brisket (B), perinephric (PN), pelvic (PV), cod (C), subescapular and internal brisket (BI) fats were also dissected. Two aliquot samples from the minced muscles were dried and then extracted with hexane for 16 hs. A third aliquot was extracted according to Folch et al.(1957) for fatty acid analysis. Multivariate analysis of variance was performed using a least square model.Discriminant factor analysis (DFA) was used to classify the adipose tissues into groups according to its fatty acid composition. Not significant differences among ROZO,ROZ1 and R1ZO in the four muscles MF% were detected but all of them had more IMF% than the RIZI($p<.05$).Considering the SB, B and Pn fatty acid composition was possible to get 100% of the steers correctly classified showing clearly the effect of both factors, food restriction and Zeranol implant in the fatty acid composition of steer body fats.

EFFECTS OF CLENBUTEROL AND SALBUTAMOL ON CARCASS AND MEAT QUALITY OF VEAL CALVES

G.J. GARSSEN, A.H. HOVING-BOLINK and J.C. VERPLANKE
Research Institute for Animal Production (IVO-DLO), P.O. Box 501, 3700 AM Zeist, The Netherlands

60 Black and White male veal calves of 46 kg live weight (LW) were fattened on a 100 % milk replacer ra during 24 weeks. Treatment with ß-agonists was from week 21 onwards and included a withdrawal period of 3 before slaughter: 3 groups of 15 calves each were given 0.5 mg clenbuterol (B), 30 mg (C) and 50 mg salbutamol per kg milk replacer (DM) respectively, while 15 calves were left untreated as a control (A). LW increased as a result of treatment and under the same feed intake for the 4 groups, feed efficiency impr (12 - 16 %) reaching significance for D. Carcass weights and dressing percentages (56.5, 59.4, 58.5 and 59 for A, B, C and D respectively) were higher ($P < 0.05$) for the treatment groups. EUROP conformation assessed before ($A:P^+;B,C$ and $D:O^+$) and after slaughter ($A:O^-;B,C:O^+;D:R^-$) improved ($P < 0.05$) and EUROP fat was found lower after treatment. Effects of clenbuterol were roughly identical to those of the highest dos salbutamol. Weights of fat depots decreased ($P < 0.05$) for B and D (kidney plus channel fat: 24 %, mesent fat: 15 %, fat around rumen and along ab/omasum: 12 %) and the percentage of intramuscular fat in longissimus muscle (m.l.d.) also decreased. Weights of some organs decreased (liver: 6 - 8 %, kidneys: 8 - 1 thymus: 6 - 26 %, pancreas: 14 - 22 %), while adrenal weight increased (8 %). Loin eye area increased (19 and 24 % for B, C and D respectively; $P < 0.001$) presumably as a result of muscle hypertrophy since protein/DNA ratio numerically increased by 5 (B), 8 (C) and 14 (D) %. Meat quality parameters as a resul treatment indicated a higher ultimate pH (24 and 96 h) for the 3 muscles examined (m.l.d., psoas major semitendinosus); the greatest effect ($P < 0.02$) was found for the m. semitendinosus. In line with this, glyc content of the m.l.d. was found to be decreased by 19 % (C and D; $P < 0.05$) directly after slaughter (glycogen concentration was found 25 (B), 35 (C) and 45 (D) % lower than the control). Tenderness of the m decreased: shear force values determined on days 2, 5 and 10 post mortem increased by 31 - 45 % ($P < 0.02$) significant effects were found for percentages drip loss on day 5 and 10, cooking loss on day 2, 5 and 10 mortem and filter paper scores; a numerically lower waterholding capacity was found for the clenbuterol group. Hunter tristimulus colour measurements on the m.l.d. were higher ($P < 0.05$) for the L^* (lightness) lower for the a^* (redness) values for the clenbuterol treated calves which is in line with a lower m myoglobin content found. In conclusion, clenbuterol and salbutamol given during 25 days improved gr performance(feed efficiency, and LW gain) and carcass quality (EUROP-conformation, dressing % and leanness veal calves while meat quality parameters indicated a higher ultimate pH, lower tenderness and for clenbuterol treatment a lighter meat colour.

SERUM-INDUCED MYOBLAST PROLIFERATION AND GENE EXPRESSION DURING THE DEVELOPMENT DOUBLE MUSCLED AND NORMAL CATTLE

D.E. GERRARD, A.L. GRANT, AND M.D. JUDGE

Department of Animal Sciences, Purdue University, West Lafayette, Indiana USA

Double muscled (DM) cattle possess nearly 40% more muscle fibers as normal beef or dairy (NM) cattle. Insulin-like gr factor-II (IGF-II) has been implicated in the regulation of myogenesis. Insulin-like growth factor binding protein 2 (IGF-BP2) regu the actions of IGF-II. These, along with other growth factors in serum, may modulate development of bovine fetuses. Twelve DM an NM fetuses were utilized for these experiments to test the effect of fetal serum on muscle cell proliferation in vitro and to determin temporal expression of IGF-II and IGF-BP2 in the liver and muscle of developing bovine fetuses. Crown-rump length (CRL) was to determine fetal age. At a given chronological age between 20 and 60 cm CRL, CRL of DM fetuses was similar to those of NM fet Incorporation of ^{3}H-thymidine by L6 and primary myoblast cultures was assessed using media containing serum from 10 DM and 60 fetuses grouped by CRL of $\leq$ 25, 26–50, 51–75 or > 75 cm. Normal muscled fetal serum-induced thymidine incorporation i myoblasts was greater ($P<.05$) at CRL > 50 than at $\leq$ 50 cm CRL. Mean incorporation tended to increase with CRL. Thymi incorporation was 56%, 41%, and 41% greater ($P<.05$) with serum from DM fetuses than that of NM fetuses at CRL of $\leq$ 25, 26–50, 51–75 cm, respectively. Primary myoblast cultures of NM and DM fetuses responded similar to L6 myoblasts. Apparent muscle number of the semitendinosus muscle was 30% greater for DM fetuses than NM fetuses at term ($P<.05$). Skeletal muscle samples taken from 12 DM fetuses and 47 NM fetuses representing 10 cm CRL growth increments during gestation. In addition, liver sam from 7 DM and 29 NM were collected. Total RNA preparations from these samples were subjected to northern and dot blot analysis rat IGF-II, IGF-BP2 and human skeletal muscle alpha-actin cDNAs. Expression of skeletal alpha-actin in muscle increased ($P<.05$) age in both NM and DM fetuses, but DM fetuses expressed greater ($P<.05$) amounts of alpha-actin than NM fetuses near term. Rel abundance of muscle IGF-II mRNA decreased ($P<.001$) with age in DM and NM fetuses. Muscle IGF-II expression was less ($P<.0$ 20 cm CRL, but greater ($P<.05$) at 40 cm CRL in DM than NM fetuses. Insulin-like growth factor II and IGF-BP2 expression in the increased ($P<.05$) with age in DM and NM fetuses. Expression of IGF-BP2 was greater ($P<.05$) near term in DM fetuses than fetuses. These results show DM fetuses have delayed expression of muscle IGF-II during early development and have greater bi borne growth factor activity than NM fetuses. These factors may play a role in the development of bovine muscle cell hyperplasia.

EFFECTS OF BREED, HALOTHAN GENOTYPE AND SEX ON THE LIPID COMPOSITION OF TWO SKELETAL MUSCLES AND ADIPOSE TISSUE IN SWINE

S. HARTMANN, W. OTTEN, M. KRATZMAIER, A. BERRER and H.M. EICHINGER
Versuchsstation Thalhausen, Techn. Univ. Munich, W-8051 Kranzberg, Germany

Fatty acids are well known as energy supplier but also as structural and functional parts of membrane systems. Fatty acids in food, especially in meat and meat products, are supposed to influence blood cholesterol levels. It was the aim of this study to investigate the influence of breed, Halothan-genotype and sex on the lipid composition of two porcine skeletal muscles and two different adipose tissues.

35 pigs of two different breeds (German Landrace = DL, Pietrain = PI), two genotypes (Halothan negative = H-, Halothan positive = h+) and sex were fed with a standard diet ad libitum. After reaching a body weight of approximately 100 kg, the animals were slaughtered, muscle samples (musc. long. thoracis, musc. supraspinatus) and adipose tissues (backfat = BF, intermuscular adipose tissue = IAT) were removed and lipids extracted. Fatty acids were determined by gas chromatography.

The total lipid content was mainly affected by breed and Halothan genotype, where the h+ pigs showed significantly lower total lipid contents. Relative amounts of saturated fatty acids in all tissues examined were significantly higher in DL animals, whereas, except for IAT, the monoenic fatty acids were significantly reduced. In general, H- animals have significantly higher relative amounts of saturated fatty acids and lower relative amounts of PUFA compared to the h+ animals. Female pigs showed relatively higher amounts of PUFA throughout all tissues.

Our results indicate, that fatty acid patterns are affected by breed, Halothan genotype and sex. Halothan genotype and sex predominantly influence the relative amounts of PUFA and saturated fatty acids, whereas breed modifies mostly the relations between monoenic and saturated fatty acids.

CARCASS AND MEAT QUALITY OF F_2-CROSSES BETWEEN EUROPEAN WILD BOARS AND DOMESTIC PIGS

K.LUNDSTRÖM[1], I. HANSSON[2], M. JOHANSSON[1], L. ANDERSSON[1], K. ANDERSSON[1] AND J. HÅKANSSON[3]
Departments of [1]Animal Breeding and Genetics, [2]Food Science and [3]Animal Nutrition and Management, Swedish University of Agricultural Sciences, S-750 07 UPPSALA, Sweden

An experiment originally designed for pig genome mapping was used in order to study carcass and muscle development as well as meat quality of F_2-crosses between the European wild boar and domestic pigs. One of the two wild boars used in the parental generation was found to be carrier of the halothane gene, while the domestic sows were non-carriers. In total, 192 pigs from the F_2-generation were studied. These pigs were typed for the halothane gene using a direct DNA-test. As the domestic pigs have been selected for a fast growth rate, this trait was used as a total marker for the influence of domestic and 'wild' genes, respectively. The material was thus devided into two parts, below (Low Growth, LG-group) and above (High Growth, HG-group) the mean growth rate. As the variation in growth rate was large, both live weight and age at slaughter varied. At assessment, the carcasses were devided into cuts. The back and ham were defatted, and the **M. longissimus dorsi** and the large muscles of the ham were weighed separately. Surface reflectance value (EEL), ultimate pH (pH_u), drip loss, pigment content, protein denaturation and shear force value were measured on the **M. longissimus dorsi**.

In comparison with the HG-group, the carcasses in the LG-group were leaner but with smaller muscles, mostly due to a lower slaughter weight. The reflectance value and the drip loss were lower and there was a tendency to less denaturated protein. The effect of the halothane gene was very obvious, although no animals had the gene in homozygote form. Animals carrying the gene were leaner but had higher reflectance value, lower pH_u, higher protein denaturation and higher shear force value. No interaction was found between growth rate group and halothane genotype in any variable.

EFFECT OF DIETARY ENERGY LEVEL ON FREE FATTY ACID COMPOSITION IN BOVINE LONGISSIMUS DORSI MUSCLE

MARGARIA[1], C. A. AND GARCIA[2], P. T.

[1] Consejo Nacional de Investigaciones Científicas y Técnicas.

[2] Instituto de Tecnología de Carnes,CICV-INTA. CC 77 (1708) Morón, Buenos Aires. Argentina.

The aim of this work was to determine if bovine diet energy level induces changes on free fatty acid (FFA) composition of meat. Twenty-four pure Aberdeen Angus steers were divided into two groups. One of them received a diet of mixed grass pasture, and the other, sorghum grain and corn silage. Both groups were slaugthered in the same abattoir after 178 days of treatment. Chloroform extracts were obtained from 24 Longissimus dorsi (L. d.) muscles and 19 subcutaneous fat portions (Folch et al. 1957), 24h after slaughtering. FFA composition was analyzed using Margaría y García (1990a) method and FFA levels using Margaría y García (1990b) technique. FFA levels in subcutaneous fat were higher for grain-fed animals (Gn-FA) than for grass-fed animals (Gs-FA) (194±34µmol% and 160±52µmol% respectively) but not statistically different (P<0.05). For L. d. muscle FFA levels were also higher for Gn-FA than for Gs-FA (202±23 µmol% and 186±22 µmol%, respectively), but not statistically different (P>0.05). Using multivariate analysis of variance, the FFAs composition of both groups resulted statistically different (P<0.007). Univariate comparisons revealed differences statistically significant for 16:1 (P<0.001), 17:0 (P<0.001), 18:1 (P<0.011) and 18:2 (P<0.001) between treatments. The proportions of these FFAs were higher in Gn-FA than in Gs-FA, except component 18:1 that was higher in Gs-FA. A discriminant analysis of the data allows separation into two groups with an efficiency of 100% and 92% for grain and Gs-FA respectively. Although both groups had the same quantities of FFAs, higher quantities of linoleic acid in Gn-FA makes those meat more susceptible to oxidative deterioration than in Gs-FA.

DEPOSITION AND COMPOSITION OF MUSCULAR TISSUE IN LAMBS UNDER DIFFERENT FEEDING LEVEL AND CLENBUTEROL PARTICIPATION

P. MARINOVA, Z. SHINDARSKA, V. BANSKALIEVA

Institute of Animal Science, 2232 - Kostinbrod, Bulgaria

SUMMARY

The effect of Clenbuterol (10 mg/kg diet) has been studied in male lambs fed diets containing different energy levels (4,3; 5,1 and 6,0 MJ/kg diet) and protein (140, 200 and 200 g/kg diet), respectively. A full slaugheter and chemical analysis of carcass and qualificative characteristics of meat have been made.The size of adipocites of intramuscular fat in m. Longissimus Dorsi and its fatty acid composition have been studied.

In contrast to low-concentrated feeding Clenduterol was established to increasing the value of carcass characteristics and protein in the other two feeding levels. In all the three experiments fat amounts in experimental animals decreases accompanied by analogic change in the size of adipose cells. Clenduterol increases total unsaturation of triacyliglicerols in m. Longissimus Dorsi and mean meat sample under high-energy feeding, whilst in the other two schemes of feeding it is of reverse effect. The use of B -agonist Clenbuterol does worse the qualitative characteristics of meat.

EFFECT OF PREGNANCY AND CALVING ON MUSCLE CHARACTERISTICS IN CATTLE

D. MICOL, P. BERGE*, D. DOZIAS, J. LEPETIT*, G. LIENARD**, B. PICARD, M. RENERRE*, J. ROBELIN, J. TOURAILLE* AND Y. GEAY

Laboratoire Croissance et Métabolismes des Herbivores, * Station de Recherches sur la Viande, ** Laboratoire de l'Economie de l'Elevage, INRA-THEIX, 63122 SAINT-GENES-CHAMPANELLE, France

Twenty-two Limousin females (12 heifers and 10 first calf heifers) were slaughtered at 36 months of age weighing 668 kg and 641 kg respectively, (31 days after calving). Heifers were raised in identical conditions after weaning (291 kg LW), wintered on maize silage and grazed during summer periods, to achieve the same average daily gain (386 g/d) until artificial insemination at 26 months. At the end of the grazing season, they were finished indoors on a maize silage diet for 71 days before slaugther. Calves were weaned from first calf heifers 3 to 5 days after calving. Empty body, hot carcase and offal weights were determinated at slaughter. The right side of carcasses (2 x 7) was dissected into muscle, fat and bone. Dry matter, total nitrogen, lipids, pigments (heme iron), total collagen content and heat-labile collagen content were evaluated on *Longissimus thoracis* (LT), *Rectus abdominis* (RA) and *Triceps brachii* (TB). Protein and DNA concentration, and isocitrate dehydrogenase activity were determined on the *Semitendinosus*, LT, RA and TB. Fiber type was determined using an immunological determination (ELISA) with monoclonal antibodies against slow and fast myosin heavy chain isoforms. At days 1 and 8 after slaughter reflectance spectra for colour stability were obtained on a cross-section of the LT and TB. The ageing of meat was studied on LT and TB, measurements were made at days 1, 4 and 14 post mortem.

Heifers produced heavier carcases than first calf heifers (+ 13 kg). Anatomical carcase composition remained unaltered by calving. Nevertheless, first calf heifers had less internal fat and a higher dressing percentage. The effect of calving produced no consistent differences in nitrogen, lipids and collagen content or collagen heat-labile collagen in the different muscles. Oxidative activity of muscle and fiber type was not affected by calving. Further, after 8-day storage, differences in heme pigment concentration, colour characteristics and metmyoglobin content were not observed. Also, there was no significiant difference in ageing of meat between the two groups. Therefore, pregnancy and calving followed by a 30-day finishing period have no major effect on carcase composition and muscle characteristics of heifers.

CARCASS AND MEAT QUALITY OF FALLOW DEER

J. MOJTO, V. KARTUSEK and O. PALANSKÁ

Research Institute of Animal Production, 949 92 NITRA, Czecho-Slovakia

There are good conditions for farm rearing of fallow deer /Dama Dama/ in Slovakia. Introduction of market economy opens further possibilities for development of this not traditional branch of animal production. Elaboration of models of new farms, optimization of slaughter weight, evaluation of meat quality and study of factors which influence it are the main task of the research.

In the first trial we compared the carcass value in three age categories of fallow deer kept in farm /10-11, 15-17, 22-23 months/. Animals at the age of 15-17 months had the highest dressing percentage /59.07 %/. On the other hand the highest share of lean meat cuts /back, thigh, shoulder/ was in the category of 10-11 months old animals /76.95 %/. In the second trial we compared the meat quality of fallow deer kept in farm with wild fallow deer. We used only males. The average slaughter weight was 48.0 kg in the first group and 45.5 kg in the second group. We observed the basic chemical composition, nutritional value, content of mineral substances, physical and technological, and sensorial properties in samples of m. long. dorsi. Meat of fallow deer kept in farm had more intramuscular fat, lower cholesterol and connective tissue proteins contents, higher content of mineral substances, more pale and tender meat, lower cooking and baking losses and it was of less characteristic taste and smell

CULL COW PHYSIOLOGICAL MATURITY AND ITS EFFECT ON CARCASS AND MEAT QUALITY

L. MÜLLER, Z. PEROBELLI, G.L.D. FEIJÓ and C. GRASSI.
Departamento de Zootecnia, Universidade de Santa Maria, Santa Maria, RS, BRASIL

ABSTRACT: An study was conducted in a private ranch with 72 cows (28 Aberdeen Angus and 44 Charolais) that were finished during a period of 150 days in native grass of medium quality. After slaughter and 24 hs chill, the carcasses were classified by physiological maturity using the USDA systhem adapted to Brazilian conditions, in C Maturity (6-7 years old, 13 cows), D (8-9 years old, 39 cows) and E (over 9 years, 20 cows). The experiment was conducted in a completely randon design in a 3x2 factorial. The objective was to determine how physiological maturity affects carcass and meat quality. There was no significant increase in carcass weight in the Angus cows but Charolais were heavier in D and E maturity. Average weight for Angus was 170 Kg and 190 for Charolais. Cold shrinkage was higher in the younger Angus, (2.08%) .97% for D and .68 for E, but the same was not noticed in Charolais that averaged .67%. C Angus maturity presented higher shrinkage ($P < .05$) than Charolais. C group show a tendency of displaing better carcass yield in both breeds. Conformation was judged as "Fair" for all carcasses. Angus and Charolais displayed a better finish in D group: 2.70 mm for Angus and 1.74 for Charolais. Longissimus area was not affected by maturity in both breeds being however superior in Charolais. It was not found any significant difference with respect to marbling, color and texture of the lean between maturity groups and breeds. Angus meat was judged similar in tenderness, juiciness and palatability by the taste panel but the shear force was higher (9.99) in E cows against 7.80 for C and D. Charolais also presented similar values for these parameters among maturity groups. Comparing Angus and Charolais the only significant difference was found for the shear value in E group: 9.99 for Angus and 7.41 for Charolais. It can be concluded from this study, that after the bovine has reached maturity litle differences can be expected to be found in carcass quality with advancing age.

EFFECT OF MANAGEMENT SYSTEM ON HISTOLOGICAL CHARACTERISTICS OF LAMB MUSCLES

F. NICASTRO[1] and W. G. MOODY[2]

[1]Department of Animal Production, University of Bari, 70126 - BARI, Italy

[2]Department of Animal Sciences, University of Kentucky, 40546 - LEXINGTON, Ky, U.S.A.

Thirty crossbred ewes and their sixty twin lambs (half ewes and half wethers) were allotted to three management systems. Lambs from these groups were further divided into four finishing groups. Lambs in group 1 remained on their mothers from birth to slaughter at 45 kg. Group 2 lambs were weaned at 8 wk., placed in drylot and fed a standard finishinh ration until slaughtered at 45 kg. One twin from each ewe in group 3 remained with the ewe until slaughtered at 45 kg. The remaining twin in this group (group 4) was weaned at 8 wk., placed in drylot and fed similar to lambs in group 2. Muscle samples were collected from the longissimus thoracis (LT) and the semimembranosus (SM) 48h postmortem. Samples were immersed in liquid nitrogen, serially sectioned on a freezing microtome and reacted with NADH-TR and ATPase to determine the oxidative and glycolitic response to the tissue using a reciprocal staining technique. Muscle fibers were classified as Beta-Red (βR), Alpha-Red (αR) and Alpha-White (αW). The βR fibers from the LT muscle in group 1 were larger ($P < .05$) than the same fiber type in group 4. There was a higher number cell ($P < .01$) βR fibers in group 4 compared to the other groups. Conversely, there was a higher percentage of βR and αW fibers in the SM muscle from lambs in group 1 compared to group 3. Group 1 however had a smaller percent of αR fibers than group 3. Although differences in both fiber types and percentages varied by muscle and groups, these differences did not appear to show a consistent pattern.

IG MEAT QUALITY IN CROSSBREED EXPERIMENTS IN THE MEDITERRANEAN AREA

LIVER, M.A., GISPERT, M., GOU, P., BLASCO, A., DIESTRE, A.

nstitut de Recerca i Tecnologia Agroalimentàries (IRTA), Centre de Tecnologia de la Carn, ranja Camps i Armet, 17121 Monells, Girona, Spain.

trial of 228 pigs representing five crosses involving Duroc (DU), Landrace (LR) and Large hite (LW) for sows, and DU, Belgian Landrace (BL) and LW for boars were compared to find the est combination of breeds for different strategies of Spanish meat industry. Pigs were laughtered at a live weight of 93.98 ± 3.62 kg in the Carcass Evaluation Unit (IRTA-CTC). There as a significative effect of sex and crossbred on the carcass characteristics studied. The rosses with BL and DU as terminal sires (BL*(LW*DU), BL*(LR*LW) and DU*(LR*LW)) showed ignificatively more lean percentage (56.4, 56.8 and 55.1) compared with the crosses with LW ires LW*(LR*LW) and LW*(LW*DU) (53.5 and 51.6). There were no significative effect of sex on eat quality except for intramuscular fat content. The crossbreeds with BL sires showed a lower R45, higher L* value and lower water holding capacity than the crosses with DU and LW as erminal sires. These results indicate that DU*(LR*LW) crosses studied had both a high lean ercentage and a good meat quality. There were no differences between crosses in fat quality easured using a portable penetrometer. In contrast to fat quality, intramuscular fat is trongly influenced by genetics, independently of fat thickness. The crosses with 50 % of DU ad significatively more intramuscular fat percentage at the same fat thickness.

FFECTS OF A MAGNESIUM FUMARATE SUPPLEMENTATION ON MEAT QUALITY IN PIGS

. OTTEN, A. BERRER, S. HARTMANN, T. BERGERHOFF and H. M. EICHINGER

ersuchsstation Thalhausen, Techn. Univ. Muenchen, W-8051 Kranzberg, Germany

agnesium is a cofactor in many enzymatic reactions of protein and energy metabolism. Magnesium is also supposed to unteract catecholamine effects in stress situations. Stress susceptibility is the main reason for the development of poor meat uality, e.g. pale, soft and exudative porc (PSE-meat). It was the aim of this study, to investigate the effects of two pplementation regimes of Magnesium fumarate in the diet of slaughter pigs from different genotypes on meat quality haracteristics.

animals of the German Landrace (DL) and 18 of the Pietrain breed (PI) were split in half reactors and non reactors to the olatile anaesthetic Halothane. These genotypes were equally distributed to form 3 feeding groups with a supplementation of 0g ontrol), 10g and 20g of Magnesium fumarate per kg standard fattening diet. Animals were fed ad libitum, starting with a body lass of 30kg until reaching an approximate slaughter weight of 100kg. After slaughtering, the following criteria were measured: rcass composition, pH, conductivity, water binding capacity and color at 1 and 24 hours post mortem and in two muscles usc. longissimus thoracis and musc. semimembranosus).

general, meat quality criteria were positively influenced by Magnesium fumarate supplementation. Meat color was less pale, H1 values higher and conductivity values significantly lower in the 10g supplementation group and partly also in the 20g pplementation group, compared to the control group. Magnesium fumarate supplementation did not affect any of the carcass mposition criteria. Significant differences in meat quality criteria and carcass composition were also found between genotypes.

EFFECTS OF ENZYME FEED ADDITIVES ON PIG PRODUCTION FOR ENVIRONMENTA PROTECTION IN LIVESTOCK INDUSTRY.

T. OSHIDA*, R. SAKATA*, T. INOMATA*, T. FUKUYASU*, K. KOHZAKI*, K. KUWANO**

*School of Veterinary Medicine, Azabu University, Sagamihara, Kanagawa 229, Japan. **Tokyo Kasei Gakuin Junior Colleg Sanbancho, Chiyoda, Tokyo 102, Japan.

The effects of enzyme feed additives on pig defecation (excrement volume and its characteristics) and production (growth, utility of fe health, nutritional conditions and quality of pork) were investigated. All trials were performed on Meicelase (MC), Delicase (DC) a Proctase (PT) in LWD pigs. The volume and characteristics of the excrement were recorded for 12 piglets (about 50.2 kg), which w divided into 3 groups: control group (only formula feed), MC group (formula feed with MC 800 u/g) and DC group (formula feed with M 500 u/g and PT 50 u/g). These piglets were individually house and allowed to feed freely for 21 days. A growth and feed efficiency trial w performed using 30 hogs and 30 gilts (about 7.4 kg), which were divided into 3 groups of 10 gilts and 10 hogs each: control, MC and D groups. These piglets were individually housed and allowed to feed freely for 161 days (189 days after birth). During the feeding tests, body weight and feed intake were measured for investigation of the growth and utility of feed, i. e. feed conversion, feed efficiency and da weight gain. The health and nutritional conditions were evaluated by blood analysis. The quality of the pork was checked when each f weighed approximately 100 kg and was slaughtered. The left side of the carcass was used to determine the carcass quality. Loin meat w analyzed for physicochemical characteristics such as pH, color and moisture. The three groups were compared for color, odor, tenderne and flavor and given a total score for these sensory evaluations. Addition of enzyme to the feed decrease the excreted volume and improv the characteristics of the excrement for animal waste management. In terms of the body weight gain during the feeding trial, there we significant differences between the test groups (MC and DC) and the control group. All the pigs in the feeding trial were in good heal according to the clinical observation. The pork quality of the test pigs (MC and DC) was found to be comparable to that of the pigs given co conventional formula feed.

HISTOCHEMICAL PROPERTIES OF FOUR BOVINE MUSCLES AS INFLUENCED BY COMPENSATORY GAIN A GROWTH IMPETUS

C.A. PAYNE[1], M.C. HUNT[1], K.E. WARREN[1], J.M. HAYDEN[2], J.E. WILLIAMS[2], and H.B. HEDRICK[2]

[1]Kansas State Univ., Manhattan, and [2]Univ. of Missouri, Columbia, USA.

Supplemented corn silage diets at three levels of dry matter intake (DMI): restricted (R), 1% of body weight (BW) for 120 restricted/realimented (RR), 1% and 2.5% of BW for two 60 d periods, respectively; and non-restricted (NR), 2.5% of BW for 12 were assigned randomly to 15 individually penned crossbred steers. Steers were weighed and intakes adjusted weekly. R and RR not differ in gain during the first 60 d, because they lost 10 and 26 kg, respectively, whereas NR gained 41 kg. During the second d, RR gained 97 kg, NR gained 85 kg, and R gained 21 kg. Total gain increased ($P < .05$) with increasing DMI. Extensor carpi radi (ECR), gracilis (G), longissimus thoracis (L), and semitendinosus (ST) muscles were selected to represent low, average, high/avera and high/average growth impetus groups, respectively. Histochemical samples were removed 4 h postmortem; frozen; sectioned; stai for β-red, α-red, and α-white fiber types; and analyzed for fiber areas, percentages, percentage-areas, and red/white and α/β fiber rat R groups had larger red/white ratios for fiber area than NR. Muscle affected all fiber characteristics ($P < .05$). ECR had the grea percent-area β-red fibers, whereas ST had the least. G had the greatest percent-area α-red fibers, whereas ST, L, and ECR were different. ST and L had larger percent-area α-white fibers than G and ECR. A compensatory growth pattern (CGP) existed in ma fiber characteristics, whereby the R diet had minimum values, RR maximum values, and NR intermediate. Fiber characteristics muscles reacted differently to diet regimen and affected fiber area more than fiber percentage or percentage-area. Interactions affec the area of all ECR fiber types, whereas only α-white fiber area was affected for G, L, and ST muscles. Fiber areas of muscles w high/average impetus (L and ST) showed a definite CGP. Fiber areas of G (average impetus) were smallest in NR animals. ECR (h impetus) fiber areas generally were smallest in R, intermediate in RR, and greatest in NR animals. Because fiber type and impetus we inherently confounded, it is difficult to say whether muscle effects were due to impetus classification or muscle fiber differences.

EFFECT OF POSTNATAL FEEDING REGIME AND CASTRATION ON MUSCLE FIBER TYPES IN CATTLE

B. PICARD, C. BARBOIRON, Rd JAILLER, Rt JAILLER, C. DAMERGI, J. ROBELIN and Y. GEAY

Laboratoire Croissance et Métabolismes des Herbivores, INRA-THEIX, 63122 SAINT-GENES-CHAMPANELLE, France

Twenty-four newborn Montbeliard calves were raised with milk replacer to achieve either a high or low rate of gain, 1 167 g/day and 658 g/day, respectively. At 146 kg, animals were weaned and 6 calves from each group were castrated. Subsequently, all calves were fed a diet of 70 % corn silage and 30 % concentrate that was calculated for a predetermined body weight gain of 1100 g/day. At 300 kg, after which puberty was well established, a biopsy of the semitendinosus muscle was taken. Fiber types were determined using histochemistry (ATPase and SDH activity) and immunocytochemistry with monoclonal antibodies against slow and fast myosin heavy chain isoforms.

This trial shows that a significant number of type IIc cells (with both fast and slow myosin isoforms) remain in these relatively old cattle, regardless of sex and initial rate of gain. The main effect of restriction of food intake is a change in fiber types (increase in type I and decrease in type IIb), and an overall decrease in fiber size, animals being compared at same body weight. No significant differences are observed between sexual types four months after castration.

EFFECTS OF pST ADMINISTRATION TO PREGNANT SOWS ON DEVELOPMENTAL STAGE AND *SEMITENDINOSUS* MUSCLE CELLULARITY OF THE NEWBORN PIGLETS

Ch. REHFELDT, I. FIEDLER, R. WEIKARD, K. SPITSCHAK and K. ENDER

Research Institute of the Biology of Farm Animals, O-2551 Dummerstorf, Germany

Pregnant Landrace sows were treated with 6 mg porcine somatotropin(pST) per day in different periods of gestation to investigate the effects on the developmental stage of their piglets at birth. The sows were divided randomly into a control group and 3 test groups differing in the treatment period, which was between 10 and 24 (I), 50 and 64 (II) and 80 and 94 (III) days of gestation, respectively. After farrowing from each of the 44 litters one piglet of representative birth weight was dissected. Selected organs and hormone glands were prepared and weighed. Body composition was determined by chemical analysis of samples of the autoclaved and homogenized piglet. *Semitendinosus* muscles were analysed for histological/histochemical fibre characteristics and for protein and nucleic acids.

In response to the pST treatment of the sows the birthweight of the piglets increased by 4.8% in group III ($P<0.05$). The mean litter size was unchanged. In tendency organs, except spleen and pancreas, and thyroid gland were heavier in group III (by 9 to 33%), and the body contained significantly more fat ($P<0.05$).

There was no increase in *semitendinosus* muscle weight, length or cross area, although changes in microstructure were evident. Group III showed significantly less nuclei per muscle fibre and per mm² ($P<0.05$) and in tendency the DNA concentration was lower, RNA concentration and RNA/DNA ratio were higher compared to controls. In each of the treated groups the percentage of fibres with central located nuclei - i.e. recognizable primary fibres - was diminished, with significance in group I ($P<0.05$), indicating a higher maturity of skeletal muscle at birth. In group I total muscle fibre number was enhanced by 27%, that means by 80.000 fibres. In group II rather a delay of muscle development than an acceleration was indicated by lower muscle weight and protein content ($P<0.05$).

The results suggest that a pST treatment of sows in the late pregnancy accelerates the development of the fetuses leading to higher body weights at birth combined with generally higher physiological maturity thereby enhancing the ability to survive. Treatment with pST in the early pregnancy may induce the formation of more muscle fibres in the fetus representing a higher growth capacity of skeletal muscle.

ISOENZYME PATTERN OF PYRUVATE-KINASE FROM PSE-PORK AND MEAT OF NORMAL CHARACTERISTICS

F. SCHWÄGELE, C. HASCHKE, *G. KRAUSS and K.O. HONIKEL

Federal Centre for Meat Research, D-8650 Kulmbach, Germany
*Department of Biochemistry, University of Bayreuth, D-8580 Bayreuth, Germany.

In order to investigate the cell biological reasons for the fast glycolysis which is observed during the development of the PSE syndrome in muscles of stress susceptible pigs, pyruvate-kinase (PK) as a key enzyme of the energy turnover in the glycolytic pathway was isolated from M. longissimus dorsi of normal and PSE-prone pigs.
Compared with the enzyme from normal muscles, PK from PSE-muscles showed an increased specific activity, a lower K_m value for phosphoenol-pyruvate and a greater K_{cat}/K_m ratio.
According to the results achieved by isoelectric-focusing techniques, PK from PSE-muscles consisted of three isoenzymes whereas the normal enzyme showed two bands only. The isoenzymes were isolated by preparative isoelectric-focusing and compared with regard to their kinetic properties. Isoenzyme 3, which is specific for PSE-meat, showed a tenfold higher specific activity and a thirtyfold lower K_m value for phosphoenol-pyruvate than isoenzyme 1. Analysis of the amino acid composition did not reveal differences between the isoenzymes 1 and 3. Furthermore for both isoenzymes serine was determined to be the terminal amino acid.
Phosphorylation and dephosphorylation experiments carried out with the isolated isoenzymes 1 and 3 from PSE-muscles and the complete PK preparations from normal and PSE-pigs showed clearly that the PSE-specific isoenzyme 3 is the phosphorylated form of isoenzyme 1. The kinetic properties of isoenzyme 1 are altered by phosphorylation with the consequence of a higher activity at more acidic pH values in the case of PK from PSE-meat.

CHARACTERISTICS OF MUSCLE FIBERS IN BULLS REGARDING GROWTH INTENSITY AND FAT RATE IN CARCASS

D. ŠKORJANC[1], M. ČEPON[1], M. ERJAVEC[2]

[1]Zootechnical Department, Biotechnical Fac., Univ. Ljubljana, 61230 Domžale, SLOVENIA

[2]School of Agriculture, Univ. Maribor, 62000 Maribor, SLOVENIA

The main objective of this research was to analyse Simmental (S) bulls from progeny and Simmental x Montbeliarde crossbreeds (SxM). Samples were taken 24 to 35 hours after slaughter from the middle part of musculus longissimus dorsi (MLD) after 7th rib in the right carcass half. On the basis of myosin ATPase activity (PADYKULA and HERMAN, 1955) muscle fibers were devided to type I and type II, and to red and white on the basis of their SDHase activity (NACHLAS et al., 1957). By computer aided method (PERNUŠ et al., 1986) it was possible to measure minimal diameter, area and extent of each muscle fiber from the photograph. In 1 mm^2 of sample area (OSTERC, 1974) the number of muscle fibers of each type was determined. With higher fat percentage in carcass the rate of red muscle fibers decreased, while the rate of white muscle fibers in MLD increased. Due to higher daily gain the rate of muscle fibers type I decreased, and the rate of type II increased. Simmental sires had statistically significant effect on the rate of all four muscle fiber types, while genotype of SxM sires had statistically significant effect on analysed characteristics of type I muscle fibers, as well as on the number of muscle fibers type I and II per 1 mm^2 of the sample.

PID COMPOSITION OF CARCASS TISSUE FROM TRANSGENIC PIGS

B. SOLOMON[1], V.G. PURSEL[2] and E.W. PAROCZAY[1]
S. Dept. of Agr., ARS, Beltsville, Maryland 20705 USA
eat Sci. Res. Lab., PQDI, [2]Gene Eval. and Mapping Lab., LPSI

tty acid profiles and cholesterol content of whole carcass ground tissue were compared from transgenic (T) pigs expressing a bovine growth hormone gene to 26 control (C) pigs. All igs were fed a common diet and were slaughtered at five different weights: 14, 28, 48, 68 d 92 kg. At 14 kg slaughter weight, carcasses from T-pigs contained 38% less fat, 44% less turated fatty acids (SFA), 48% less monounsaturated fatty acids (MUFA) and 38% less lyunsaturated fatty acid (PUFA) compared to C-pigs. At 28 kg, T-pigs had 38% less total rcass fat, 42% less SFA, 46% less MUFA and 24% less PUFA compared to C-pigs. At 48 kg, T-gs contained 48% less total carcass fat, 55% less SFA, 59% less MUFA and 22% less PUFA mpared to C-pigs. At 68 kg, T-pigs had 78% less total carcass fat, 78% less SFA, 79% less IFA and 53% less PUFA compared to C-pigs. At 92 kg, T-pigs contained 85% less carcass fat, % less SFA, 91% less MUFA and 66% less PUFA than C-pigs. Cholesterol content was not fferent between T- and C-pigs at any of the slaughter weights. However, the trend was for olesterol content to decrease with increasing slaughter weight. These results suggest a lution effect of fatty acids in carcass tissue from T-pigs with increasing slaughter ight. Furthermore, total carcass fat follows a different pattern of deposition in T-pigs th increases in slaughter weight compared to C-pigs.

OURCES AND QUALITY OF BEEF PRODUCED IN ESTONIA

. SUURMAA, V. KANGRO
stonian Research Institute of Animal Breeding and Veterinary Science,
S 2400 Tartu, Estonia

he aim of this study was to determine the growth rate, some quality characteristics of attle carcasses and beef derived from Red Estonian and Black-and-White Estonian dairy reeds. Beef constitutes ca 39 % of total meat production in Estonia. The main sources of eef are the young fattening bulls, culled cows, heifers and first lactation heifers. Ca % of beef is produced from young fattening bulls. The mean live weight of young bulls t slaughtering was 420... 460 kg and the age about 20... 22 months. The carcasses of the oung bulls were estimated to be the best but the carcasses of culled cows and heifers ere not acceptable due to the high proportion of subcutaneous fat as well as fat in the ody cavity.

he results obtained with the Red Estonian young bulls showed that the proportion of ubcutaneous fat increased after 18 months of age and therefore carcass quality was ecreasing.

n order to get desirable beef carcasses meeting the demands of customers and meat indust-y, body fat must be reduced by regulating the feeding of cattle and by partial introduc-ion of crossbreeding programs.

INFLUENCE OF NUTRITION ON MEAT QUALITY IN DOUBLE-MUSCLED BULLS.

VAN VOOREN T., VAN HOOF J., VEREECKE D., ISTASSE L.*, DUFRASNE I.* and DESWYSEN A.°.

University of Ghent, Faculty of Veterinary Medicine, Laboratory of Hygiene and Technology of Food from Animal Origin, Wolterslaan 9000 Ghent, I.W.O.N.L. Brussels, BELGIUM.

* University of Liège, Fac. of Vet. Med., "CENTRE DE RECHERCHE SUR L'ELEVAGE ET LES PRODUCTIONS FOURRAGERES EN HAUTE BELGIQ Chemin de la Ferme 6, Bâtiment 39, Sart Tilman, 4000 Liège.

° University of Louvain, Fac. of Agronomic Sciences, Dept. of Genetics, Place Croix-du-Sud 2 bte. 14 - GENA, 1348 Louvain-la-Neuve.

Objectives: Meat color of three groups double-muscled Belgian White-Blue (BWB) bulls, put on different rations, has been compared.

Experimental methods: A first group (A) composed of 28 bulls were fed pulp, barley and soya meal and were housed in farm A second group (B) consisted of 36 WB bulls, fed concentrate (10 % spelt) and was housed in farm B. A third group (C) consisted of 18 bulls, fed corn silage and was housed in farm A (same farm as group A). The bulls were slaughtered at the age of 15 months (group B an or 20 months (group A). Two or three days after slaughtering, a monocostal cut was collected (M. Longissimus dorsi: LD). Meat color measured with the Hunter Lab and the pigment content was determined.

Results: A significant difference in brightness (L-value) and hue (a/b-value) between group A and C and between group B and C occur in that way that the LD of the 18 bulls of group C had a higher brightness and a lower hue compared with the LD of the bulls of the two groups. Analysing the a-value (stands for red color) and b-value (stands for yellow color), a significant different b-value was assessed: higher for the 18 bulls, fed corn silage. This means that the meat color is yellower. So the pale hue is the result of a more yellow color o meat, which should be due to the carotenoids of the corn.

Conclusion: The type of ration seems to influence meat quality, in particular meat color of the LD of the double-muscled Belgian W Blue. The meat of the BWB is known to be pale comparing with other breeds. As a consequence, feeding corn silage seems to ha negative effect on the LD of the BWB that is already relatively pale in itself.

THE EFFECT OF BREED ON THE COLOUR OF THE MUSCLE *LONGISSIMUS DORSI* IN CATTLE

C. WINKEL *

C.S.I.R.O. Meat Research Laboratory, P.O. Box 12, Cannon Hill Q.4170 Australia

ABSTRACT

A number of factors, are known to influence meat colour, however, information on the genetic influences on meat colou scarce and the results conflicting this study concentrated on the effect of breed on meat colouor in both *Bos indicus and Bos t* crosses. A secondary objective of the programme was to assess the reliability of the subjective meat colour score (MCS) by comp the MCS to the objective assessment of colour using tristimilus colour analysis.

257 cattle from one southern Queensland feedlot consisting of 6 breeds or crosses were surveyed for meat colour of the LD mu The meat quality attributes measured were: age (dentition), fat thickness in mm at the P8 site (rump), hot standard carcass weight marbling (visual intramuscular fat) score 1-6 at the 10/11 rib site, fat (1-8) and meat colour (1-9) scores at the 10/11 rib site. *longissimus dorsi* muscle was used to assess the meat colour, fat colour, marbling and texture by a certified assessor, usin AUSMEAT Chiller Assessment Scheme (AMLC Chiller Assessment Manual 1990).

The breeds and crosses used in the trial were: Santa Gertrudis (27), Santa Gertrudis X Hereford (14), Murray Grey (92), Her X Murray Grey (9), Angus (61), Angus X Hereford (52). All breeds were fed in the same feedlot on the Darling Downs using n commercial procedures.

The cattle were all slaughtered at one abattoir and the carcass' processed conventionally. After chilling (24 hour post mor the carcass were quartered, between the 10th and 11th ribs, to expose the LD muscle.

A sample steak, at least 1.5cm thick, was taken from the 10/11 rib site of each carcass. The samples were then chille transported to the laboratory.

The colour of the lean (meat) of the samples was assessed using a Minolta Chromameter (CR231) using standard proce (Minolta Chromameter CR231 users manual). Five replicate measurements were made on both surfaces of each sample. Colou recorded as Light (L), (Chroma (C) and Hue (H).

There were significant differences in meat colour between breed groups. Part of the difference is related to breed differenc growth rate and fatness (at a given carcass weight) and apparently, the differing age,weight and fatness at which breed groups introduced into the feedlot. This means that the apparent breed differences could be different given differing feedlot practices in re to these factors.

The relationships between meat colour scores and meat colour measurements were not very close. The reaons for this nee be determined urgently, to further the development of a viable meat colour assessment/measurement scheme.

* Author is now employed by: Woolworths, Berry St, Churchill Qld 4035, Australia. Fax: 61-7-812 2595

Session 3

PRESLAUGTHER AND SLAUGHTER

W LAIRAGE SYSTEM FOR SLAUGHTER PIGS – EFFECT ON BEHAVIOUR AND QUALITY CHARACTERISTICS

TRICIA BARTON GADE, LARS BLAABJERG and LEIF CHRISTENSEN
ish Meat Research Institute, Maglegaardsvej 2, DK-4000 Roskilde, Denmark

age design on abattoirs has only evolved slowly. While most factories are aware that long narrow pens with solid walls are antageous, that ventilation must be adequate and watering facilities available, most still hold pigs in large groups (up to 60), which es it difficult for factory personnel to move pigs from the lairage to the stunning without using force, thus reducing welfare.

Danish Meat Research Institute has developed a fully automatic lairage system where groups of 15 pigs are held separately and the of this research was to investigate the effect of this system on pig behaviour and meat quality characteristics.

experimental material consisted of 1561 pigs. On arrival at the factory pigs were equally divided between 3 experimental pens and aviour noted during the 90 minutes lairage period. After slaughter relevant meat quality characteristics were measured. The results of study were also compared with 1609 randomly selected pigs slaughtered when the factory still had the old lairage installed.

results showed that keeping pigs in small groups reduced aggression, even though the 15 pigs did not necessarily come from the same pen. This reduced aggression allowed pigs to rest more quickly and reduced skin damage significantly. Filling and emptying the small p system was easy and could be carried out with the minimum of force. PSE-incidence on the other hand was unaffected by group as was the incidence of DFD-meat and blood splashing.

pared to the original lairage system at the factory keeping pigs in small groups halved the incidence of skin damage and blood shing and reduced the DFD-incidence even more. PSE incidence was, however, unaffected.

new lairage system thus leads to a much better welfare and gives some improvements in meat quality. It is now running routinely on Danish factory.

CT OF TIME INTERVAL BETWEEN BLEEDING AND THE ENTRY OF CARCASSES IN TO THE CHILLING CHAMBER CHILLING RATES ON PORK QUALITY.

SAN, M.C.; CULAU, P.O.V.; OURIQUE, J.M.R.; NICOLAIEWSKY, S..
rtamento de Zootecnia, UFRGS, Porto Alegre, CEP 90001, Brasil.

present study aimed to evaluate the effect of three time intervals (TI), 30, 40 and 50 tes between bleeding and the entry of carcasses in the chilling chamber and three chilling s (CR), in which the chilling chamber temperature of 2°C was attained 2:30h,4:30h and 6:30h r the entry of the carcasses. Three hundred and sixty carcasses of crossbred Landrace, e White and Duroc swine weighing 85 to 95kg body weight were used. Each right half carcass an experimental unit. The variables using the semimembranosus muscle were temperature of asses and pH 1, both measured one hour after slaughter; pH 2, and colour measured by photographic l were recorded 18 hours after slaughter. Water holding capacity measured by unfreezing and ing the longissimus dorsi and semimembranosus muscle were also measured. All carcasses were ected to nine treatments with 40 replicates each, distributed in a 3x3 factorial arrangement completely randomized design. The exceptions were pH 1 and temperature, which were ected to three treatments with 120 replicates each. Results showed that pH 1 averages 6,24; and 6,12 were different ($P<0,05$) for TI of 30,40 and 50 minutes, respectively. A higher entage of carcasses showing PSE was positively related with TI and negatively related with . There was an interaction ($P<0,01$) on pH 2, in which long TI associated with a slow ling rate resulted in an elevation of pH 2 post-mortem. The meat colour was not influenced reatments. Semimembranosus muscle subjected to TI and CR treatments was more sensitive longissimus dorsi muscle in respect to water holding capacity. An interaction ($P<0,01$) een TI and CR was observed in thaw and heat loss. An improvement in water holding capacity emimembranosus muscle was observed by reducing the time interval and increasing the ling rate. More thaw drip occurred when TI was the longest and CR the slowest.

INFLUENCE OF PREVIOUS EXPERIENCE AND PRE-SLAUGHTER BEHAVIOUR ON PIG MEAT QUALITY

G.A. ELDRIDGE and R.D. WARNER

Victorian Institute of Animal Science, Department of Food and Agriculture, Werribee, Victoria, AUSTRALIA, 3030.

In an experiment designed to study the relationship between behavioural responses of pigs from different sources to pre-sla management within the abattoir and pig meat quality, groups of 20 pigs from 5 different piggeries situated similar distances fro abattoir were slaughtered on 6 occasions at 3 weekly intervals. The pigs were selected independently by piggery management basis of sex and liveweight specification before dispatch to the abattoir. Each group of pigs was assessed for behaviour during and handling at the abattoir and meat quality post-slaughter. Groups of boars and gilts were assessed on alternate occasions.

The mean ultimate pH (pHu) and colour (surface L* reflectance) of the muscle *longissimus thoracis* 24 hours post-slaughter fro group of pigs was significantly correlated to the number of interactions between handler and pigs in lairage pens ($P<0.01$), proc time between stunning and de-hairing ($P<0.01$) and the level of kicking that occurred after shackling post-stunning and sticking ($P<$

The mean incidence of PSE and DFD carcasses from each group of pigs over the period of the experiment was 23.2 a respectively. Although there were no overall significant differences in the incidence of PSE carcasses between piggeries and within piggeries, the incidence in PSE carcasses from gilts from 3 of the piggeries was significantly ($P<0.05$) greater than the inc from boar carcasses (43.9% cv 15.1% respectively).

It was concluded that although pre-slaughter factors and post-slaughter processing may influence meat colour and pHu, a major c variation in pig meat quality is the source of slaughter pigs and this may be due to their previous experience and or genotype influ their behavioural, physiological and psychological responses to pre-slaughter stressors.

PSE IN PORK: THE GENOTYPE, AS DETERMINED BY THE RESTRICTION ENDONUCLEASE ASSAY, AND THE ENVIRONMENT

A.FORTIN, S.A. POMMIER* AND A. HOUDE*

Centre for Food and Animal Research, Agriculture Canada, Ottawa, Ontario, Canada, K1A 0C6 and Lennoxville Res Station*, Agriculture Canada, Lennoxville, Québec, Canada, J1M 1Z3

The development of PSE in pork after slaughter is associated with the preslaughter management of the pig a as with its genetic make-up. Research evidence also points to a genotypic-environmental relationship. Wi recent developments in the detection of the gene responsible for the development of malignant hyperthermia pig, it is now possible to investigate this interaction on a large scale under filed conditions.

Four hundred-forty-eight commercial pigs were subjected to one of the following preslaughter treatments under conditions: feed removal, 44 or 30 hours prior to slaughter; feed removal, 20 or 6 hours prior to slaughter; and weighed, 44 or 30 prior to slaughter; sorted and weighed, 20 or 6 hours prior to slaughter. The genoty or Nn/nN) of all pigs was determined by applying the restriction endonuclease assay for porcine ma hyperthermia on a sample of the LD muscle. The quality of pork (PSE) was objectively determined using the coordinates as measured by the Colormet Meat Probe.

The timing of feed removal relative to slaughter had no impact ($P>0.05$) on the development of PSE in pork. H the timing of sorting/weighing did ($P<0.05$); sorting/weighing 44 or 20 hours prior to slaughter relative t 6 hours, respectively, improved the quality of pork. Furthermore, the magnitude of the response was higher of the Nn/nN genotype. Regardless of the preslaughter manipulations, pigs of the Nn/nN genotype had poorer pork quality than pigs of the NN genotype. The correlation coefficient between L^* and genotype was 0.12 ($P<$

DUCTION OF DFD CARCASS PERCENTAGE BY SUPPLY OF SORBITOL BEFORE AUGHTERING.

FOSTIER

vice Qualité des Viandes, Institut de l'Elevage, 14310 Villers Bocage, France

e aim of these trials was to test the supply of sorbitol in cattle at abattoir to reduce the occurence DFD carcass.

ee trials were conducted.

first trial involved 60 holstein young bulls. The sorbitol supply after an experimental stress eased significantly ($p<0,03$) the glycogen level in the longissimus dorsi taken by biopsy, only hours after the end of the stress.

second trial involved 42 normand young bulls. Any difference in the glycogen level at 15 hours r the end of the experimental stress was observed as the sorbitol supply was of 1, 2 or 3 Kg.

third trial involved nearly 2000 cows waiting during one night at the slaughterhouse. The centage of DFD carcass was 30% lower ($p<0,05$) by the supply of 1 Kg of sorbitol per animal.

was concluded that the sorbitol supply before slaughtering is a usefull and paying measure to uce the DFD carcass percentage.

her investigations are needed to better understand the metabolic effects of sorbitol.

UBLE RAIL RESTRAINER SYSTEM FOR HOLDING LARGE BEEF CATTLE DURING STUNNING

GRANDIN

partment of Animal Sciences, Colorado State University, Fort Collins, Colorado 80523 USA

r the last fifteen years, large beef slaughter plants have used a V-shaped conveyor restrainer for holding large beef cattle during nning and shackling. During the last two years, this system has been replaced in nine large plants by a double rail system veloped by the author. The plants have a line speed of 200 to 400 large cattle per hour. In the double rail system, cattle ride ride two parallel moving rails. The rails fit up under the animal's armpits. The animals enter the system by walking over a spreader bar in the leadup race. Solid side panels on each side of the moving rails prevent the animal from tipping sideways. ese panels can be adjusted for different sized cattle. A solid cover over the entrance and the first one-third of the moving nveyor blocks the animal's vision and keeps the cattle calm. Each animal is stunned with a captive bolt gun while it is riding ong on the double rails. At the same time, the shackle chain is attached to one back leg.

he double rail system is more efficient and humane than the V conveyor it replaced. Cattle enter the double rail system more sily because they can walk in with their legs in a normal position. Stunning is easier because the captive bolt gun operator can and closer to the animal's head. Shackling is also more efficient because the animal's rear legs are separated. In the V strainer, the rear legs are pushed together. In a slaughter plant processing 350 large cattle per hour, 80% of the animals luntarily entered the double rail system. A prod was required on only 20% of the cattle. To obtain these results, the double il must be properly installed and illumination of the entrance must be adequate. Poor illumination of the entrance can cause lking. Employees must also be trained in good cattle handling practices.

CARDIOVASCULAR FUNCTION IN STRESS SENSITIVE PIGS

N.G. GREGORY, L.J. WILKINS AND C.A. JONES

Department of Meat Animal Science, Bristol University Veterinary School, Langford, Bristol, BS18 7DY, United Kingdom

The object of this work was to learn more about the way in which stress could lead to death in Stress Sensitive (SS) pigs. In particular looked at the interaction between an acidosis and high circulating levels of catecholamines and K^+ on cardiovascular function. The cardiovascular responses to intravenous injections of noradrenaline and isoprenaline were assessed in anaesthetised SS pigs before and after infusing 0.3 M solutions of either HCl, KCl or NaCl. The HCl infusion produced a systemic acidosis (blood pH = 7.01) and the KCl infusion maintained an increase in plasma K^+ of 2.8 mg. l^{-1}, a level which was just below that which induced dysrhythmias. In comparison with the NaCl controls, both the HCl and KCl infusions resulted in a reduction in the vasodilatory (and to a lesser extent) heart rate response to isolprenaline. KCl resulted in an increase in S-T segment depression in response to noradrenaline and isoprenali It was concluded that a concomittant acidosis or hyperkalaemia could provide some protection against catecholamine overloading durin stress, but, the effect of K^+ would depend on the degree of the hyperkalaemia as at high levels it would cause lethal dysrhythmic episodes.

pH VARIATIONS AND CARCASS BRUISING IN BEEF CARCASSES FROM TWO SLAUGHTERHOUSES

TORSTEN L. HALD and LISE RAMSGAARD JENSEN
Danish Meat Research Institute, DK–4000 Roskilde, Denmark

Abstract

The aim of this work was to evaluate the frequency of meat with high pH and to describe the extent and character of bruis cows and young bulls.

The examination includes 2360 heads of cattle slaughtered at two different slaughterhouses: 62 % young bulls, 33 % cows, heifers and 1 % steers. The following information was recorded: transport method (loose or tied), acquisition through market or d delivery from farm, dehorned/horned, lairage conditions at the slaughterhouse, category, EUROP–conformation and carcass weig

The carcasses were electrically stimulated for 20 seconds (young bulls) or 30 seconds (cows). pH was measured in the longiss dorsi muscle 20 hours post mortem. The results of the pH measurements were categorised as: "normal" pH = pH 5.4 – 5.9, "sli elevated" pH = 5.9 < pH < 6.2 and "very high" pH = pH > 6.2. Evaluation of bruising was carried out on the slaughterline immedi after dehiding and evisceration. Observations were made in three areas: shoulder, loin and rump, and the severity described as: n bruise, heavy bruise and deep bruise.

3 % of the carcasses had pH > 6.2. The incidence was 5 % in young bulls and 2 % in cows. The incidence of cows with 6.2 was higher than expected, although low. No previous investigations in Denmark have had that many cows with high pH. 2 the carcasses had deep bruises on the shoulder and loin, and 5 % af the carcasses had deep bruises on the rump. 6% of the heavy b were found on the shoulder, 8 % on the loin and 13 % on the rump. The bruises on the rump were mostly found on tuber ischi tuber coxae. There was a tendency to find most carcasses with pH > 6.2 among carcasses with deep bruises. 2 % of the young had deep bruises on the rump compared to 12 % of the cows. Transport method, supply route, horns, lairage conditions, cate EUROP–conformation and carcass weight were found to account for about 13 % of the variations in pH, and 19, 22 and 2 respectively, of the variations in bruises on the shoulder, loin and rump.

THE STUDY OF MICROSTRUCTURE OF SLAUGHTER ANIMALS MEAT UNDER CONDITIONS OF ECOLOGICAL DISBALANCE

.I.KHVYLYA, A.A.BELOUSOV, T.G.KUZNETSOVA, V.V.AVILOV

ıe All-Russian Meat Research Institute, MOSCOW, RUSSIA

ological disbalance influences significantly quality of raw material. For this reason we nducted complex and microstructural research of beef and pork on early stages of ageing ing qualitative and quantitative histological and cytological analysis. According to pH lue of meat and to its colour characteristics raw material was divided into three groups: rmal, PSE and DFD meat.

ffering from normal meat, dark and firm meat (DFD) was characterized by longer ageing d by increased water-holding ability. Pale, soft and exudative meat (PSE) was characte- ized by more active ageing and by greater amount of destructive changes in muscle fibers. ter-holding ability of this meat was lower.

us, ecological disbalance at breeding of meat animals leads to changes of quality parame- rs of meat, increasing availability of more DFD and PSE meat with changed structure of scle tissue, character and time of ageing. With this account earlier prediction of meat ality is required along with adjustments of technological regimes of processing aiming t improving quality of finished meat products.

RESS SENSITIVITY AND MEAT QUALITY VALUATION FROM SOWS BY BIOPTIC METHOD

KOVÁČ[1], R. ĽAHUČKÝ[2] and J. MLYNEK[1]

[1]Department of Special Animal Husbandry, University of Nitra, 949 76 Nitra, ČSFR
[2]Department of meat technologie, Research Institute of Animal Production, Hlohovecká 2, 949 92 Nitra

Breeding tests for inproving stress resistance and meat quality were made from 650 sows slovak landras breed. The results confirm that during a two year period no halotan positi- individuals were found in this breed. In the 8 year period, when the meat quality was ob- erved by bioptic method, there was a decrease of PSE meat occurrence from 13,6 % to 4,5 %.

In the experiment, we worked with posterity of 30 sows from boars with bad meat quality). 326 head were tested in weight of 20-25 kg by halotan (5min., 5 % narkotan spofa). In he weight of 85-90 kg was made meat quality test by bioptic method. Three groups were built: group H^+; B^+ n = 10 heads; II.group H^-; $B^\pm$ n = 10 heads; III.group H^-; B^- n = 10 heads.

To sows in the weight of 95 kg a canyla was inserted to vena cava superior. It was ossible to take blood without stress. CK-test was made in the equipment for compulsory otion of sows in the lenght of 250-700 m. Blood taking was made before the work and 24 hours fter. In blood plasma were searched the important enzymes nad material metabolities. We are iopsy into the musculus longissimus thoracis et lumborum - m.l.t. At he 14th thorax ertebra. Sting depth was 5 cm, averace taking sample was 0,62 g and varied from 0,52-0,85 g sing canyla with Ø 8 mm. Muscle tissue was taken using the spring technique for biopsy PB-2. Their advantaces are especiality, that there is no influence of gun powder waste, braking sample is continual, high sting speed secured that the taking is without stressed and he wounds from taking are improved very fast.

In bioptate after tissue incubation these factors were observed: pH, R-value, ATP, IMP, CP, laktat, F.W. The meat colour and percentace of trickle water were also observed after illing the animal.

In the observed posterity, we find the occurrence frequency of H^+ sows 26,5 %. Occurren- of sows with bad meat quality tested by the bioptic method was 72,6 % and after killing as 69,8 %. Sows with good meat quality were 4,2 % by bioptic test and 3,8 = after killing.

TIME FROM LAST FEED TO SLAUGHTER IN RELATION TO SKATOLE LEVEL OF ENTIRE MALE PIGS

HANNE MARIBO

Danish Meat Research Institute, Maglegaardsvej 2, DK–4000 Roskilde, Denmark

Abstract

The aim of this work was to find out whether the length of time from last feed to slaughter had an effect on the skatole level in the of entire male pigs carcasses.

The experimental material consisted of 300 entire male pigs supplied from three farms. The farms were selected according to the skatole content in their previous deliveries. Each farm represented in each of the three groups Low, Medium and High skatole level. were fed ad libitum. The male pigs were divided into two groups. Group 1 pigs were last feed the evening before delivery. Group 2 access to feed until dispatch to the slaughterhouse.

The average carcass weight was 70.8 kg and the average meat percentage was 61.7.

Group 1 had a significantly lower skatole content in the backfat than Group 2. The average skatole content in the male pigs was for 1: 0.12 ppm and for Group 2: 0.15 ppm. There was a significant difference in average skatol content between the pigs from the three Averages for farms 1, 2 and 3 were 0.08 ppm, 0.12 ppm and 0.23 ppm respectively.

The effect of time from last feeding before slaughter was highest in pigs delivered from the farm with the highest average skatole

There was no effect on the weight, meat percentage or meat quality (pH_1, rigor, pH_2, marbling or skin damage).

THE EFFECT OF MIXING, FASTING AND GENOTYPE ON CARCASS SHRINKAGE AND PORK QUALITY

A.C. MURRAY and S.D.M. JONES

Agriculture Canada, Research Station, Lacombe, Canada, T0C 1S0

The effects of genotype for stress susceptibility (NN=homozygous normal, Nn=heterozygous, nn=homozygous recessive), fasting mixing during the period 24h prior to shipping for slaughter upon carcass traits and muscle quality were investigated. A total of 22 of three genotypes (NN,Nn,nn) were assigned to one of two mixing treatments (unmixed or mixed) and one of two fasting treatme 24h off feed). The number of pigs in each of the 12 genotype/mixing/fasting treatment subclasses ranged from 17-22. Pigs of the genotype had higher carcass yields (44 g kg^{-1}), and greater lean content in the major cuts (42 g kg^{-1}) than those of the NN genoty Nn genotype tended to have intermediate values for yield parameters compared to the other two genotypes. Mixing and fasting bot live animal weight losses and a reduction in warm carcass weight. The net result of the fasting and mixing treatments for 24h was carcass weight ranging from 15-23 g kg^{-1} depending on the fasting/mixing treatment. Pigs of both the nn and Nn genotypes produ poorer muscle quality than did those of the NN genotype. Fasting of pigs for 24h pre-slaughter only lowered the frequency of pale pork by a small extent. Mixing, with or without fasting, improved muscle quality in pigs of the Nn and nn genotypes. However, s gains in meat quality due to mixing and or fasting are negated by the decreases in the carcass yield, by the additional carcass dama to fighting and finally by their possible detriment to animal welfare.

ECT OF ADDING NICOTINIC ACID AND NICOTINAMIDE IN PIGS DIETS FEW DAYS PRIOR SLAUTHERING ON SCLE GLYCOGEN CONTENT.

TIVA, A. PRANDINI, M. MORLACCHINI and L. DI RENZI.
uto di Scienze della Nutrizione, Facoltà di Agraria, U.C.S.C., 29100 Piacenza, Italia.

ogen content of muscle at slauthering is an important determinant of meat quality. Stress factors at this point like fasting, journeys, social and physical interactions may negatively influence a correct muscle glycogen storing, depletion and equent lactate formation in meat. This situation can easily lead to PSE meats, especially in stress sensible animals. There are e evidences that high doses of vitamin PP has a tranquillizing effect and we have postulated the influence of this effect on cle glycogen content and meat quality.

trials have been carry out to evaluate the effect of supplemental vitamin PP in pigs diets on muscle glycogen, lactate and 45 utes pH. In the first trial twenty-four heavy pigs (LW x L x D, 160 kg l.w.) were assigned to one of four treatments with added tinic acid (0, 75, 150 and 300 ppm). The basal diet was the same for both trials and contained corn, barley, soybean meals and at bran. Treatments have been carried out 7 days prior slauthering. The second trial differed from the first for: vitamin PP ce (niacinamide), breed (Seghers) and the slauthering weight of pigs (110 kg l.w.). A colorimetric assay for tissue glycogen d on iodine binding (Dreiling et al. 1987) and an enzyme assay for lactate (Boehringer) have been used.

he first trial 300 ppm of nicotinic acid where negatively correlated with glicogen content of *m. semimembranaceus* (- 42.4% *vs* pm) ($P<0.01$), while 75 and 150 ppm increased it respectively of 116% and 48% *vs* control ($P= 0.098$). In the second trial the ogen content of *m. supraspinatus* has been increased of 84% and 60% respectively with the 75, 150 ppm treatments and uced of 8% with 300 ppm ($P<0.05$). In both trial no significant differences have been shown on 45 minutes pH and lactate centration.

onclusion, high doses of niacinamide (300 ppm) that is 30 - 60 times higher than usual adding, few days before slaughtering, uce muscle post-mortem glycogen content in 110 and 160 kg l.w. pigs, while intermediate doses of nicotinamide (75 - 150 n) greatly increase it only in 110 kg l.w. pigs.

SE OF THE DNA BASED RESTRICTION ENDONUCLEASE ASSAY TO DETERMINE THE RELATIONSHIP BETWEEN ALIGNANT HYPERTHERMIA AND PORK QUALITY

A. POMMIER and A. HOUDE
griculture Canada, Lennoxville Research Station, P.O. Box 90, Lennoxville, Québec, J1M 1Z3, Canada

selection of 913 pork loins were sampled in a commercial abattoir in order to relate meat color, water holding capacity (WHC) d ultimate pH (pH u) to the genotype for malignant hyperthermia (MH). Genotype was determined by the restriction donuclease assay which detects a C to T transition in the ryanodine receptor of pigs affected by MH. This test constitutes the fect measurement of the genetic mutation associated with MH. Color was determined with a Colormet surface colorimeter, HC by a modified filter paper method and pH u with a piercing electrode. Results show that 75.9% of loins came from normal gs (NN), 21.7% came from heterozygotes (Nn) and 2.4% came from homozygotes (nn) for MH. Loins from NN pigs were gnificantly darker ($P<0.01$) than loins from Nn and nn pigs. Meat WHC was similar between loins from nn and Nn animals but eat WHC from NN animals was greater ($P<0.01$) than meat from the other two genotypes. Meat pH u was significantly ($P<0.01$) wer for loins from Nn animals than loins from NN pigs. pH u of nn loins was intermediate between NN and Nn individuals. he data was then categorized with respect to color, WHC and pH u in order to determine the incidence of the different genotypes thin categories. Using a L value of 53,5 to discriminate between normal and PSE loins yielded a genotype distribution of 88.4% N, 11.02% Nn and 0.55% nn in the normal loin class vs a genotype distribution of 67.24% NN, 28.73% Nn and 3.64% nn in the SE loin class. Meat WHC and pH u confirmed these findings. Correlation coefficients between L values and WHC was 0.58 <0.001) and between WHC and pH was -0.717 ($P<0.001$). Results confirmed previous studies and show that NN pigs can roduce PSE meat while Nn pigs can produce normal quality meat. Preslaughter management techniques to enhance meat quality hould be considered and implemented in the future.

THE INFLUENCE OF SOME ANTISTRESSORS TO TECHNOLOGICAL CHARACTERISTICS OF PORK

M. REI and V. KIRIKALL

Meat and Dairy Institute, Estonian University of Agriculture, EE2400, Tartu, Estonia

The aim of this work was to find some antistressors, which are effective in our conditions for improving pork quality. We made experiments with two antistressors: "Suacron" and aminazine.

Pigs were separated into two groups: experimental group (was injected with antistressor) and control group (was not injected). When "Suacron" was tested the experimental group consisted of 40 pigs (21 barrows and 19 sows), control group - of 35 (18 and 17 respectively). The experiments with aminazine were carried out on 26 pigs (12;14) and 26 pigs (12) were in control group. Pigs for experimental group were injected on the farm. Then they were transported to the slaughter-house. The period from injecting to unblooding was 4 - 6 hours. The samples were taken 48 hours after slaughtering and cooling.

Protein, water, ash, fat contents, pH, heat loss, water holding capacity and colour were determined in pork.

The analysis of results showed that injecting of antistressors did not essentially influence chemical characteristics of pork, but they improved the technological properties of pork. Better results were achieved with "Suacron" than with aminazine: head loss decreased 2.11 and 0.40 % respectively, water holding capacity increased 1.96 and 1.20 %.

PRE-SLAUGHTER BEHAVIOUR AND MEAT QUALITY OF PIGS FED EXCESS DIETARY TRYPTOPHAN

R.D. WARNER, G.A. ELDRIDGE, J.L. BARNETT, R.H. KING and C.G. WINFIELD

Victorian Department of Food and Agriculture, Princes Highway, Werribee, 3030, Australia.

The amount of stress an animal undergoes preslaughter can markedly influence meat quality but animals will vary in their response to stress. Dietary tryptophan has been used to reduce the stress response in horses, humans, hens, mice and rats. This experiment was designed to investigate the use of excess dietary tryptophan to (i) moderate pig behaviour during the penning period pre-slaughter and (ii) reduce the incidence of meat quality problems. Fifty Large White X Landrace entire male pigs weighing 85-90 kg were allocated to one of two treatments; (i) Control or (ii) tryptophan (diet supplemented with 5g of excess tryptophan/ kg of feed for five days pre-slaughter). There were no consistent differences in behaviour (monitored by video cameras) or stress responsiveness (blood corticosteroids) on the farm between treatments. During the 16h penning period pre-slaughter, the pigs fed excess tryptophan exhibited less aggression ($P<0.05$) and reduced mounting activity ($P<0.05$) than the control pigs. Measurements of meat quality (pHi, pHu, meat colour and protein solubility) in the longissimus thoracis (LT) and quadriceps femoris) did not differ ($P>0.05$) between the treatments. The incidence of PSE (LT pHi<6.0) and DFD (LT pHu>6.0) was 24% and 4% respectively for the tryptophan treatment and 36% and 12% for the control but these differences were not significant ($P>0.05$). The results indicate that tryptophan fed for several days pre-slaughter can reduce aggressive behaviour in pigs during the waiting period at the abattoir. Although tryptophan treatment did not improve meat quality in this study, pigs with a greater stress susceptibility may have responded with improved meat quality.

Session 4

ASSESSMENT OF CONSUMER PREFERENCES

(CONCURRENT SESSION)

STATUS OF MEAT SCIENCE AND TECHNOLOGY IN PAKISTAN AND SOUTH ASIA

HAMID AHMAD

MEAT RESEARCH LABORATORY,
BIOTECHNOLOGY AND FOOD RESEARCH CENTRE,
P.C.S.I.R. LABS. COMPLEX LAHORE (54600),
PAKISTAN

resentation shows the meat production, consumption and other regional relevant statistical arameters of Pakistan and South Asia with comments on pros and cons. Meat tecnology, laughter, handling, tranport, consumption, practices are shown. Prospects and projections f meat development in Pakistan and region may be discussed in between. Type and ossibilities of desireable technoliogies based on Socio-economic, traditional and eligeous background would be delivered and debated as much as possible. Trendy research nd meat product themes drawn and shown for the interest of cooperative, aid and commercial otives of different agencies.

FECT OF pH AND GENETICS ON TEXTURE CHARACTERISTICS OF DRY CURED HAM.

NAU, J., GUERRERO, L., MANEJA, E. and GOU, P.

ntre de Tecnologia de la Carn (IRTA), Granja Camps i Armet, 17121 Monells, Spain

kture is one of the most important characteristics of dry cured ham. The main problems on kture in dry cured ham are: soft and/or pasty texture, making the slicing process more fficult, and the incrustation and formation of holes around the coxofemoral joint, being rmally associated with some flavour and aspect defects. The aim of this paper is to study the fect of pH of the meat and different commercial lines on texture of dry cured ham. Twenty hams pH24>6,2 in the *Semimembranosus* muscle, twenty of pH24<5,8 and thirty hams of three different mmercial lines of the Pig Improvement Company (L15, Duroc; L10, high muscular development; , Comborough) were evaluated after 6 months of ripening by a trained panel test. In the high group, crumbliness, pastiness, adhesiveness and softness were higher than in the low pH oup. The crumbliness, pastiness and formation of holes around the hip joint were higher in than in the other lines. The pH and genetic line influenced significantly on the texture dry cured ham.

USEFULNESS OF SOME CHEMICAL-PHYSICAL ANALYSES TO PREDICT THE SENSORIAL QUALITY OF BEEF MEAT

. BARGE, G. DESTEFANIS, A. BRUGIAPAGLIA

artimento di Scienze Zootecniche, Via Genova 6 - 10126 TORINO, Italy

multiple linear regression on data obtained from 33 samples of Longissimus dorsi of beefs, different for ed, sex and slaughtering weight (330 - 680 kg) has been used to study the usefulness of some instrumental a- yses to predict the sensory quality of meat.

have considered as dependent variables the sensory characteristics assessed by a trained panel using an 8- nts scale: appearance of raw meat; tenderness (ease of sinking, friability and residue after chewing), juic- ss (initial and sustained), overall acceptability. The independent variables included: chemical composition, colour (L, a, b, Hunter system), shear force on raw meat, water holding capacity (weep losses, water bath ses, filter paper press method). The determination that resulted more useful was the shear force, correlated all of the sensory characteristics, especially the ones of cooked meat. Secondly, lighteness appeared very ful, especially for appearance. As regard the water holding capacity methods, the water bath loss has been more efficient in relation to tenderness, juiciness and overall acceptability.

3 above-mentioned variables explained from the 64% (sustained juiciness) to the 72% (overall acceptability residue) of the total variability. Further contributions were provided by: pH and protein content (appear- e); water percentage (sustained juiciness). In our experimental conditions, the ether extract (0.16 - 2.29%) n't appear to be useful to predict the meat sensory quality.

RIATIONS IN PORK QUALITY: A 1991 U.S.A. SURVEY

G. CASSENS, R. G. KAUFFMAN, A. SCHERER AND D. L. MEEKER

partment of Meat and Animal Science, University of Wisconsin, Madison, WI 53706, U.S.A.

tlations in pork quality affect consumer acceptance and utilization for processing. wever, the extent of this quality variation is unknown. During July and August, 1991, 14 k processing plants (40% of the nation's hog slaughter) were surveyed. The gluteus medius 10,753 hams was subjectively scored for color, firmness-wetness and marbling. Based on or and firmness scores, hams were categorized as either PSE (pale, soft and exudative), (dark, firm and dry), RFN (reddish pink, firm and non-exudative), or RSE (reddish pink, t and exudative). Three-fourths of the observations were soft and floppy and one-third e either too pale or too dark. Over 90% contained less than small quantities of marbling. n color-firmness characteristics were combined, only 15% were identified as RFN ('ideal') reas 16% were PSE and 10% were DFD. More than half the hams were RSE (questionable lity) due to their firmness-wetness even when color was acceptable. One plant possessed a incidence of PSE (the minimum was 6%), and the incidence of DFD ranged from 4 to 18%. wever, we conclude that if value differentials would be applied at the market, and if ropriate genetic and environmental precautions would be taken, the variation in quality ld be either minimized or completely eliminated.

YIELD AND MARKET QUALITY IN PIGS IN RELATION TO SEX, SLAUGHTER WEIGHT AND MEAT CONTENT

MARCHEN ANDERSSON, Danish Meat Research Institute, Maglegårdsvej 2, DK–4000 Roskilde, Denmark

The aim of this research was to investigate the influence of sex, slaughter weight and meat content on the yield and market quality pigmeat.

The experimental material consisted of 12 groups of 30 pigs selected at a Danish slaughterhouse during the course of one week. The grou were composed of pigs from 3 groups with different slaughter weight, viz. Low (66 kg), Medium (73 kg), and High (77.5 kg). In ea weight group pigs were chosen with meat percentages: Medium (x = 59) and High (x = 63). Half the pigs chosen from each group we gilts and half entire male pigs. The carcass were split in the following primary cuts: picnic ham, picnic shoulder, loin and belly for t Japanese market, loin and belly for the U.K. market. The weight of the primary cuts was registered individually, and the market quali of the bellies was evaluated.

The results show that for primary cuts the yield was influenced by the meat percentage. There was no difference in results from the weight groups. Entire male pigs had a significantly larger foreend and smaller loin and ham than gilts. There was no interaction betwe sex, weight and meat content.

An evaluation of quality requirements showed that bellies from pigs with a high meat content were more suitable for the U.K. market th for the Japanese market, where bellies from heavy pigs were preferred.

SENSORY EVALUATION OF MEAT IN YOUNG BULLS FED WITH DIFFERENT DIETS

P. ALBERTI, C. SAÑUDO[1], P. SANTOLARIA and C. TOURAILLE[2]

Servicio de Investigación Agraria D.G.A., Apdo. 727 . 50080 ZARAGOZA, Spain

1) Facultad de Veterinaria, c/Miguel Servet, 177 . 50013 ZARAGOZA, Spain

2) Station de Recherches sur la Viande, I.N.R.A., Theix 63122 ST-GENES-CHAMPANELLE, France

The objective of this work was to study the influence of diet, breed, sire and ultimate pH on the meat sensory traits. 72 Brown Swiss and 36 Pirenaico bulls were fed with forages and different proportions of concentrate. The meat pal was assessed by trained sensory panel on samples of muscle *longissimus dorsi* for tenderness, juiciness, flavour and acceptability.

Bulls fed with forage supplemented with 2 kg of concentrate and finishing period before slaughter, tended to hav sensory scores for tenderness, juiciness, and overall acceptability when meat had a pH<6, but with pH>6 the sensory increased and no significant differences were found owing the diet. No breed effect was found. The mean sc tenderness, juiciness and overall appreciation were affected by sire. Sire by pH interaction was significant for ten juiciness, flavour and overall. The results of this study indicate that the effect of ultimate pH on meat palatability was than diet, breed or sire effects. Sire had more effect than breed. The interaction of pH and diet suggests that meat pal could be influenced by diet when pH is lower then 6.0 but this effect tends to disappear when pH is greater than when meat presents DFD (dark, firm, dry) palatability attributes.

SENSORY EVALUATION OF SPANISH HAM WITH DIFFERENT SALTING PERIODS

F.LEON CRESPO, H.GALAN SOLDEVILLA, N.CIUDAD GONZALEZ, A.PERALTA FERNANDEZ, B.BALDERAS ZUBELDIA, L.MARQUEZ PRIETO and A.MOLINA ALCALA
Planta Piloto de Tecnología de Alimentos. F.Veterinaria. UNIV.CORDOBA.14005 CORDOBA. Spain

Four lots of Spanish Ham processed in the same traditional way except with different length of the salting period (3, 5, 7 and 9 days) has been submitted to sensory evaluation. The sensory method applied was the Quantitative Descriptive Analysis (QDA) including the evaluation of six analitical hedonic parameters (color, marbling, odor, flavor, juiciness and saltiness) as well as general acceptability, using a standard uniform 10 points scale for all of them. From each ham three different regions were studied. The analysis of variance shows statistically significant diferences among regions on color, marbling and flavor. Differences are also shown among hams in color and flavor. From the mean data descriptive profiles are constructed that allow distinguish among regions and hams.

INFLUENCE OF INTRAMUSCULAR FAT ON THE EATING QUALITY OF PORK.

Å. Göransson, G. von Seth and E. Tornberg

Swedish Meat Research Institute, POB 504, S-244 24 Kävlinge, Sweden

There is a trend towards leaner pig carcasses in Sweden and it is often believed that the eating quality will necessarily fall as the intramuscular fat (IMF) content is reduced in the meat. The aim of this work was to investigate the relationship between eating quality and IMF in *M. longissimus dorsi* (LD) of normal pork quality.

30 LD with an IMF level ranging from 0.5 to 3.0 % were selected, where other factors which might affect the eating quality such as pH_1, carcass weight, percentage lean, pH_{24} and FOP_{24} were kept as constant and normal as possible. The eating quality was assessed by a 9-member taste panel four days post-mortem. As the IMF level differs along the LD muscle, each muscle was assessed as two samples, one anterior (at the seventh thoracic vertebra) and one posterior (at the fifteenth thoracic vertebra).

The sensory tests showed, despite the wide range in the IMF content, that no positive relationship was obtained between the eating quality and the IMF content. Taking into account the effect of the assessors and the placement of the sample along the muscle with multiple analysis of variance, the IMF content was found to affect tenderness. A higher IMF content did, in fact, deteriorate the tenderness in the anterior sample, but only slightly. Juiciness, on the other hand, did not show any relationship with the IMF level. Of the investigated parameters, pH_{24} affected tenderness most, even though the pH_{24} did not vary to any great extent (5,36-5,50). A lower pH-value gave a more tender meat. A notable result is that the anterior piece was more tender and tasted better than the posterior piece, whereas juiciness did not differ in the two pieces. In conclusion, the good eating quality of pork, which was the case in this investigation, was maintained even at low IMF values.

TUDY OF THE EFFECT OF THREE PROTEIN SOURCES TO PROVIDE SATIETY IN HUMANS

. HAMILTON, D. OBERLEAS, and M. HARDEN

ood and Nutrition Program, Texas Tech University, Lubbock, Texas, 79409-1162, U.S.A.

his study involved 26 Texas Tech female and 15 male students of normal weight ranges, recruited after screening for taste preferences nd demographics. A preload of beef, chicken and fish were fed to subjects followed by fruit-flavored yogurt shakes as the test meal. ubjects were seated in sensory panel booths where odor, lighting, and conversation were controlled. The preload levels of protein ources were determined by offering unlimited quantities of beef, chicken or fish to the subjects on three successive test days. Preloads f 120 g were selected for females and 200 g for males. Subjects were allowed 15 minutes to consume the protein preload then at me parameters of 20 or 40 minutes after the consumption of the preload, yogurt milkshake was ingested. Subjects were asked to onsume 100% of the protein source and at the specified time were given the milkshake to drink until satiety (satisfaction or a feeling f fullness) was attained. Quantitative measurements of the milkshake consumption were used to determine the satiety value of the rotein source. The data were treated with a 3-way ANOVA with replications. The four variables were protein source, lean beef, hicken, and fish; time delay; particle size; and gender. There was a significant effect for protein source ($p < 0.0001$) with the mean SEM as; beef 290.1 $\pm$ 20.9, chicken 348.3 $\pm$ 20.1, and fish 361.1 $\pm$ 19.0 g. and a difference between gender ($p = 0.026$) with males consuming 302.7 $\pm$ 12.2 and males 386.0 $\pm$ 23.1 g shake. The protein:gender interaction was ($p = 0.003$). Present results ndicate that beef satiates longer than chicken or fish of the same fat levels.

ASSESSMENT OF EGYPTIAN BEEF AND BUFFALO NUTRITIVE MEAT QUALITY

M. KAMAL E. YOUSSEF, MOHAMED R.A. RASHWAN AND S.I. EL-SYIAD

Food Science & Technology Department, Faculty of Agriculture, Assiut University, ASSIUT, A.R. EGYPT.

Both male beef and buffalo longissmus dorsi muscles (sirloin), Psoas major & Psoas minor muscles (Fillet) and Extensor & Flexor muscles (leg) of a marketable age (1-5 years) were used to asses the nutritive meat ual quality. The gross chemical composition of such muscle was assessed using the official method of analysis. The amino acid composition, fatty acid composition, mineral composition were determined applying Amino acid ana- h lyzer, GLC and atomic absorption, respectively. The electrophoretic pattern of beef and buffalo muscle extracts ess were performed using PAGE electrophoresis. The data revealed that 17 amino acids were detected in all studied sa beef and buffalo muscles in rather variable levels. Meanwhile, 9 fatty acids were present in all studied muscles. The most predominant saturated fatty acids were palmitic and stearic, while oleic acid was the major ng unsaturated acid.

ith 8 mineral elements were evaluated among which sodium and phosphorus were the major element, while cupper el. and iron were the least element in all studied muscles.

A Moreover, the PAGE electrophoretic pattern of the above-mentioned studied muscles revealed rather variable r p specific fractionation for both beef and buffalo muscles.

sti

THE EFFECT OF MICROCOMPONENTS IN SALT ON SENSORY AND PHYSICOCHEMICAL PROPERTIES OF PROSCUITTI

HIROTAKA KOHATA, MAKI KAWAGUTI, MASAHIRO NUMATA and TOYOO NAKAMURA
ITOHAM FOODS INC. 1-2 Kubogaoka, Moriya-machi, Kitasouma-gun, Ibaraki Pref., 302-01 Japan

Five types of salt mixtures (prepared by mixing microcomponents, $MgSO_4$, $MgCl_2$, $CaSO_4$ and KCl, NaCl at levels of 0, 4, 8, 16 and 32%, respectively) were used to study the effect of salt composition o sensory and physicochemical properties of proscuitti. Ripening of proscuitti used each salt mixture wa followed by measuring parameters including pH, Aw, weight loss, degradation of proteins and AT related compounds, extractability of protein and myosin heavy chain, endogenous enzymatic activity muscle and organoleptic quality. The pH, Aw, IMP, extractability of both proteins and activities cathepsins, calcium-activated neutral protease and aminopeptidase C and H gradually decreased wi the ripening whereas the amount of free amino acids, peptides and hypoxanthine increased. The effe of microcomponents in salt on these phenomena during ripening was recognized as a tendency that th extractability of both proteins and the amount of free amino acids increased depending on the increas of microcomponents in salt. This tendency was noticeable in the first 10 weeks of ripening but a litt the later. Sensory evaluation of finished products showed that umami and brothy taste intensity becam stronger with the increase of microcomponents in salt used. The results obtained suggested th microcomponents in salt had an action to increase the amount of free amino acids caused by the increas of the protein extractability, contributing to the taste development of proscuitti during ripening.

BEEF QUALITY AND FACTORS INFLUENCING IT

V.I.IVASHOV, Yu.V.TATULOV, T.M.MITTELSTEIN, O.A.LYAPIN
The All-Russian Meat Research Institute, Moscow, Russia

Due to acute necessity of satifying consumer market demand in high-quality beef of low cost, research aimed at revealing of factors for achievement of this goal, acquires spe cial importance.
Tests performed on young beef animals allowed to conclude that the main factors, respon for high indices of meat productivity of cattle and for meat quality are conditions of wing and of maintenance of cattle, and also its breed and sex.

FLUENCE OF HALOTHANE SENSITIVITY AND OF MEAT QUALITY ON THE SENSORY EVALUATION OF COOKED HAM

GAERT Chantal[1], DE SMET S.[2], VERPLAETSE A.[3], DEMEYER D.[2] & VIAENE J.[1]

Department of Agro-Marketing, University of Gent, Coupure Links 653, 9000 Gent, Belgium

Research Centre for Nutrition, Animal Production and Meat Technology, Melle, Belgium

Ter Beke N.V., Waarschoot, Belgium

ms of the right carcass side of forty-eight pigs were used for the production of cooked ham
ee De Smet et al., this conference). Sensory evaluation was performed on samples of the cooked
h using an untrained panel of 10 judges. The method used was a rank test. In each of twelve
ssions, the panel ranked four samples of cooked ham, two deriving from halothane-positive (HP)
d two deriving from halothane-negative (HN) animals. Three sensory variables were evaluated
colour, taste and texture. Rank analysis by means of the rank sum method indicated that the
nel preferred the samples of cooked ham prepared from HN animals for all three criteria
amined (P<0.1). However, correlations of the sensory results with the meat quality
asurements were low. Only small differences were found between the means of the meat quality
asurements of the group ranked first and the group ranked fourth. In conclusion, differences
sensory evaluation of cooked ham for colour, taste and texture, although apparent in this
periment, beared little relationship to differences in fresh meat quality.

E COMPETITION AMONG DIFFERENT TYPES OF MEAT CONSUMED STILL AND ESPECIALLY A QUESTION OF PRICE

MAINSANT - G. DE FONTGUYON -
RA-IAA - 63 Bd de Brandebourg - 94250 Ivry Cedex

TRODUCTION The choice among the different kinds of meat consumed by households is still largely determined by the relation between price of the different kinds of meat. Nevertheless, other psychological and sociological factors enter into this determination as well. This dy utilizes the results of panel data from a survey of french households (SECODIP) over the period 1977-1991.

HEAP MEAT TEND TO INCREASE ITS SHARE OF THE MARKET

is is the case with respect to chicken, turkey, fresh pork and ground beef. Poultry and pork benefit from low costs of production and a nd of rising productivity. Ground beef benefits from the decline in demand for meat prepared by braising and other slow methods of oking inferior cuts, and also from the mechanization of grinding.

XPENSIVE CUTS AND EXPENSIVE TYPES OF MEAT TEND TO LOSE MARKET SHARE.

is is the case for the cuts of beef and horsemeat used in grilling and roasting, their price in Europe remaining elevated relative to the other at. Nevertheless, for lamb, grilling cuts, which used to be expensive fifteen years ago, are increasing their share of the market as a result decline in their relative price associated with the entry of Great Britain into the EEC.

ERTAINS MEATS HAVE LOST MARKET SHARE INDEPENDENTLY OF THE SHIFT IN RELATIVES PRICES.

is is the case for cuts of beef, veal, lamb and horse prepared by braising of other slow methods of cooking. These cuts and kinds of meats ve drawn no benefit from their low retail price as a consequence of the indadaptability of slow preparation to the modern way of life.

is is also true of veal, wich for a long time has suffered the consequences of a certain aversion among a certain class of consumers for at produced under "industrial" conditions.

NCLUSION France, like the EEC, has experienced an erosion in the share of the market for meat held by the ruminants, in spite of the dustrial nature of production of non-ruminants. Future reforms of the CAP could exacerbate this tendency by reducing the cost of cereals ed as feedstocks for pork and poultry.

Common Salt Replacement by Modified Potassium Chloride in Italian Salami and Mortadella Sausages: Influence on Composition and Sensory Properties

F. PALMIA[1] and C. NEGRINI[2]

[1]Experimental Station for the Food Preservation Industry - Via Tanara 31/A - Parma - Italy

[2]Faculty of Agricultural Sciences - University of Bologna - Bologna - Italy

The effect on final composition and sensory properties of reducing sodium content by replacing part of comm with modified potassium chloride was investigated in Italian typical sausage products. The modified potassium ch used in this study was supplied by Takeda Chemical Industries, Tokyo, Japan through the italian representative & Co. Italia S.p.A., Milan, Italy; the product, called RIBO-KCl, is prepared in a proprietary manner by Takeda. Salt cement levels were 0%, 50% and 75% of the amount given in usual recipes; the substitution ratios of salt: RIBO-KC chosen so as to keep the water activity values of the original formulations unchanged. The products investigated w one-month-ripened fermented sausages (salami) and b) cooked sausages (mortadella, piece weight 1 kg). Sodium co (expressed as mg/kg meat product) of the final products at the three replacement levels were found to be 15200, 4900 and 11100, 4000, 2200 for salami and mortadella, respectively. Preparation and processing of both products was un ted by the replacement level.

Taste was the only sensory attribute influenced by salt replacement: sensory evaluations by the triangular te cedure showed the fermented sausages (salami) at the higher level (75%) of salt replacement to be the most prone products tested to taste changes.

THE RATIO OF VARIOUS PARTS OF THE GOOSE CARCASS AND DETERMINATION OF THEIR NUTRIENTS

QING-XIAN NAN, WEN-JI LI, XUI-FANG PU, Dept of Food Science, Beijing Agricultural University
Beijing 100094 - P.R. China

20 male and 20 female geese sampled randomly from 400 geese were slaughted and the carcasses wer weighted. The carcass ratio and the weight percentage of breast and legment to carcass wer calculated. The weight ratios of chest meat, legmeat, neck, leg-bone, frame, as well as the mea to bone weight ratio of leg and wing, were obtained after seperation.

Meat samples were ground and vaccum dried at 45 C, -650 mmHg while bones were ground to paste usin superparticle grinder before subjected to assay.

Carcass ratio was 63.41%(Shitou geese 65.3%, Xupu geese 65.2%). The ratios of meat weight to carca were 53.3%(male) and 50.6%(female). The weight ratios of high-quality meat from chest and legs carcass were 31.2%(male) and 30.5%(female), respectively. The weight ratio of meck and frame to carcass were 25%.

Protein content of bone was 25-30%. The moisture, protein and fat contents of meat were 70-72%, 2 24% and 3-5%, respectively. The shape of bone particles was irregular. The size of bone particl was smaller than 100um and over 50% of the particles were smaller than 20um.

RY PROFILE AND ACCEPTABILITY SCORES OF DIFFERENT RESTRUCTURED STEAKS

SSET[1], I. WAKELING[2], J.F. MARTIN[1], H. MACFIE[2], C. TOURAILLE[1]

A, Station de Recherches sur la Viande, Theix, 63 122 Saint Genès Champanelle, France

C, Institute of Food Research, Earley Gate, Whiteknights Road, Reading RG6 2EF, Great Britain

The aim of our present work is to study consumer preference and at first to explain the consumer preference by sensory ristics. We chose to study the influence of texture and taste on acceptability scores.

s and methods : The products were 4 restructured steaks different in the size of flakes and the nature of the binder. So we out a profile test and a consumer test in order to assess the effect of different manufacturing processes on the sensory ristics and the acceptability scores. Preference mapping analysis was used to visualise individual opinions and to relate lity scores to the profile.

Preference mapping shows that the majority of consumers are strongly fitted to the first (36 % of variance) and the second (34 % nce) preference dimension. The 4 products are located in 4 different sites of the preference map. This fact could mean that the red steaks are assessed using different sensory criteria. In order to understand consumer preference, we related the sensory ristics to the preference space. So the first preference dimension is mainly explained by salty taste. The second preference axis is ed with texture descriptors. Gristle, greasy, stringy are positively correlated with this axis while tender, granular are negatively ed. Consumers are equally negatively and positively correlated with the second preference dimension. Thus there is no preference s for the tenderest restructured meat.

ion : Consumers split either side of both preference dimensions. So there is no overall acceptability consensus for any sensory ristic.

RY MEAT CHARACTERISTICS FROM LIGHT LAMB CARCASSES

UDO, P. SANTOLARIA, I. SIERRA, M.J. ALCALDE, C. TOURAILLE[1]

iento de producción Animal, facultad de Veterinaria. 50013 ZARAGOZA, Spain

n de Recherches sur la Viande, I.N.R.A., Theix, 63122 ST-GENES-CHAMPANELLE, France

er of different products have appeared in the local markets and with trade transactions increasing, they are being using the same label. The result being that consumers are disappointed as they are not able to find a standardised nd they loose the interest on traditional products.

ose of this study was to compare sensory meat evaluation from different light lamb carcasses.

lamb carcasses (9.5-11 Kg) were obtained as follow: a group of animals from Rasa Aragonesa (RA - control group), ga (MA), Lacaune suckling lambs (SLA), Lacaune weaned lambs (LA), were produced indoors (housing) and then ed at 60-80 days; a second group of animals from extensive pasture and 130-160 days old, British (BRI), New (NZ) and Argentina (A) carcasses; and finally a group of animals from Merino Precoz x Merino crossbreed (ME) ian Merino (GME) which were produced in pasture and finished with concentrates.

ess, juiciness, flavour, and overall palatability were evaluated by a trained sensory panel as the following ons shows: RA-BRI-ME, RA-NZ-A, RA-MA-SLA and RA-GME-LA. A number of 64 observations have been from each breed, except for the control (RA) with 256 observations.

lts indicate a higher score for suckling lambs in sensory properties , and negative effect of weaning in palatability. nore, it is observed that the same production system (same weaning, finishing period) involves homogeneous quality . A canonical discriminant analysis with palatability scores, meat quality traits and carcass quality evaluations e importance of production system.

PROGRESS IN THE STRATEGY OF DISCRIMINATION OF MEAT-PRODUCING ANIMALS TREATED GROWTH PROMOTERS*

M.L. SCIPPO, G. DEGAND, P. GASPAR, G. VANVYNCHT and G. MAGHUIN-ROGISTER,

Laboratoire d'analyse des denrées alimentaires d'origine animale, Université de Liège, B-42 Sart-Tilman, B-4000 Liège, Belgique

The consumer has lost confidence in the food chain as a result of scandals reported in the media in recent years especially of the use registered products and even prohibited substances such as growth promoters in meat production. This is probably one of the reas explains the decrease in meat consumption, especially beef. The implementation of EC directives, banning the use of substances with h action in meat-producing animals, must be guaranteed by an efficient system of control. The survey of xenobiotic growth promoters (ar ß-agonists) is rather well ensured by immunochemical methods for the screening and by chromatographic (TLC, HPLC, GC) and specti (MS, IR) methods for the confirmation. New molecules introduced in the black market can be identified by mass spectrometr Multiresidue methods at the ppt-ppb (ng—µg/kg) levels have yet to be improved; multiple MS is probably the method of cho discrimination of animals treated with substances or their derivatives that are also endogenous hormones is still difficult especially cattle. The discrimination criteria will probably be based on the ratio values between concentrations of hormones and of their metab biosynthetic precursors. In the case of protein hormones used as foodstuffs production enhancers like BST for milk and meat, the p approach to solve the problem of treated animal identification is based on immunological, biochemical and high performance spectrom electrospray-MS. Reliable and efficient strategies of control are required to reestablish the confidence and the protection of the co through official controls performed by the state departments of agriculture and of public health or through responsible label organ involved in assurance quality certification of foodstuffs.

* *With the financial support of the Belgian Institute for the Promotion of Research in Industry and Agriculture (IRSIA)*

INDIGENOUS MEAT PRODUCTS OF INDIA

N. SHARMA

National Research Centre on Meat, Indian Veterinary Research Institute, Izatnagar, U.P., India.

The current level of meat production in India is around 1.5 million metric tonnes. Of the meat produced in the country, less than 1 percent is processed into products such as canned meat, bacon, sausages etc. and these products are sold to elite customers in metropolitan cities. These pr are of exotic orgin. Besides these products there are many indigenous meat products processed and con by meat eating population of the country. However, statistics and scientific information are not ava regarding their production and processing. In the present article an attempt has been made to de them. Meat products of Indian origin can be broadly classified into curried, dry cooked, minced pickled products. Products like Tandoori, various meat curries, Qarma, Kabbas, Rista, Goshtabas and pickles etc. are discussed.

NSORY QUALITY OF PICKLE-CURED, VACUUM PACKED AND COOKED DFD AND NORMAL BEEF

rlena Skvarča, B. Žlender

iversity of Ljubljana, BF, Jamnikarjeva 101, 61000 Ljubljana, Slovenia

stract

ere was studied a sensory profile of colour, texture and flavour of pickle-cured beef LD (young bulls) normal and DFD quality after vacuum packaging, storing (10 days at 0 to 2 °C) and thermal treatment by o methods (roasting, boiling). The content of residual nitrite, NO-myoglobine and total pigment was termined too.

e colour and texture properties of DFD cured beef were scored mostly higher after both thermal treatnts. Normal and DFD samples did not differ in the juiciness and flavour. In spite of better colour the FD samples contained significantly ($P \leq 0.001$) less NO-myoglobine and total pigment but more residual trite than the normal samples. Boiled samples of both qualities had significantly ($P \leq 0.001$) more sidual nitrite but less NO-myoglobine and total pigment than roasted one.

SESSMENT OF BACKBACON QUALITY

SØHOLM PETERSEN, O.K. PEDERSEN and M. ANDERSSON*

pt. for Research in Pigs and Horses, National Institute of Animal Science, Foulum, P.O. Box 39, DK-8830 Tjele, Denmark.
anish Meat Research Institute, Maglegaardsvej 2, DK-4000 Roskilde, Denmark.

ckbacon quality is highly related to the area and distribution of meat and fat areas in the bacon slice. The aim of this experiment was investigate the variation in meat and fat distribution in backbacon slices along a back. Furthermore, the aim was to develop a model prediction of backbacon quality.

female and male pigs of Danish Landrace and Duroc were slaughtered at 100 kg live weight and prepared for backbacon production. ch back was sliced into 230 slices with a thickness of 2 mm. The slices were recorded on video, and then devided into a dorsal (DPS) d a ventral (VPS) part, of which the areas of meat and fat were measured. The areas were obtained semi-automatically using an image alysing programme.

prediction equation was developed based on areas of meat and fat in slices that were graded subjectively into four quality groups. The uation was tested by cross-validation.

e lean : fat ratio (L/F) in the two parts of the slices showed that especially the L/F of the VPS varied systematically with the anatomical ation of the slices. The L/F was high in the VPS from the caudal and cranial parts and low in slices from the medial part of the back. e average L/F of the VPS was higher in backs from Danish Landrace than from Duroc pigs. Furthermore, the average L/F of the VPS higher in female than in male pigs.

cross-validation the prediction model classified 87% of the slices into the same quality group as did the subjective classifiers. According the model slices of the best quality, predicted from the L/F of the whole slice, were from the medial part of the back. The average quality the backbacon slices was not significantly different in the four groups of pigs.

PORK LIVER: THE FORGOTTEN VARIETY MEAT IN THE U.S.

S. SPECHT-OVERHOLT and J. ROMANS

South Dakota State University, Department of Animal and Range Sciences, Brookings, South Dakota 57007-0392

Consumption of variety meats is low in the U.S. as reflected in prices paid for variety meats. Pork livers s for 20 cents/kg. The low demand for variety meats (pork liver) is an indication of consumer preferences. Resea has been conducted to produce pork products which have greater levels of omega-3 fatty acids than pork from cont hogs. Pork livers from hogs fed diets containing 15% flaxseed for the last 28 days (d) of finishing were hig (P<.0001) for 18:2, 18:3 and 20:5 and lower (P<.0001) for 20:4 than livers from control hogs. Therefore, p products could be marketed to consumers that have a more desirable n-3/n-6 fatty acid ratio. This research conducted to determine 1. consumer preferences toward preparation method for fresh pork liver and 2. consu responses toward Braunsweiger made from control versus pork livers from hogs fed a finishing diet containing flaxseed for the final 28 d and 42 d of feeding. For the first objective, trained taste panelists (n=6) prefe liver with caramelized onions in balsamic vinegar sauce over raspberry sauted liver (P<.05). The variation a panelists was significant (P<.01). For the second objective, two consumer groups (n=48 and n=23) rated Braunswe samples on a scale of 1 to 5 with 1=highly favorable and 5=highly unfavorable. Means of 2.4, 2.5, and 2.8 control, 28 d and 42 d flax, respectively (n=48), and 2.3 and 2.2 for control and 28 d flax treatment, respecti (n=23), did not differ (P>.05). This research indicates consumers found pork liver and Braunsweiger from tre hogs and control hogs equally favorable. With proper marketing, consumers may allocate more of their food doll towards the purchase of nutritionally enriched variety meats and products manufactured from variety meats.

CONSUMER EVALUATION OF MEAT QUALITY CRITERIA

C. TOURAILLE

Station de recherches sur la viande, I N R A Theix, 63122 St Genès Champanelle FRANCE

A thousand consumers filled in a questionnaire concerning their meat consumption, the way they purchase meat, and evaluated the importance of various factors on their choice for meat :nutritive value, price, eating qualities... They were asked to score the importance of sensory qualities (colour, tenderness ...) and estimate the role of various factors on meat quality (influence of animal, butcher, cooking...).

The results showed that sensory properties and security aspects (hormones) of meat are of paramount importance for the consumer. Taste and tenderness are estimated as the most important organoleptic qualities.

Most production factors are thought to be important for meat quality, altough feeding of animals and meat treatment after slaughter are recognised as the most significant.

Data have been submitted to Correspondance Analysis in order to show the relations between the consumer's characteristics (age, sex, meat purchase and consumption) and the estimated importance of meat qualities. The age of consumers seems to be one of the most discriminating factor for quality perception.

The results may help to find good arguments to promote meat and meat products.

Session 5

MUSCLE BIOLOGY, POST MORTEM CHANGES AND MEAT QUALITY ; AN INTEGRATED APROACH OF THE MEAT TENDERNESS PROBLEM

TIVITY OF SARCOPLASMIC RETICULUM OF FAST AND SLOW RABBIT SKELETAL MUSCLES

I. ABDUL WAHAB* **and Y. BRIAND**

ept. Anim. Sci., College of Agric. Univ. of Baghdad, Iraq
ioch. Lab. Univ. of Clermont II, 63177 Aubière Cedex

ue to the importance of the sarcoplasmic reticulum and calcium in the transformation of muscle to meat s study was undertaken. The sarcoplasmic reticulum vesicles were isolated from the three metabolic pes of muscles in rabbit, by the centrifugation method. The yield of sarcoplasmic reticulum from both pes of fast-twitch muscles (the psoas major) and (the gastronemius medialis) was almost three times as gh as from slow twitch red muscles (the semi membranosus proprius). Polyacrylamide-gel ctrophoresis profiles of sarcoplasmic reticulum from fast and slow muscles showed a significant ference in the protein pattern. The calcium-dependent ATPase activity and calcium uptake of the rcoplasmic reticulum vesicles from both types of muscles were measured by the spectrophotometric thod and by the filtration procedure respectively. The calcium-dependent ATPase activity and the lcium-uptake capacity of the fast twitch white muscles (the psoas major) were higher than in fast twitch d muscles (the gastronemius medialis). Such kinetic measurement, could not be carried out in slow-itch red muscles because of their relatively low content in sarcoplasmic reticulum.

J.A. present address Bioch. Lab. Univ. of Clermont II, 63177 Aubière Cedex

ORMAL CALCIUM REGULATION IN CULTURED CELLS FROM NORMAL AND HALOTHANE CEPTIBLE PIGS

nne ARCHER, R. LABAS, E. ROCK and X. VIGNON
n de Recherches sur la Viande, INRA - Theix, 63122 CEYRAT, France

The low contracture threshold induced by caffeine in biopsied muscle from animals susceptible to Malignant Hyperthermia is iated with an increased cytoplasmic calcium level. The cellular mechanism of this syndrome is poorly understood.

The effect of caffeine on intracellular calcium was monitored in primary cultures of muscle cells from normal pigs and those from thane susceptible (MHS) pigs. Calcium variations were estimated by recording changes in fluorescence ratio obtained on dual excitation at nd 380 nm of myotubes loaded with the Ca^{2+} fluorescent probe Fura-2. Myogenic precursors were satellite cells obtained from Masseter le of adult pigs previously tested for their sensibility to halothane. The cells were cultured until differenciation of multinucleated ubes. Measurements of fluorescence ratio were performed at room temperature in the absence or in the presence of 0.5 to 6 mM caffeine.

The resting fluorescence values were not significantly different in normal and MHS cells. Caffeine induced an increase in fluorescence in both types of cells. The magnitude of this increase was commonly higher in myotubes from MHS pigs for caffeine concentration r than 2 mM. This result indicates an abnormal Ca^{2+} homeostasis in cultured cells from halothane susceptible pigs which may be a festation of the lesion that causes Malignant Hyperthermia. Satellite cells isolated from muscle tissue could therefore provide a good l for investigation on sarcoplasmic calcium regulation.

KINETICS OF CATHEPSINS FROM DIFFERENT PORCINE MUSCLES

G. ARTIGAS, M. GIL and C. SARRAGA

Institut de Recerca i Tecnologia Agroalimentàries (IRTA). Centre de Tecnologia de la Carn. 17121 Monells. Girona. Sp

Calpains and cathepsins systems play an important role in the proteolytic changes that take place during the meat tender process.

The characterization and purification of these enzymes and their endogenous inhibitors open a possibility for a new biotechno approach to the strategies on meat quality and meat products improvement.

In this study, the kinetic parameters of cathepsins B, L and D from cardiac and *longissimus dorsi* (LD) muscles were co Partial purification of the enzymes was done using fresh muscles and included a precipitation with ammonium sulfate betw 25 % and the 65 % of the salt. Cathepsins B and L were assayed with the common substrate Z- Phe - Arg - NHMec; ca B was assayed with Z - Arg -Arg - NHMec, and cathepsin D with denatured haemoglobin.

Results showed that the enzymes from cardiac muscle had a higher affinity for the substrate (between 30 and 50 %) enzymes from LD muscle.

The purified cathepsins now available commercialy can not be used in the food industry. The obtention of enzymes with high for their substrates, from viscera of low commercial value, gives a tool for the use of cathepsins as additives in the meat and related fields in a near future.

THE SLAUGHTERING AGE EFFECT ON THE PHYSICO-CHEMICAL PROPERTIES OF BROILER CHICKENS INTRAMUSCULAR COLLAGEN

A. BASTIAENS AND C. DEROANNE

Centre Agronomique de Recherche sur la Viande - section 3 (I.R.S.I.A.)

U.E.R. de Technologie des Industries Agro-alimentaires, Faculté des Sciences Agronomiques, 5030 Gembloux, Belgique

The objective of this study, realized in collaboration with the "Centre d'Ethologie des animaux domest de l'U.C.L.", is to research the influence of slaughtering age on the properties of intramuscular collagen broiler chickens were equitably divided according to strain (JA 57, Cou Nu d'Aquitaine), sex and slaughtering age (7, 10 and 13 weeks).

The principal analytic methods are the thermal solubility and the Diffential Scanning Calorimetry of Collagen.

The leg collagen is more soluble than the collagen of the pectoral muscle. For the two types of muscle solubility decreases when the slaughtering age increases. It's generally weaker for the females. The strain doesn't influence these results.

The Differential Scanning Calorimetry of collagen gives us a peak that we can divide into three parts and S3) corresponding to links of increasing thermal resistance. We observe that the number of the thermostable links increases with the animal age to a maximum where S_3 reachs roughly 20 %. This generally obtained between 10 and 13 weeks according to the chickens sets.

This study is realized on two chickens strains with slow growth and we show that the intramuscular collagen is stabilized by crosslinkings between 10 and 13 weeks. The collagen reaches then to a "mat state that allows to obtain a sufficiently firm meat.

PURIFICATION AND CHARACTERISATION OF INTERMEDIATE Mr PROTEINASE INHIBITORS FROM BOVINE SKELETAL MUSCLE

M. BERRI, P. ROUCHON, M. ZABARI, T. SAYD, J. SIBOULET & A. OUALI

Meat Research Station, INRA de Theix, 63122 Ceyrat, France.

As most tissues and cells so far investigated skeletal muscle contains proteinase inhibitors inactivating serine and cysteine proteinase. Their exact nature and their physiological function remain however unknown. The present study is part of a more general work dealing with the purification and characterisation of proteinase inhibtors from bovine skeletal muscle.

Gel chromatography on a Sephadex G 100 column (5x100 cm) of a crude extract obtained from bovine *Diaphragma* muscle sparated four fractions active again either papain, trypsin or both and with Mr in the range of 40-70 kDa (FI and FII), 20-40 kDa (FIII) and 10-20 kDa (FIV). In this paper, the purification procedure and the properties of the FIII fraction inhibitor were decribed. The Sephadex G100 FIII fraction inhibited specifically papain and showed no activity against either trypsin, chymotrypsin, pepsin.

The Sephadex G100 fraction was first loaded on a Q-sepharose column (2.5x10cm) equilibrated at pH 8.1 and proteins eluted with a linear 0-0.5 M NaCl gradient. An active fraction inhibiting papain but not trypsin was eluted between 0.2 and 0.3 M NaCl. This fraction was then run on a second Q-Sepharose column at pH 7.6 and the activity eluted at about 0.2 M NaCl. Isoelectricfocusing of the pooled active fraction also revealed one band with a pI of 6.7. Under both non-reducing and reducing conditions only one band was obtained after SDS-PAGE suggesting the activity corresponds to a monomeric protein inhibitor.

This proteinase inhibitor is highly heat-stable in a temperature range of 40-100° C. Furthermore, the papain inhibitory activity was stable at mildly acidic pH ranging from 7 to 5.

Regarding papain, the enzyme-inhibitor complex formation was slow and depends on the inhibitor/enzyme molar ratio. This muscle protein inhibitor could be classified as a slow tight binding inhibitor an assumption supported by the very low Ki value ranging between 10^{-10} and 10^{-11} M. Although to various extent, the purified inhibitor bound tighly to cathepsins B and L, two other cysteine proteinases whereas no activity was detected against all serine and aspartyl proteinases tested.

EFFECT OF BRINE INJECTION ON ENERGY CATABOLISM : P-31 NMR STUDIES ON *BICEPS BRACHII* MUSCLE OF RABBIT

BIELICKI G., DONNAT J.P., FOUCAT L., BENDERBOUS S., RENOU J.P.

Structures Tissulaires et Interactions Moléculaires / Station de Recherches sur la Viande INRA Theix 63122 Ceyrat

The catabolism of high energy phosphate compounds was examined by P-31 NMR spectroscopy, in rabbit muscle. The time-dependent *post mortem* changes were analyzed for different technological treatments.

The rabbits were anaesthetized, and the *Biceps Brachii* muscle was exposed, perfused by artery and then removed to be placed in the specfic probe. The simulated death of the muscle was performed by stopping the perfusion. The brine was immediately injected by the arterial system. The NaCl concentration was 3 and 5M in brine. The NMR experiments are performed at 162MHz on a homebuilt P-31, H-1 tuned probe. The temperature in the NMR probe was 20°, 4°C and a temperature gradient was also performed. With this experimental system, it is possible to keep muscle metabolism stable, and thus to monitor the initial concentrations of phosphorylated metabolites. The effects of brine on some traits of metabolism were investigated without producing twitching or damage to the tissue during insertion into NMR tubes. The whole muscle was examined in the probe. This process prevented sampling problems because the brine diffusion was heterogeneous. The rate of pH fall and the evolution of phosphorylated compounds were determined. The results showed a dependance on the composition of the brine.

ELECTROPHORETIC AND IMMUNOLOGICAL ASSESSMENT OF DEGRADATION BY CALPAINS OF LAMB MUSCLE PROTEINS.

P. CEÑA, J.A. BELTRAN, I. JAIME and P.RONCALES.
Dep. de Producción Animal y Ciencia de los Alimentos. Facultad de Veterinaria. Universidad de Zaragoza. 50013 ZARAGOZA. SPAIN

As a part of a comprehensive study on the degradation of high molecular weight muscle proteins by effect of either calpains or agi present here results concerning changes of proteins of a molecular size larger than α-actinin and smaller than myosin heavy chain (MHC)

SDS-PAGE using 6.5% acrylamide showed that both calpain I and II were capable of degrading at least seven different proteins (p peaks I through VII), of a molecular weight between 100,000 and 200,000 Da, when myofibrils were incubated with enzymes at op conditions of pH 7.5, 2.5 mM Ca^{2+} and 25°C. Two of these proteins, peaks V and VII, likely correspond to M-protein and C-p respectively. The same proteins were found to be naturally degraded throughout postmortem meat aging, although proteolys significantly slower.

By effect of further proteolysis several degradation peaks appeared at a position close to former peaks I, II, III and VII, as well as peak (IV') between peaks IV and V, either after incubation with enzyme or by effect of aging. Three of these degradation peptid molecular size between that of C-protein and MHC have been shown, using a Western blotting immunological technique, to proceed f as yet unidentified protein, named by ourselves G-protein but which likely corresponds to filamin. This protein of an approximate mo weight of 300,000 was previously reported by our group to be extensively degraded, either by incubation with calpains or by effect of a

No changes of myofibrillar proteins could be found when myofibrils were incubated in the presence of mM Ca^{2+} and calpastatin added enzyme; this fact allows to impute the observed myofibrillar protein changes, either after incubation with calpains or by effect o to enzyme action alone and not to an effect due to the mere presence of a high Ca^{2+} level.

OBSERVATION OF ABNORMAL MITOCHONDRIA IN WHITE MUSCLE FIBRES OF CARRIER PIGS

Marielle ESTRADE, X. VIGNON, C. BAZIN and G. MONIN
Station de Recherches sur la Viande, INRA, Theix, 63122 Ceyrat, France

The RN^- gene affects meat quality by increasing the glycogen content of muscle. Glycogen localizatio myofibre ultrastructure were studied in the *Longissimus* muscle from pigs suspected to be RN^- carriers (called pigs) and pigs considered as normal (called rn^+ pigs). White fibres from RN^- pigs showed an excess of glycogen i sarcoplasm and exhibited abnormal mitochondria espace. Mitochondria contained scattered particles of glycog showed disorganised cristae. No abnormality was visible in red fibres.

Oxygen uptake was measured polarographically using a Clark electrode at 25 °C on mitochondria isolated *Longissimus* muscle of rn^+ pigs and RN^- pigs. Citrate synthase activity was determined. The respiratory control higher in mitochondria isolated from RN^- pigs as compared to rn^+ pigs (means values were respectively 2,5 and Respiratory activity was higher in mitochondria from RN^- pigs. Citrate synthase activity was 0,20 µkat / g of muscle of RN^- pigs and 0,14 µkat / g for rn^+ pigs. Thus, RN^- gene seems to be associated with altered glycolyti oxidative metabolisms of skeletal muscle. However, the primary cause of these abnormalities remain unclear.

LATIONSHIP BETWEEN LACTATE AND GLYCOGEN CONTENTS AND pH VALUES IN *POST MORTEM* *NGISSIMUS* MUSCLE OF THE PIG.

FERNANDEZ (1) and R. GUEBLEZ (2)

, INRA- Station de Recherches Porcines, Saint-Gilles, 35590 L'Hermitage, France.

, ITP- Pôle Amélioration de l'Animal, BP 3, 35650 Le Rheu, France.

STRACT

This study was conducted with the aim of examining the relationships between i/ *Longissimus* muscle glycolytic potential (GP, an imator of resting glycogen level) determined in *post mortem* samples and ultimate pH (pH_u, 24 h *post mortem*) and ii/ lactate content pH value at 45 min *post mortem* (pH_1). The study involved 170 pigs among which 59 Large White, 60 Landrace and 51 Pietrain, ughtered under commercial conditions. *Longissimus* muscle samples were taken c.a. 45 min *post mortem*.

The best prediction of the relationship between GP and pH_u was obtained using a segmented quadratic model with plateau (r= -; P<0.001). Convergence was reached at a GP value of 173 µmol/g. Below this value, pH_u decreased curvilinearly when GP increased. ove the convergence point, a plateau was reached (pHu= 5.50). This result confirms that ultimate pH cannot be predicted in a linear hion from values of muscle glycogen content at time of slaughter.

A segmented linear model with plateau allowed the best prediction of the relationship between pH_1 and lactate content (r= -0.96; .001). Lactate concentration remained at a constant level (48 µmol/g) for pH_1 values below the convergence point (pH_1= 5.82). Above threshold, a linear decrease in lactate was observed. This suggests that in the pH_1 range 5.2-5.82 for which a maximum rate of colysis seems to be reached, the differences in pH_1 cannot be accounted for by differences in glycolytic rate.

E RELATIVE EFFECTS OF ANIMAL PRODUCTION AND CARCASS PROCESSING FACTORS ON EF TENDERNESS

FISHER, G.R. NUTE, G.A.J. FURSEY & A. CUTHBERTSON*

artment of Meat Animal Science, University of Bristol, Langford, Bristol. BS18 7DY. United Kingdom.

eat & Livestock Commission, P.O. Box 44, Winterhill House, Snowdon Drive, Milton Keynes. MK1 1AX. United Kingdom.

aims of this project were to identify key factors in commercial beef production which affect beef tenderness, and to assess their ive importance. Hereford x Friesian heifers and steers were each allocated to a 'fat' and a 'lean' group of 18 animals each. al- and silage-fed Limousin x Friesian bulls and cereal finished suckled bulls sired by continental breeds, were represented by imals each, and slaughtered at ages of 11, 18 and 11 months, respectively. Post-mortem treatments, balanced within groups, prised 700-volt (HES), 85-volt (LES) and zero (NES) electrical stimulation; aitch bone and conventional carcass suspension; (10°C for 10h) and rapid (1°C for 24h) chilling; and ageing meat for 6, 10 and 14 days prior to freezing. The texture of ed *longissimus lumborum* was expressed as force at first yield (Fy, kg) and work done in shearing (W, Joules.10^{-2}). ked steaks were assessed by ten trained assessors scoring on a scale of 1 (extremely tough) to 8 (extremely tender). There no significant differences in texture between heifers and steers, or between fatness groups. Suckled bulls were as tender as rs and steers and both these groups were more tender than silage bulls (minimum probability <0.05). Barley bulls were mediate. Differences in Fy, W, and panel scores between silage bulls on the one hand, and combined heifers and steers on the were 1.04kg, 4.16 J.10^{-2} and 0.49 panel score units respectively, the bulls being tougher by all three criteria. These - the mum production differences - can be compared with the magnitude of carcass processing effects in the heifers and steers. binations of processing treatments, as in a blueprint, produced additive effects. For Fy and W, the biggest differences were een NES, rapid chill, 6 days conditioning (toughest) versus HES, slow chill, 14 days, giving values of 1.72 kg and 8.94 respectively. For panel scores, NES, rapid chill, conventional suspension (toughest) contrasted with slowly chilled aitch suspension (and little additional effect of ES), with a maximum difference of 1.41 panel score units. It is concluded that inations of post-mortem treatments can have larger effects on meat tenderness than even extreme animal type x production n combinations.

RELATIONSHIPS BETWEEN ULTIMATE PH AND MEAT QUALITY VEAL

F. GUIGNOT, C. TOURAILLE, M. RENERRE and G. MONIN
Station de Recherches sur la Viande, INRA, Theix, 63122 Saint Genès Champanelle, France

The aim of this study was to evaluate the relationships between the ultimate pH and the colour, th sensorial qualities and the cooking loss in veal meat. Variations in ultimate pH were induced by adrenalin administration (0.1 to 0.4 mg/kg liveweight). Animals were transported 2 by 2 to the slaughterhouse. Th control animal of each pair was killed just after arriving. The other animal was injected with adrenaline an killed the day after. Measurements were made on the *Longissimus dorsi* muscle. Sarcomere length and pH wer measured at 2 days after slaughter, and colour at 2 days and 9 days after slaughter. Sensorial qualitie (tenderness, juiciness, flavour) and cooking loss were measured at 9 days after slaughter. Sensorial qualitie were estimated by a trained panel.

Meat from adrenaline-injected animals had a higher ultimate pH than meat from controls (mean valu were respectively 6.25 and 5.59), except in one case (pH = 5.65 with 0.2 mg/kg of adrenaline). The ultimate p and the sensorial qualities were linearly correlated (respectively r = 0.83 for tenderness, 0.81 for juiciness an 0.71 for flavour). Meat with high ultimate pH was more tender, more juicy and had more flavour than me with normal ultimate pH. Moreover, meat from adrenaline-injected animals had shorter sarcomeres and lost le weight during cooking than meat from controls (cooking loss respectively 25 % and 32 %). However, colour meat from adrenaline-injected animals was darker ($P < 0.01$) and cleared less during the days after slaughter.

THE STUDIES ON TENDERIZATION OF BEEF

HE YINFENG, YNAD ZHIHUA, WANG ZHAOPENG, LIU JIMING
Department of Food Engeering, Inner Mongolian, Institute of Agriculture and Animal Husbandry, HUHHOT INNER MONG R.P. Chine

The Longissimus dorsi, Semitendinosus and Triceps brachii were chosen from three years old Inner Mongolian steer, aging fo 15°C temperature, 85 % relative humidity. By measuring physical biochemical and ultrastructure of post morem muscle, the e muscle tenderness and tenderization by temperature and time were researched. The results indicated :

1- the longissimus dorsi, Semitendinosus and Triceps brachii tenderness were separately increased 20 %, 26 % and 31 % in 24h comparison with 1h post mortem. But controls were decreased 36 %, 25 % and 33 % ;

2- the lactic acid content increased evidently, pH value decreased and adenosine triphosphate decomposed rapidly in 15°C for 2 results, the rigor mortis and autolysis occured in advance ;

3 - At 15°C for 24h the electron microscope ultrastructure of myofibril varied evidently ;

4- the soluble hydroxyproline had no significant increase in aging for 24h ;

5- the volatile amine nitrogen content was in keeping with hygiene standard of fresh meat in China. Maximum value was 11.9m

6- the tenderness and flavor of muscle have improved evidently in 15°C for 24h by judgment of specialists.

ES IN MYOFIBRILLAR CYTOSKELETAL PROTEINS OF BOVINE LONGISSIMUS MUSCLES DIFFERING IN TENDERNESS

HUFF, F.C. PARRISH, JR. AND R.M. ROBSON. Iowa State University, Ames, Iowa 50010

bjective of this study was to determine changes in myofibrillar/cytoskeletal proteins associated with rness differences because of effects of postmortem aging and of animal age and sex. Strip loins were ed from the carcasses (24 hr postmortem) of ten bulls and ten steers of approximately 14 months of age, and ows of 44 months of age and older. The thirty strip loins were vacuum packaged and stored at 2°C. Samples removed at 3, 7, 14, and 28 days postmortem and were stored at -20°C until analysis. Purified myofibrils solated from raw samples of each sex and age category at the four postmortem aging periods and analyzed by n dodecyl sulfate polyacrylamide gel electrophoresis (SDS=PAGE). A 5% polyacrylamide (acrylamide/bisacryla- 100:1, w/w) slab gel was used to monitor changes in extremely high molecular weight proteins (e.g., titin ebulin), and a 12% polyacrylamide (acrylamide/bisacrylamide = 37:1, w/w) slab gel, with a 5% polyacrylamide ing gel, was used to monitor changes in lower molecular weight proteins. SDS-PAGE analysis revealed that ,000-dalton component was more intense with increasing time postmortem concomitant with an increase in tenderness. In addition, increasing postmortem aging time was accompanied by loss of the T_1 band of titin. s tender steaks from cows, the T_1 band of titin persisted longer, and was more frequently observed through s of postmortem aging. SDS-PAGE analysis also revealed that a nebulin band was more frequently present at postmortem in steaks from bulls, and in less tender steaks from steers and cows. The results of this suggest that the structural proteins titin and nebulin are more resistant to degradation in less tender from older animals and from bulls, and that the amount of structural integrity of these proteins seem to significance in tenderness.

E GLYCOGEN DEPLETION PATTERN AT EXSANGUINATION OF PIGS FED HIGH OR LOW PROTEIN DIET

RLSSON[1], B. ESSEN-GUSTAVSSON[2] and K. LUNDSTRÖM[3]

of Food Science, [2] Dept. of Medicine and Surgery, [3] Dept. of Animal Breeding and Genetics. sh University of Agricultural Sciences, S-750 07 UPPSALA, Sweden

s-situations and treatment of pigs pre-slaughter influence muscle glycogen levels which an important rôle for meat quality. Little in known about glycogen content within rent fibre types at exsanguination, and its relation to meat quality. Muscles from pigs ng the halothane gene contain several glycogen depleted fibres at slaughter and give meat or quality. The aim of this work was to study the muscle glycogen depletion pattern in a of slaughter pigs of halothane-gene-free Swedish Yorkshire (entire males and gilts) fed a or a low protein diet. Immediately after exsanguination, muscle samples from M. longis- dorsi at the last rib and blood samples were taken. Serial sections of the muscle were ed for myosin-ATPase and classified as type I, IIA and IIB fibres. Fibre areas and gen depletion pattern were evaluated on PAS stains using an image analysis system. gen content in whole muscle was analysed on freeze dried samples dissected free from , fat and connective content. pH (pH_u) was measured on homogenates with iodoacetate. Meat ty was measured as surface reflectance (EEL), ultimate pH (pH_u) and drip loss at 24h post . Shear force values (SF) were measured on cooked meat using the Warner-Bratzler atus. There were no differences in the meat quality between pigs on the two diets. The consisted of 6% type I, 6% type IIA and 88% type IIB fibres. Low glycogen levels were in most of type I and IIA fibres while a greater variation in glycogen levels was seen type IIB fibres. The proportion of depleted IIB fibres was correlated positively to lactate levels and negatively to SF. These results indicate that most type I and IIA and approximately 25% IIB fibres had been recruited in these pigs due to the pre- ter treatment. This type of glycogen depletion pattern seemed to have no negative nce on meat quality.

LATERAL CROSSLINKS, POLYMERIC COLLAGEN AND MEAT TEXTURE

L.B. KURTH, R. KUYPERS AND D.J. HORGAN

CSIRO Division of Food Processing, Meat Research Laboratory, Cannon Hill, 4170, Australia

A causative relationship between thermally induced collagen shrinkage and meat texture has been established. intensity of the compressive force generated by collagen is directly related to the number and nature of thermally crosslinks in the tissue. As animals increase in age it is thought that the nature of their collagen crosslinks chang they become more stable to heat and hydrolysis by acids. We have previously shown that the stability of crosslinks collagen of young animals is tissue dependent and is determined by the relative prominence of crosslinks formed hydroxyallysine pathway. The principal crosslinks on this pathway are pyridinoline and a collagen associated chromogen. We know that the concentration of pyridinoline increases with age by about 30% from birth to o There is however considerable animal to animal variation in pyridinoline content at any particular age. We hav unable to show a good correlation between the pyridinoline concentration of a muscle and measures of meat tou At present we are unable to accurately measure the concentration of Ehrlich chromogen due, we suspect, to its structure. Beyond 18 months of age, the concentration of Ehrlich chromogen appears to decline, yet the relaxatio time determined by hydrothermal isometric tension shows an increase in the number of thermally stable crosslink consider these to be Ehrlich chromogen residues that are no longer reactive with the detection reagent. Alternativ reaction products of the relatively minor allysine system may be implicated, since the relaxation half-times of where these crosslinks predominate also increase with increasing animal age.

EFFECT OF CASTRATION ON SOME MUSCULAR CHARACTERISTICS IN CALVES AND BUFFALO CALVES

P. MARINOVA, Ya. GORINOV, M. RENERRE, A. LACOURT

Institute of Animal Science, 2232 - Kostinbrod, Bulgaria

Station de Recherches sur la Viande, INRA Theix, 63122 CEYRAT, France

A parallel investigation has been conducted on 40 calves and buffalo calves to establish the effect of castration and type spe metabolic composition of muscles and meat quality. 10 animals of each type have been castrated at age of 6 months and slaugh reaching 450 kg of live weight. Histochemical analyses and qualitative characteristics of meat were conducted on muscles Lo Tensor Fasciae Latae, Diaphragma and Psoas Major.

Castration of calves was accompanied by increasing the part of fast-oxidative-glycolytic and fast-glycolytic fibres in Tensor Fas and Diaphragma muscles, whilst in buffalo calves relative part of glycolytic fibres increased in most muscles studied. improved mainly meat tenderness in both types of animals and increased intramuscular fat content in calves.

IFFERENTIAL SCANNING CALORIMETRIC STUDIES ON THERMAL PROPERTIES OF MUSCLE ROTEINS IN NORMAL AND PSE PORK

IING TSAO CHEN, CHIH PING LEE and DENG CHENG LIU
epartment of Animal Science, National Chung-Hsing University
aichung, Taiwan 40227, Republic of China

SC is used progressively to study thermodynamic properties of muscle proteins, recently. The aim of this udy conducted to investigate the thermal properties of muscle proteins in normal pork as compared to PSE ork. Muscle samples were excised from M. longissimus dorsi at 5-11th rib 30 min after slanghter. DSC was rformed on a ULVac DSC-7000 (Sinku-Riko, Japan) equipped with thermal analyzer. Samples (15-20mg) ere weighed in aluminium pans (No. 201-53090) and then sealed. The scanning temperature was 25°-99°C at heating rate of 10°C/min, triplicate samples were analyzed. a reference containing 12-13mg distilled water as used. The fine ground excised dorsal muscle was homogenized with 0.3M KCl to extract salt soluble otein was run alone, with 0.1mM $CaCl_2$, 5mM EDTA, as well as 0.1mM $CaCl_2$ + 20mM ATP. Result was bserved thermogram of 0.3M KCl extracted sample with $CaCl_2$ was similar to the control, and there were two dothermic peaks appearing on thermogram. Tmax of the transition of the control and with $CaCl_2$ measured re 56.9°-57.9°C for the peak of myosin, and 78.2°-78.9°C for the peak of actin, but endothermic peak of yosin disappeared from thermogram as the control sample added with EDTA. In addition, Tmax of extracted mple with $CaCl_2$ and ATP was higher than that of the control. Normal whole muscle held for 24.5 hr stmortem exhibited three major peaks of transition which were same as PSE pork. Tmax for myosin in PSE rk was lower than that of normal pork, but actin for PSE pork was higher as compared to normal pork. Both naxes changed with time postmortem. The enthalpy of denatured (ΔH) for PSE pork was lower than the rmal pork under the same conditions. This result was evident by the change of myosin endothermic peak in S pork. An exothermic peak was observed on thermogram for normal muscle fibers and showed a ogressive decrease in the size with postmortem time. However, the exothermic peak was only slightly ident in PSE pork as affected by pH and temperature. The enthalpy of thermal transition for samples of rmal and PSE was also evaluated. In conclusion, the thermograms and ΔH were varied with muscle types, eatments and postmortem times.

UDIES ON 2,3-DIPHOSPHOGLYCERATE, PYRUVATE KINASE AND MITOCHONDRIAL ATPase TIVITIES IN PSS PIG

NG TSAO CHEN, CHIH PING LEE and DENG CHENG LIU
partment of Animal Science, National Chung-Hsing University
chung, Taiwan 40227, Republic of China

diphosphoglycerate(DPG) is an important factor for oxygen-hemoglobin dissociation curve. It can facilitate regulate hemoglobin to bind oxygen or release oxygen to tissue. Normally, the PSS pigs have oxygen ficiency as they are stressed. The experiment was conducted to study the metabolism of 2,3-DPG and vate kinase (PK) and mitochondrial ATPase activities in the PSS pig. LYD three crossbred pigs were ened into normal and PSS pigs with Halothane test, which were used as test animals. The blood samples ined from the stressed animals for determining DPG and PK activity before slaughtered, and Longissimus muscle was taken for measuring mitochondrial ATPase activity 30 min postmortem. The concentration of DPG was determined with the method described by de Verdier & Ericson (1981) and NMR-trophotometry, and pyruvate kinase activity was measured with the method of Fujii & Miwa (1981). The chondrial ATPase activity was measured with the method of Snelld & Mullock (1981). pH of the blood of pig was also measured.

of the blood in the PSS pig was lower than that of the normal pig (6.70±0.25 and 7.16±0.19, respectively). concentration of DPG in blood of the PSS pig was lower than that of the normal pig. This result was in ement with the structure of DPG changed or dissociated in the blood of the PSS pig. PK activity in the PSS was higher than in the normal animals. However, no difference in mitochondrial ATPase was detected in tressed and the normal pigs. The result was also found there was difference in DPG concentration between and female pigs within the groups, but no difference in PK activity was detected in different sex.

EFFECTS OF THE RN⁻ GENE ON SOME TRAITS OF MUSCLE AND LIVER IN PIGS

G. MONIN, Christelle BRARD, P. VERNIN and J. NAVEAU*

INRA, Station de Recherches sur la viande, Theix, 63122 Ceyrat, France

* SCA Pen Ar Lan, 35380 Plélan-le Grand, France

The present study involved 2 experiments. The pigs under study originated from a population where the presence of the RN⁻ gene had been previously demonstrated. The animals were slaughtered in a commercial slaughterhouse and were classified as normal or RN⁻ carriers on the basis of the Napole yield (Ny) measured on the *Semimembranosus* muscle (normal : Ny > 90 ; RN⁻ carriers : Ny ≤ 90). In experiment 1, the contents of water and protein were measured in the *Semimembranosus* muscle of 90 pigs slaughtered in 4 weekly series. Samples were taken from the *Semimembranosus* muscle around 30 min after slaughter, for determination of Ny and protein and water contents. Muscle from RN⁻ carriers (n = 54) contained less protein ($P < 0.01$) and slightly more water ($P < 0.01$) that muscle from normal pigs (n = 36). In experiment 2, samples were taken from the *Semimembranosus* muscle and from the liver of 27 pigs around 30 min after slaughter for determination of protein and glycolytic potential levels. Muscle from RN⁻ carriers (n = 17) contained a higher glycolytic potential ($P < 0.01$) than muscle from normal pigs (n = 10), while no difference was observed in liver between the 2 groups of animals. It was concluded that the increase in muscle glycolytic potential induced by the RN⁻ gene does not result from a hormonal deficiency, but from a defect inherent in skeletal muscle cells.

THE INTERRELATIONSHIP BETWEEN MYOFIBRIL FRAGMENTATION AND TENDERNESS FOR BEEF MEAT.

U. OLSSON and E. TORNBERG

Swedish Meat Research Institute, POB 504, S-244 24 Kävlinge, Sweden

Myofibril fragmentation (MF) has been shown to correlate with tenderness of loins from conventionally handled carcasses. The aim of this study was a) to refine the method and b) to evaluate the effect of different pre-rigor and conditioning temperatures on the MF and tenderness evaluated by instrumental and sensory measurements. The MF was followed by measuring the length, using an image analysis system, of myofibrils on micrographs instead of absorbance measurements. In experiment 1, the influence of different pre-rigor temperatures (1, 4, 7 and 10°C) on MF and shear force for M. *longissimus dorsi*, during storage at 4°C (3, 7 and 14 days), was investigated. Sensory properties were assessed 14 days post mortem. In experiment 2, the influence of different temperatures during conditioning (7, 14 and 21 days at 2 and 4°C and 3, 8 and 14 days at 6 and 8°C) on MF and tenderness of M. *longissimus dorsi* and *semimembranosus*, excised 24h post mortem, was studied.

There was a significant decrease in length of the myofibrils between day 2 and day 14 at all four temperatures in experiment 1. However, at three of the temperatures, no decrease in the shear force was registered. The only correlation between length and shear force was found at the pre-rigor temperature 4°C (0.77**). This means that no overall correlation (0.12) between length and shear force existed. Moreover, although there was no difference in length at day 14, tenderness increased with increasing temperature. In experiment 2, no reduction of myofibrilar length as a function of time or temperature was found. Tenderness, on the other hand, increased with time and temperature. These results suggest that the fragmentation of the myofibrils is not a determining factor for tenderness since no correlation was found between the length of myofibrils and shear force or tenderness in this investigation.

C ACID TREATMENT OF PRE-RIGOR BEEF AND DISTRIBUTION OF CATHEPSIN B+L ACTIVITY.

'DAL[1)] L. M. LARSEN[2)] and A. J. MØLLER[1)]
yal Veterinary and Agricultural University. [1)] Dept. of Dairy and Food Science, Howitzvej 11, DK-2000 Frederiksberg
nistry Dept. Thorvaldsensvej 40, DK-1870 Frederiksberg C. Denmark.

of lactic acid in pre-rigor meat can be used to create a rapid pH-fall. The combination of low pH and high temperature es conditions for release and action of lysosomal enzymes.

of this work was to study the influence of different concentrations of lactic acid on the stability of the lysosomal mem- was assumed that a decrease in membrane stability would result in a larger release of lysosomal enzymes.

nomandibularis was removed 45 min. post-mortem, from 3 young bulls slaughtered at approximately 450 kg live The meat were cut into small pieces and immersed in 0,015 M; 0,045 M and 0,060 M lactic acid solutions and incu- a water bath (≈18 °C). At 0 hour and 24 hours of incubation, samples were gently homogenized with a Colora cell- enizer (a method which showed to be effective in "preserving" the lysosoms during homogenization) and a microsomal was obtained by centrifugation. The relative distribution of cathepsin B+L activity between the soluble fraction and the rnal fraction was calculated as: relative-free activity = soluble activity in percent of (microsomale + soluble) activity.

ults showed that the relative-free activity was approximately: 76%; 73 %; 91% and 95% for lactic acid treatment of 0 M; M; 0,045 M and 0,060 M, respectively. There was no difference in the relative-free activity between 0 hour and 24 hours ation, but the total activity (microsomal and soluble activity) increased during incubation.
045 M lactic acid treatment resulted in a finial pH-value of 5,50, after 24 hours of incubation. The two other lactic acid nts (0,015 M and 0,060 M) produced either a smaller or larger pH-decrease, respectively.

e concluded that a lactic acid-treatment can induce a fast pH-fall in pre-rigor meat and that the relative-free activity of in B+L will increase with increasing concentration of lactic acid.

E TYPE AND MEAT TENDERNESS: POSSIBLE RELATIONSHIPS

LI [1], A. TALMANT [1], G. GEESINK [2], F. SMULDERS [2], & C. VALIN [1]
search Station, INRA de Theix, 63122 Saint Genès Champanelle, France
rtment of the science of food of animal origin, University of Utrecht, 3508 TD Utrecht, The Netherlands.

nderness greatly varies between muscles from the same animal and, for a given muscle, between animals. In the present work, we ed in detail the variability in the tenderising rate between 8 different bovine muscles of an heterogeneous set of 10 animals (experiment iability in the ultimate tenderness of Longissimus muscle from an homogeneous set of 12 animals (experiment 2) in relation with a muscle biochemical (contractile and metabolic types) and physicochemical (pH) parameters characterising muscle biochemistry. Meat e was assessed by using the biochemical index (BIMA) previously described. Ultimate meat tenderness was mechanically determined force measurement on cooked samples. In the first experiment muscle contractile and metabolic types were assessed by measuring enzyme activities [Lactate dehydrogenase (LDH), glyceraldehyde-3-phosphate dehydrogenase (GDH), myofibrillar ATPase (ATP)] iron content whereas muscle type was determined by histochemistry in the second experiment.

RIMENT 1: The most efficient predictor variables for ageing rate extracted by backward stepwise multiple regression analysis applied whole set of data were mLDH, Fe, GDH and ΔpH. Ageing rate predicted for each muscle by using the established equation were ly related to the experimental values ($r = 0.63$; $P < 0.001$). This correlation increased by comparing predicted and experimental mean ermined for each muscle classes ($r > 0.80$; $P < 0.001$).

RIMENT 2 : As above, the main variables extracted by backward stepwise multiple regression were % of type IIB fibres, the cross rea of both type I and IIC fibres and the ultimate pH value. Comparison of the shear force values calculated for each animal by using cally established equation to the experimantal values determined 14 days postmortem led to a significant linear relationship ($p <$ h a r value of 0.92.

o separate experiments clearly showed that apart from pH, the most efficient predictor variables for both ageing rate and ultimate are descriptors of the metabolic and contractile types of muscles but the underlying mechanisms are unknown. The present work rther that muscle biochemistry account for a large part of the animal variability in tenderising rate and ultimate tenderness of meat.

ISOLATION AND CHARACTERIZATION OF PROTEASOMES (PROSOMES) FROM RABBIT MUSCLES

Marie-Noëlle POUCH, Gérard BOISSONNET, Yves BRIAND and Hans-Peter SCHMID
Université Blaise Pascal, Clermont-Ferrand, 24 Avenue des Landais, F-63177 Aubière Cédex, France

Proteasomes (Prosomes) are involved in various intracellular metabolisms of degradation. They protease-, peptidase-, as well as RNase activity and block the in-vitro translation of various viral RNA

A combination of ultracentrifugation low- and high pressure chromatography was used to proteasomes from rabbit muscles. Muscle tissue is relatively poor in proteasomes, the amount of p particles was about 10% of the quantity we got from calf-liver. They eluted from Mono Q colums Pharmacia) in Tris-buffered solutions at 320mM KC1 while proteasomes from calf-liver eluted at KC1. Thus the ionic charge of both particles is quite different. Proteasomes of rabbit muscles consi specific set of proteins which band in Laemmli polyacrylamide gels in the range of 19 000 - 35 0 However in two dimensional gel systems its protein components migrated rather different th proteins of calf liver proteasomes. It exist a wide gap of about one pH unit between the acidic and components.

Furthermore we have shown that rabbit muscle proteasomes have protease activity and some proteins reacted strongly with polyclonal antibodies raised against calf-liver proteasomes. Thu antibodies are usefull for subcellular localisation of proteasomes in muscle cells or immuno chromatography.

This work was supported by the Hasselblad fondation and the Ministère de la Recherche et Tech (Programme essor des Biotechnologies)

Schmid, H.P., Akhayat, O., Martins de Sa, C., Puvion, F., Koehler, K. and Scherrer, K. (1984). EMB

EFFECTS OF APPLICATION OF PAPAIN ON THE MUSCLE PROTEIN OF LIVESTOCK AND POULTRY

QING-XIAN NAN, HONG-QOU LIANG, XIAN-RONG WU, FA-ZHENG REN, XING-MIN LI- Dept of Food Science, Beijing Agricultural University, Beijing 100094 - P.R. China

This paper reported the effect of application of pure papain and meat tender agents, one of papaya proteinase products, on the various parts of livestock and poulery at different dasages. results demonstrated the muscle fibrin and collagen fibrin had been undertaken a strongly hydrol through the degradeting effect of papain. It was determinated that the content of coarse protei the enzymolytic solution was 2.15--3.15 fold higher that those in the hydrolytic solut especially the level of proline degradation was high.

The grains of muscle fibre became unclear and some of them broke into small pieces after treatment of papain. The result suggested that best dosage for tendering the flaky meat and bl meat should be at the concentrations of 0.05%--0.1% and 0.2%--0.5% of meat tenderizer.

CATHEPSIN B GENE STRUCTURE AND EXPRESSION

H. RHAISSI, S. MORDIER, A. OBLED, D. BECHET and M. FERRARA

UR Expression des Protéases Lysosomales, Station de Recherches sur la Viande, INRA Theix, 63122 CEYRAT, France

The lysosomal cysteine proteinase cathepsin B plays an important role in intracellular proteolysis. *Post mortem,* the cathepsin B could be a potent contributor to meat tenderization. Recently, it has been reported that this enzyme is also involved in tumor metastasis.

In vivo , cathepsin B activity has to be highly regulated and this might be controlled through at least two ways:

1- at the level of gene expression (transcriptional induction).

2- at the level of the enzymatic activity by tissue-specific inhibitors.

In order to better understand the regulation of expression of cathepsin B, the mouse cathepsin B gene and its putative promoter were cloned and characterized. The gene spans about 12 Kbp and contains 9 exons encoding the 339 residues of mouse preprocathepsin B.

The 5' flanking region of the gene was identified and sequenced: It shows promoter activity, variable upon cell types tested by transfection. The precise location of transcription initiation site(s) is now investigated by primer extension: the results indicate the presence of two putative leader sequences. Primer extension products cloning and sequencing are in progress.

ULTRASONICATION OF LAMB SKELETAL MUSCLE FIBRES ENHANCES POSTMORTEM PROTEOLYSIS.

P. RONCALES, P. CEÑA, J.A. BELTRAN and I. JAIME.

Dep. de Producción Animal y Ciencia de los Alimentos. Facultad de Veterinaria. Universidad de Zaragoza. 50013 ZARAGOZA. SPAIN.

The ability of ultrasound treatments to disrupt membranes and to release enzymes from cellular compartments is well known. The aim of our work was to investigate if such a treatment would be able to activate endogenous proteolysis in muscle fibres. We first demonstrated that ultrasonication was indeed effective in releasing lysosomal enzymes from liver cells, as shown by the presence of acid phosphatase activity in cytoplasm extracts. Cell membranes were damaged only to a limited extent, as revealed by turbidity measurement of buffer medium.

Proteolysis brought about by endogenous proteinases, after one day of fibre storage at 4°C, was assessed by means of SDS-PAGE in controls as well as in fibres treated with ultrasounds varying in intensity and time of exposition. The incipient appearance of a number of faint bands in the 30000 Da region was the only evident change of control gels. Results revealed that ultrasonic treatment of fibres strongly enhanced proteolytic degradation, depending on time and output of sonication, as shown by the increased intensity of 30000 Da region bands. A distinct change featuring sonicated fibres was the degradation of a 87000 Da protein and the appearance of a 83000 Da peptide. It is discussed wether calpains or cathepsins are to be responsible for observed changes.

Cell damage appeared to be not very extensive, although it was dependent upon ultrasonication conditions. As a consequence, ultrasonication of muscle fibres may be regarded as a novel method for increasing postmortem proteolysis, and thus meat tenderisation, despite technical problems derived from ultrasound application must be previously solved.

PURIFICATION OF HIGH-MOLECULAR-WEIGHT PROTEINASE INHIBITORS FROM BOVINE SKELE MUSCLE.

P. ROUCHON, M. ZABARI, M. BERRI, T. SAYD, J. SIBOULET AND A. OUALI

Meat Research Station, INRA Theix, 63122 CEYRAT, France

High-molecular-weight proteinase inhibitors were purified from bovine *Diaphragma* muscle using selective extraction prior to conven gel filtration and ion exchange chromatography techniques. These inhibitors were descriminated on the basis of their efficiency to inac trypsin, papain or both.

Sephadex G100 column chromatography resulted in four peaks of papain inhibiting activity. Only the first fraction eluted just after the volume and containing inhibitors of highest molecular weight (>30 kDa) was investigated.

This fraction was first loaded on a S-Sepharose column (16 x 2.5 cm) equilibrated in acetate sodium buffer pH 5.4. Non adsorbed ma (S_0) and a peak (S_1) eluted from the column at about 0.08 M NaCl inhibited papain and trypsin. Another peak (S_2) eluted at about 0. NaCl inhibited trypsin but not papain. Each active fraction was further purified by anion exchange chromatography on Q-Sepharose co (16 x 2.5 cm) equilibrated in Tris-HCl buffer pH 8.

- Non adsorbed material from S-Sepharose (S_0) was separated in two fractions eluted between 0.2 and 0.3 M NaCl. The first one (S_0Q_1 active against papain and trypsin while the second (S_0Q_2) inhibited only papain. SDS page showed one band with Mr of approximately 6 for this second peak. Characterisation of the S_0Q_1 fraction is under progress.
- The first fraction eluted from S-Sepharose (S_1) contained only one peak (S_1Q_1) inhibiting both papain and trypsin. SDS page showe bands of Mr 40 and 65 kDa further separated by gel filtration on Sephadex G75. Both inhibitory activities were associated with the 6 proteins but whether these activities are brougth by only one protein is not yet known.
- The trypsin inhibiting fraction from S-Sepharose (S_2) contained one active peak (S_2Q_1) corresponding after gel filtration on Sephadex G an inhibitor of about 65 kDa as assessed by both SDS page and gel filtration.

EFFECT OF DIVALENT CATIONS ON HEAT-INDUCED GELATION OF MYOSN

K. SAMEJIMA, T. KASHIWAKURA and M. ISHIOROSHI

Department of Food Science, Rakuno Gakuen University, Ebetsu, Japan 069

Gelation of protein is an important pthenomenon which takes place in all structured meat products during thermal processin involves both intramolecular and intermolecular changes in proteins. We pointed out that only myosin in the myofibrillar pr had the ability to influence the heat-induced gelation of model system. However, the heat-indeuced gelation of myosin affected by many factors such as temperature, pH, ionic strength, protein concentration, storage period and myosin isoforms b the molecullar structure of this protein is highly complication. In this work, we report the effect of calcium and magnesium on the rheological properties of thermal gels of myosin since no detailed information is available on the influence of di cations on heat-induced gelation of myosin.

Myosin was isolated from rabbit back and leg muscles. The effects of Ca^{2+} and Mg^{2+} on the changes in properties of th gel of myosin were judged from the measurements of turbidity, rigidity, fluorescence intensity, differential scanning calori (DSC) and scanning electron microscopic observation.

Turbidity of myosin upon heating was maximum at about 5~10mM of Ca^{2+} or Mg^{2+} at 0.5 M KCl. The changes of th rigidity on Ca^{2+} or Mg^{2+} for myosin thermal gel was similar to those of the turbidity. The results obtained from fluores spectra was consistent with those of the turbidity measurements. The dramatic decrease in apparent enthalpy of heat denaturat myosin was observed by the addition of Ca^{2+} or Mg^{2+} from the measurement of DSC. The net work structures of heat-se of myosin with or without Ca^{2+} or Mg^{2+} corresponded to the results of their rigidity.

From these results, we concluded the enhancement on the rigidity of myosin thermal gel was due to the conformational ch in myosin moleclule induced by the addition of calcium or magnesium.

RELATIONSHIPS BETWEEN ULTIMATE pH AND TENDERNESS OF BEEF

W.R. SHORTHOSE[1], P.V. HARRIS[1] and I. LOXTON[2]

[1]CSIRO Division of Food Processing, Meat Research Laboratory, PO Box 12, Cannon Hill, Qld 4170, Australia
[2]Queensland Department of Primary Industries, Box 6014, Rockhampton Mail Centre, Qld 4702, Australia

A total of 620 steers were grown on four planes of nutrition and slaughtered at the same abattoir. The carcass weights at slaughter were 180, 260 or 320 kg and age at slaughter varied from 500 to 1250 days. All carcasses were electrically stimulated. Samples of *M. longissimus dorsi* (LD) were taken, at 24 hours postmortem, and frozen. The ultimate pH value of each sample was determined directly (at 22°C) after thawing. Samples of 250 grams were cooked, at 80°C for an hour. Warner-Bratzler initial yield (IY) and peak force (PF) measurements, and Instron Compression (IC) measurements were determined.

Over all 620 samples, ultimate pH and (ultimate pH)^2, together, explained no more than 10% of the variation in IY, PF or IC measurements. However, within age groups (determined by number of erupted incisors) they explained up to 42% of the variation in IY and PF values, but only a small proportion of that in IC values. It was concluded that ultimate pH influences tenderness by effects on the myofibrillar component of tenderness.

THE STUDY OF THE DYNAMICS OF BROILER MEAT AGEING

L.A.SOKOLOVA, B.V.KULISHEV, I.I.TOCHILOVA
Scientific and production unity of poultry processing industry "Complex" RUSSIA
S.I.KHVYLYA, V.V.AVILOV, T.V.KUZNETSOVA
The All-Russian Meat Research Institute, MOSCOW, RUSSIA

Modern industrial technology of poultry processing and the use of poultry meat for semi-prepared and ready foods imply the use of mainly chilled poultry meat, though there is certain interest in including hot poultry meat into technological cycle, however, data on this subject are contradictory.

The aim of the present work was to study broiler meat at early stages of ageing for development of the technology of its hot boning.

As object of research served M.pectoralis major and M.quadriceps femoris taken 15,30 min. and 1,2,4, 24 hrs post mortem. We used methods of microstructural analysis, pH, structural, mechanical and rheological properties of raw materials as well as cooking losses were also determined.

It was established that hot-boned meat has lower cooking losses, but tougher consistency and lower viscosity as compared to meat, aged during 24 hrs. The obtained data evidence about inexpediency of use of hot meat (15 min p.m.), namely of pectoral cuts for manufacturing of frozen semi-prepared foods.

PRESSURE EFFECTS ON THE TEXTURE, ULTRASTRUCTURE AND MYOFIBRILLAR PROTEIN OF BEEF SKELETAL MUSCLE

A. SUZUKI, Y. IKEUCHI and M. SAITO*

Department of Applied Biochemistry, Faculty of Agriculture and *Electron Microscopic Laboratory, Universit of Niigata, Niigata 950-21, Japan

High hydrostatic pressures of 100 MPa to 300 MPa were applied to beef post-rigor muscle to investigate the efficiency of pressurization as a meat tenderizer.

The hardness measured by Rheometer decreased and the fragmentation of myofibrils increased with increasi pressure applied to the muscle. The degree of fragmentation reached to its maximal level after briefly ex- posing (5min) post-rigor muscle to the highest pressure (300 MPa). Electron microscopic studies of the pre- surized muscle revealed that marked rupture of I-band and loss of M-line materials had progressed in the m fibrils with increasing applied pressure. However, degradation of the Z-line in myofibrils that can be obs naturally in conditioned muscle was not apparent in the pressurized muscle. There was no significant diffe in the electrophoretic pattern of myofibrillar protein among the control and pressurized muscles in spite the marked change of ultrastructure.

From the results, it is suggested that the application of a high hydrostatic pressure to post-rigor mus causes tenderization of the meat in a different manner from that of conditioning.

POSTMORTEM CHANGES IN SKELTAL MUSCLE CONNECTIN

R. TANABE, H. NAKAI and *K. TAKAHASHI

National Institute of Animal Industry, Tsukuba Norindanchi, Ibaraki 305, Japan

*Department of Animal Science, Faculty of Agriculture, Hokkaido University, Sapporo, Hokkaido 060, Japan

Connectin (also called titin) is a long, filamentous protein of striated muscle, and was found by Maruyama et a (Nature, 262,58-60,1976). Connectin links the thick filament to the Z line. This protein is also responsible for positioning the thick filament at the center of a sarcomere. There are two types of connectin, α-connectin and β-connectin, and their molecular masses are estimated as 2,800 kDa and 2,100 kDa, respectively. In this paper, w report the postmortem changes in connectin of chicken muscles.

Chicken leg muscles were stored at 5℃. At the appropriate postmortem time, myofibrils were prepared from the muscles. Then myofibrillar proteins were separated by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) to detect the changes in connectin. Furthermore, myofibrils prepared from freshly excised muscles were suspended in a Ca^{2+} solution containing 0.1 mM $CaCl_2$, 30 μg of leupeptin/ml. This suspension was stirred gently Then these Ca^{2+}-treated myofibrils were also applied to SDS-PAGE. In both stored muscles and Ca^{2+}-treated myofibr the 1,200 kDa peptide appeared. Polyclonal antibodies against this 1,200 kDa peptide were obtained in a rabbit. immunoblot analysis, the origin of the 1,200 kDa peptide was investigated.

The amount of α-connectin decreased with storage time in chicken leg muscles. The other hand, the amount of β-connectin increased, and the 1,200 kDa peptide appeared during storage. The densitometric analytic data showed the 1,200 kDa peptide was stoichiometrically produced from α-connectin. The same changes also occurred in Ca^{2+}-t myofibrils. Using immunoblot analysis, it was shown that the origin of the 1,200 kDa peptide was α-connectin.

We concluded that α-connectin was divided stoichiometrically into β-connectin and a 1,200 kDa peptide in post chicken leg muscle, and this division was induced by 0.1 mM Ca^{2+}.

EFFECT OF LOW VOLTAGE AND HIGH VOLTAGE ELECTRICAL STIMULATION ON PORK QUALITY

TAYLOR and L. MARTOCCIA

rtment of Meat Animal Science, University of Bristol, Langford, Bristol. BS18 7DY, United Kingdom.

sses from 36 Large White gilts, 70-80 kg live weight, were randomly allocated to three experimental groups. Pigs from Group A were ically stimulated during bleeding (85v, 14Hz for 64 sec) before splitting.The left sides were rapidly chilled in air at -15°C for 75 min and t 1°C for 23h; the right sides were chilled conventionally in air at 1°C for 24h. Carcasses from Group B were unstimulated, and after ng, sides were chilled either rapidly or conventionally. In Group C, two different stimulation treatments were used at 20 min post- ter; the left sides were low voltage stimulated (85v, 14Hz for 64 sec), while the right sides were stimulated with high voltage (700v, Hz for 90 sec). Both sides were then rapidly chilled.

ty parameters such as drip loss, colour and texture were measured in *M. longissimus thoracis et lumborum* at 3 and 10 days laughter.

igh voltage ES treatment gave the most tender meat at 3 days post-slaughter, by all the measured texture parameters ($P < 0.01$) and did oduce meat which was pale in colour or lost more drip than non-stimulated controls. Low voltage ES during bleeding gave meat which 8% more tender than the non-stimulated controls, but the improvement in tenderness was not as great as the 28% achieved with high e ES. Unexpectedly, low voltage ES, applied 20 min after slaughter, was almost as effective in improving tenderness (by 17%) as low e ES applied during bleeding.

rness improved from 3 days to 10 days in all stimulated samples, but not in the non-stimulated controls, suggesting a degree of cold- ening in the latter, even with conventional chilling.

EFFECT OF CHILLING, ELECTRICAL STIMULATION AND CONDITIONING ON PORK EATING QUALITY

TAYLOR, G.R. NUTE AND C.C. WARKUP.*

rtment of Meat Animal Science, University of Bristol, Langford, Bristol BS18 7DY, United Kingdom

at and Livestock Commission, P O Box 44, Winterhill House, Snowdon Drive, Milton Keynes, MK6 1AX, United Kingdom.

ffect of three different post-slaughter treatments and subsequent conditioning times on the eating quality of pork was studied,using a total boars and 36 gilts (80-90 kg live wt.). The treatments were,

A- holding in air at >10°C for 3 hrs, followed by chilling in air at 1°C

B - chilling in air at 1°C

C - high voltage electrical stimulation (ES) at 20 min post-slaughter, followed by treatment B.

ty attributes were measured in *M.longissimus thoracis et lumborum* (LTL) and in *M. semimembranosus* (Sm). Carcass characteristics of eight, backfat thickness and marbling fat were also recorded.

was little difference in cooling rate between the three treatments; major effect on quality came from the use of ES in treatment C. ES ed pH at 45 min. by approx 0.3 units, and achieved pH values at 3h post-slaughter of 5.64 (LTL) and 5.87 (Sm). Under these conditions, d not produce PSE meat. Drip losses were generally low, but were slightly higher with treatment C. By all three instrumental texture eters, LTL from treatment C was significantly more tender than from A and B at 4, 7 and 12 days post-slaughter, suggesting that either old-toughening with A and B was overcome by ES in treatment C or that ES had some other action. Conditioning at 1°C gave consistent ement in tenderness of LTL from 4 days to 7 days and further to 12 days. Taste panelling of loin chops and Sm roast confirmed that nt C gave significantly more tender meat than A and B, and that ageing from 4 to 7 and further to 12 days gave significant improvements derness. Treatment C, with ES, produced loin muscle which was more tender at 4 days than at 12 days with other treatments.

IMPROVING PORK QUALITY BY ELECTRICAL STIMULATION OR HIP SUSPENSION OF CARCASSES

A.A. TAYLOR, Miss A M PERRY AND C.C. WARKUP.*

Department of Meat Animal Science, University of Bristol, Langford, Bristol. BS18 7DY, United Kingdom.

** Meat and Livestock Commission, P O Box 44, Winterhill House, Snowdon Drive, Milton Keynes, MK6 1AX, United Kingdom.*

This investigation compares the separate and combined effects of electrical stimulation (ES) and hip suspension of pig carcasses chill rapidly or conventionally on the important meat quality attributes. Sides from 80 pigs, 80-90 kg live weight, were allocated to one o treatments followed by either conventional chilling (1°C for 24h) or rapid chilling (-20°C for 2-3h, before 1°C until 24h post-slaughte 4 treatments were

(a) & (b) Achilles suspended, with and without high voltage ES

and (c) & (d) Hip suspended, with and without ES.

Quality attributes measured in *M. longissimus thoracis et lumborum*, at 10 days post-slaughter included pH, colour and opacity, dri instrumental and sensory texture. Rapid chilling reduced evaporative weight loss by 0.5%.

There were no significant effects of treatment on colour or opacity, although ES samples were slightly paler. Drip loss was slightly g with ES, particularly when combined with hip suspension, but in no case was PSE meat observed. All three instrumental measurem texture showed improved tenderness with either ES or hip suspension, even after 10 days ageing. The improvement was less pronou when ES and hip suspension were combined. Taste panelling confirmed that samples treated by ES or hip suspension, separately or combined, were significantly more tender than samples from non-ES, Achilles hung sides, although juiciness tended to be lower in stimulated samples.

ES and hip suspension were equally effective in improving tenderness of pork. Hip suspension did not suffer the disadvantage of in drip loss that occurred with ES.

EFFECTS OF IN SITU INJECTION OF EXOGENOUS PROTEASE EFFECTORS IN BEEF MEAT

UYTTERHAEGEN L., CLAEYS E. and DEMEYER D.
Research Centre for Nutrition, Animal Production and Meat Technology, University of
Proefhoevestraat 10, 9090 MELLE, Belgium

Post-mortem storage of bovine carcasses improves meat tenderness. Although the indications that proteases such as the cytosolic calpains, the lysozomal cathepsins B even other enzyme systems play a major role, the precise mechanism responsib tenderizing has not yet been identified. In this paper we have investigated the eff exogenous inhibitory and activating substances added to meat, on texture and proteolys At 24h pm LD steaks adjacent to the 6th, 7th and 8th thoracic rib of three one ye Belgian white-red bulls (East Flanders) were removed and cylindrical cork bore (d=1.27 cm) were taken parallel to the fiber direction. The effect of injection (± 10 into the cylindrical cork bore samples of 400 µM leupeptin, 2mM calpain inhibitor I, EDTA, 300 mM Ca^{2+} and 1% Triton X-100 at 24h pm, on Warner-Bratzler shear force, myofibrillar fragmentation and selective myofibrillar solubility in 0.3 M NaCl at pH=1 pH=7 was investigated by means of SDS-Page after 7 additional days of ageing.
Injection of leupeptin and calpain inhibitor I, both inhibitors of cysteine proteinas as the calpains and cathepsins B & L, resulted in a very significant increase of force. This was also reflected in significantly higher amounts of titin and troponin reduction of the 30 KDa peptide. Less proteolysis also resulted in a sharp decrease solubility in 0.3 M NaCl at pH 7 and 5.5 of several myofibrillar proteins such as actin, myosin and α-actinin. Although changes were less spectacular, injection of E Ca^{2+} respectively resulted in significantly higher and lower shear forces with corres changes in proteolysis and solubility. Injecting Triton X-100 decreased shear for resulted in significant higher 30 KDa and lower troponin-t levels, possibly due release of bound enzymes by this detergent. These results provide evidence for a relationship between shear force and cysteine proteinase activity, indicating that c play a key role in development of beef tenderness.

IGNIFICANCE OF CONSISTENCY OF PORCINE SEMIMEMBRANOSUS MUSCLE IN PROCESSING PROPERTIES

. VADA-KOVÁCS

ngarian Meat Research Institute, Gubacsi út 6/b, H-1097 Budapest, Hungary

(Abstract)

rcentage of severe stiffness measured by rigorometer at 40 mins and 24 hrs post mortem in 3 porcine semimembranosus (SM) muscles varied in different meat quality groups. At 40 mins st mortem 1.7, 28.3, 41.17 and 33.33 %, while at 24 hrs post mortem 12.7, 39.62, 29.40 and 66 % rigid muscle was found in normal, slight DFD, extreme DFD and PSE group, respectively. rther 34 SM muscles were selected on the basis of pH_1 and rigorometer measurements for amination: pH, rigidity, cooking and processing properties (cured meat) as well as sarcomere ngth were determined 24 hrs post mortem in order to compare normal and slight DFD muscle oups including both rigid and non-rigid subgroups. Rigid muscles - mainly the uncured ight DFD - proved to be less tender. Furthermore, irregular shape and insufficient binding the cured ham model prepared from rigid muscles were observed. Sarcomere length of rigid scle samples was reduced. The results suggested, that severe rigor observed in the aughterline and rigidity of post rigor porcine SM muscle could be related to rigor shortening ich was expressed more frequently in muscles of higher ultimate pH. As regards the eating ality (tenderness) and also the selection of raw material for cured product, porcine muscles higher pH should be critically viewed.

FFECT OF VARIATION OF ANTE-RIGOR TEMPERATURE ON MEAT AGEING.

VERNAZ P., LEPETIT J.

ation de Recherches sur la Viande, INRA, Theix, 63122 SAINT GENES CHAMPANELLE, France.

ovine Longissimus Dorsi and Semimenbranosus muscles from 5 old cows were removed 1 h 30 min after slaughter d divided into 7 parts. Two of the parts were maintained at 15° C (sample T15) and 30° C (sample T30) during 24 Each of the five other parts were stored at 15° C exept for a period of 3 hours where they were maintained at 30° The time at which they were transfered at 30° C was changed between about 0.1*Tr and 1*Tr where Tr is the ration of rigor onset determined by low deformation measurements. This time had no effect on ageing state easured at one days (D1) and nine days (D9) post-mortem. The ageing amplitude is the difference between the sistance of myofibrillar structure measured at D1 and the resistance measured at D9. Keeping a sample during 3 h 30° C in the ante rigor period decreased the resistance of myofibrillar structure compared to the T15 at D1. This crease represent approx. 30 % of the ageing amplitude of the T15 for LD muscles and only 10-20 % for SM uscle at D1 . At D9 no difference remained between these treatments and the T15 . The effect of 24 h at 30° C 30) was dependent on the muscle. At D1 , T30 samples were more aged than T15 ones but the ageing amplitude Longissimus Dorsi T30 samples were reduced.

THE EFFECTS OF COLLAGEN CHARACTERISTICS ON SENSORY ASSESSMENT AND SHEAR VALUES OF COOKED SHEEP *SEMIMEMBRANOSUS* MUSCLES

O.A. Young, T.J. Braggins and G.J. Barker
Meat Industry Research Institute of New Zealand (Inc.), P.O. Box 617, Hamilton, New Zealand

The concentration and heat-dependent solubility of collagen were measured in *semimembranosus* muscles of 36 sheep age to five years. Collagen concentration was unaffected by age, but solubility by the Hill test (*J. Food Sci.* 31, 161) decl from 17 to 4 % over the five years. Collagen extracted from a subsample of muscles was analysed for pyridino concentration. Concentration increased from about 0.30 to 0.55 mole per mole of collagen. For the ages examined, this r was higher than reported elsewhere for other species or muscles. The high pyridinoline content might be responsible fo high thermal transition temperatures of collagen previously noted in this ovine muscle.

In an experiment to assess the relative importance of collagen concentration and collagen solubility on tenderness and tex the muscles were cooked in boiling water to an endpoint of 75°C before sensory panel assessment and Warner-Bratzler s tests. The panel data showed collagen concentration was the more important determinant of eating quality, while the s data were better correlated with solubility. In view of the relative insolubility of collagen in this muscle, compared with *gluteus* muscle (unpublished data), we propose that *semimembranosus* collagen is so insoluble throughout an animal's lif solubility hardly matters in sensory perception after the muscle is quickly cooked. For ovine *semimembranosus*, the coll concentration is more important.

PURIFICATION AND CHARACTERISATION OF LOW Mr PROTEINASE INHIBITORS FROM BO SKELETAL MUSCLE

M. ZABARI, M. BERRI, P. ROUCHON, T. SAYD, J. SIBOULET & A. OUALI
Meat Research Station, INRA de Theix, 63122 Ceyrat, France.

As most tissues and cells so far investigated skeletal muscle contains proteinase inhibitors inactivating serine and cysteine proteinas exact nature and their physiological function remain however unknown. The present study is part of a more general work dealing purification and characterisation of proteinase inhibtors from bovine skeletal muscle.

Gel chromatography on a Sephadex G 100 column (5x100 cm) of a crude extract obtained from bovine *Diaphragma* muscle separ fractions active again either papain, trypsin or both and with Mr in the range of 40-70 kDa (FI and FII), 20-40 kDa (FIII) and 10- (FIV). In this paper, the purification procedure and the properties of the FIV inhibitory fraction were decribed. Although to various the Sephadex G100 FIV fraction inhibited efficiently papain, trypsin, chymotrypsin but not pepsin or cathepsin D.

This fraction was then loaded on a chromatofocusing PBE column (1x10cm) equilibrated at pH 7.0 and proteins eluted with a 7.0 gradient obtained with a polybuffer 74 solution adjusted at pH 4. This step separated five activity peaks called P1, P2, P3, P4 and P order of their elution from the column.

P1 and P2 eluted at pH 6.6 and 6.4 respectively were active against serine proteinases, i.e. trypsin and chymotrypsin, but showed no when incubated with either papain or aspartyl proteinases (pepein and cathepsin D). By SDS-PAGE analysis of these fractions, P were shown to contain only one band with a Mr of 15 kDa and 12 kDa respectively. P3, P4 and P5 fractions eluted at pH 5.8, 5.2 respectively, inhibited papain but neither serine (trypsin and chymotrypsin) nor aspartyl (pepsin and cathepsin D) proteinases. SDS analysis of these fractions revealed that each of them contain only one band with a Mr of about 14 kDa. Cathepsins B and L, re cysteine proteinases, were also strongly inhibited by the last P3, P4 and P5 fractions.

The five different purified low Mr skeletal muscle protein inhibitors exhibited a high heat and pH stability in the range of 40-100°C a 3-10.

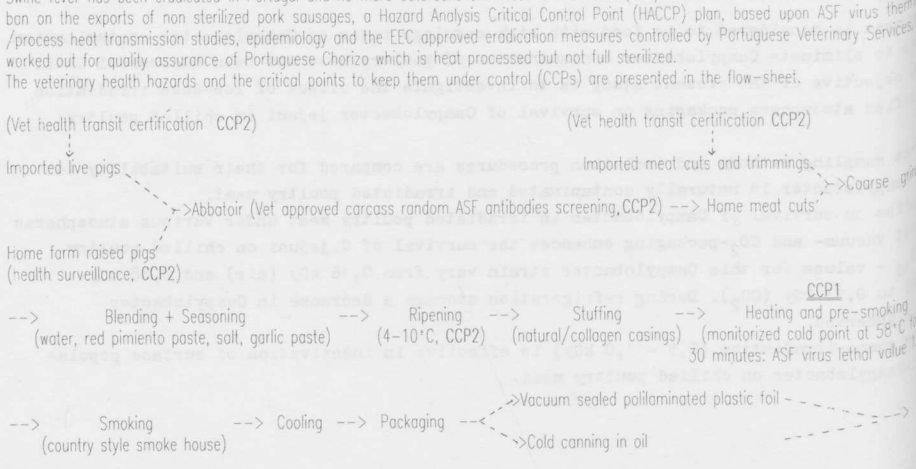
Session 6

MICROBIOLOGY AND HYGIENE

A SPECIFIC HAZARD ANALYSIS CRITICAL CONTROL POINT PLAN FOR THE QUALITY ASSURANCE OF PORTUGUESE PORK CHORIZO TO WARRANT A SWINE FEVER VIRUS-FREE CONDITION

A.S. BARRETO, MARÍLIA F. FERREIRA, JAQUELINA S. OUAKININ, A.M.R. RIBEIRO
Universidade Técnica de Lisboa. Faculdade de Medicina Veterinária. Rua Gomes Freire, 1199 Lisboa Codex. Portugal.

Swine fever has been eradicated in Portugal and no more outbreaks of African Swine Fever (ASF) have been declared North of Tagus. The ban on the exports of non sterilized pork sausages, a Hazard Analysis Critical Control Point (HACCP) plan, based upon ASF virus thermal /process heat transmission studies, epidemiology and the EEC approved eradication measures controlled by Portuguese Veterinary Services, was worked out for quality assurance of Portuguese Chorizo which is heat processed but not full sterilized.
The veterinary health hazards and the critical points to keep them under control (CCPs) are presented in the flow-sheet.



This plan, fullfilling the seven HACCP principles, will be submitted for approval and certification by the veterinary health authorities.

AN ASSAY FOR SCORING OF PLASMID ENCODED BACTERIOCIN EFFECT IN FERMENTED FOOD

S.E. BIRKELAND*, T. AUKRUST and H. BLOM
MATFORSK, Norwegian Food Research Institute, Oslovn. 1, 1430 Ås, Norway
* NORWEGIAN DAIRIES ASSOCIATION, Breigata 10, 0186 Oslo, Norway

The effect of the bacteriocins sakacin A and lactocin S, both from *Lactobacillus sake* produced *in situ*, have been assayed in m vegetable and dairy fermentation products. Sakacin A, produced by *L. sake* Lb 706 acts inhibitory against *Listeria monocytoge* in fermented meat (1). Production and secretion of sakacin A is plasmid encoded. Lactocin S, produced by *L. sake* Lb 45 inhib closely related bacterial species and is, like sakacin A, plasmid encoded, (2).
An assay, based on transformation of plasmid cured, sensitive strains (Bac^-, Imm^-) with pVS 2 to construct Cam^R strains have developed. Provided that the growth characteristics of the uncured (Bac^+, Imm^+, Cam^S) and the cured (Bac^-, Imm^-,Cam^R) strain the same, a mixture of the two strains can be used to demonstrate "the true bacteriocin effect" in fermented food experiments, environmental influence can be neglected. Transformation with pVS2 was achieved by electroporation in 30 % polyethylenglyc (setting: 1.5 kV, 400 Ω, 25 μF and 2 mm cuvettes) at a transformation efficiency of approximately 10^4 transformants per μg D Dry fermented sausage, fermented carrots and cheese (St. Paulin) were made with a mixture of the producer and the bacteriocin sensitive, antibiotic resistant strains. Growth was followed for both strains through the fermentation period by means of Cam^R bacteriocin producing c.f.u. Preliminary experiments disclosed that addition of amino acids, Mn and glucose was needed for b strains to grow well in milk and brine for vegetable fermentation. With these additions, production of bacteriocin could be det cheese, however, no bacteriocin effect could be demonstrated, although the number of bacteria reached a level sufficient for b production to be detected. During fermentation of carrots, both strains produced active bacteriocin. In dry sausage, lactocin S production could be demonstrated, while the effect of sakacin A production from *L. sake* Lb 706 was more uncertain when sc this assay.

1 Shillinger, U. & Lücke, F.K. (1987) Food Microbiol 4 199-208

2 Mortvedt, C.I. & Nes, I.F. (1990) J. Gen. Microbiol 136 1601-1607

EFFECT OF STARTER CULTURES ON THE DEGRADATION OF ORGANOCHLORINE PESTICIDES

K.BOSCHKOVA, G.MARUDOV
Higher Institute of Food and Flavour Industries, Plovdiv, Bulgaria

This study was conducted to determine the effect of starter cultures of Lactobacillus plantarum strain K_6 and Micrococcus varians strain L_6 as single strains and in combination on the degradation of some organochlorine pesticides.

Starter cultures of L.plantarum strain K_6 and M.varians strain L_6, isolated from bulgarian fermented sausages, were used as a suspention with an inutial count of 10^6 - 10^7 cells/ml. The organochlorine pesticides lindan and garlon were added in different concentrations (from 0,1 mg/ml to 5 mg/ml) in liquid medium. The degradation ability of the starter cultures was evaluated by gaschromatographic of the pesticide resudes in the medium after 24, 48 and 120 hours incubation at 30°C.

Obtained results show that the starter cultures of L.plantarum strain K_6 and M.varians strain L_6 degrade the examined pesticides in the used concentrations. M.varians strain L_6 degrades to the highest extent the pesticides. The intensity of degradation depens on the concentration of the pesticides.

TROL OF LISTERIA MONOCYTOGENES IN MEAT PRODUCTS BY A STRAIN OF L. PLANTARUM.

AMPANINI, I. PEDRAZZONI, S. BARBUTI and P. BALDINI
erimental Station for the Food Preservation Industry - Via Tanara 31/A - Parma - Italy

ies done in recent years have shown that L. monocytogenes occurs frequently in meats including cured and fermented acts. A potential means of preserving fermented meats from this pathogen is trough the use of bacteriocin-producing -acid bacteria as starter cultures. Inhibition of L. monocytogenes by Pediococcus and L. sake strains was observed nly in culture medium, but also in meat and meat products. Strains of Lactobacillus spp. isolated from italian dry ni were found to have antilisteria activity in culture medium. The objective of this study was to assess the bacterial ity of a L. plantarum strain against L. monocytogenes in culture medium, minced meat and ripening salami.

HODS: Growth of L. monocytogenes was monitored by an impedometric method in APT broth at pH 6.0 and 5.5 as as in filtered (0.2 micron) pH-adjusted supernatants from 24 h cultures of L. plantarum MCS and of mutant strain 1. Minced raw pork with added curing agents and salami batter were inoculated with L. monocytogenes strains (10^3 cells/g) alone or in combination with Lactobacillus MCS and MCS1 strains (10^6 - 10^7 cells/g). Listerias in minced stored at 18°C and in salami during ripening were enumerated on Palcam agar.

ULTS: In MCS and MCS1 culture supernatants adjusted to pH 6.0 L. monocytogenes growth was differently ited, with delays in detection time of 32-50 h and 5 h respectively. At pH 5.5 no growth was observed in 96 h in MCS rnatant while in MCS1 supernatant Listeria did grow. In minced meat inoculated with MCS strain L. monocytogenes ts declined by a logarithmic cycle in 15 days at 18°C, while in samples inoculated only with Listeria growth was ved. During ripening, in salami inoculated only with Listeria the pH value remained almost constant at 5.7-5.8 and growth was observed after 7 days. However in the presence of L. plantarum MCS and MCS1 strains, pH decreased to after 7 days and the viable number of L. monocytogenes remained more or less constant. After 14 days Listeria counts ed to decrease in all samples: at 28 days small differences were observed in the survival of listerias in the samples lated or not inoculated with lactobacilli.

CLUSION: Lactobacillus strains suppress multiplication of L. monocytogenes in cured meat and salami; however, ivation is less effective in meat products than in culture systems.

ICROBIAL ACTIVITY OF LACTIC ACID BACTERIA FROM MEAT ORIGIN AGAINST SELECTED INDICATOR MICROORGANISMS

S, L., W. MUREIRA, J. RODRIGUEZ, O. SOBRINO, M. FERNANDEZ, B. SANZ and P. HERNANDEZ

tamento de Nutrición y Bromatología III, Facultad de Veterinaria, Universidad Complutense,

-MADRID, SPAIN

lactic acid bacteria have the potential to inhibit the growth of pathogenic and spoilage bacteria and the bility exists of using them to improve the higienic quality and to extend the shelf-life of different meat eat products. Bacteriocins produced by lactic acid bacteria are also interesting to the food industry for ossible uses as food preservatives, once they have been adequately characterized.We report in this commu- on the antimicrobial activity of lactic acid bacteria isolated from Spanish dry fermented sausages against ted indicator microorganisms.

timicrobial (bacteriocin) activity of the isolates was evaluated not only against related microorganisms the genera Lactobacillus, Pediococcus, Leuconostoc, Lactococcus and Streptococcus, but also against spoi- nd/or pathogenic representatives of the genera Bacillus, Clostridium, Listeria, Propionibacterium and ococcus. None of the isolates was active against any of the Gram-negative bacteria tested, which inclu- mong others, S. typhimurium and Y. enterocolitica.

sults confirm the existence in dry fermented sausages of lactic acid bacteria with antagonistic (bacterio- ctivity against selected pathogenic and spoilage bacteria. Further work will be done towards the partial ical, inmunological and genetic characterization of the bacteriocin(s) of some of the isolates showing oadest antagonistic spectrum.

ON OF SPOILAGE BACTERIA DURING BEEF PROCESSING USING CONDUCTANCE TECHNIQUE, PLATE COUNT AND PROLIFERATION INDEX

AVSSON and E. BORCH

Meat Research Institute, P.O. Box 504, S-24424 KÄVLINGE, Sweden

hal plate counting for determining the numbers of spoilage bacteria on beef carcasses and meat during processing does not perform satisfactorily with regard needed for analysis or to the detection of very low numbers of bacteria. The application of the conductance technique may facilitate improvement of the ction of spoilage bacteria.

of contamination of beef carcasses with different types of spoilage bacteria during slaughter, chilling, cutting/deboning was monitored. The growth of acteria over a period of five weeks of storage of the corresponding beef cuts in vacuum packages was also monitored. *Pseudomonas, Enterobacteriaceae,* and c bacteria were estimated by conductance monitoring (Malthus 2000) and conventional plate counts of excised meat samples. Storage of the excised meat th plate counting at fixed intervals (0, 7, 14 d) was performed to obtain a proliferation index (sum of bacterial counts) in order to estimate the low numbers bacteria present prior to storage.

detection of *Pseudomonas* and *Enterobacteriaceae* by conductance monitoring was performed using designed selective media. The conductance t showed significant correlations with the corresponding plate counts. The bacteriological survey along the processing line, including three methods for the ection of spoilage bacteria, indicated that conductance monitoring performed better than conventional plate counts and almost equal to the highly sensitive index.

esigned specific media for the conductance monitoring of spoilage bacteria in meat products ensures that accurate detections are made. The application of nce method will produce appropriate results in a matter of hours, compared to plate counting, which takes days, or the proliferation index which takes rform.

SAMPLING PLANS TO MONITOR MICROBIAL QUALITY OF COMMERCIAL BEEF CARCASSES

P. CARTIER
Service Qualité des Viandes, INSTITUT DE L'ELEVAGE, 14310 VILLERS-BOCAGE, France

The aim of this stydy was to design an adequate sampling scheme for monitoring microbial quality of commerci carcasses. Two consecutive trials (I and II), corresponding to two important considerations involved in deciding suitable assessment procedure, were performed.
Trial I : In the purpose to choose which parts of a carcass to examine, 24 forequarters were sampled at 20 defined site that characterized the best the hygienic quality of whole quarter surface, were selected.
Trial II : As it is necessary to sample a limited, but representative, number of carcasses, variability between different of the same batch has to be determined. With this object, bacteriological quality of 18 batches of carcasses was asse sampling around 50 quarters per batch. Precision of sampling plans versus the numbers of sampled carcasses w established.
As bacteriological index, we choose to seek Total Viable Counts (TVC), Pseudomonas (PS) and indicator of faecal p (Coliformes, CF). Carcasses were sampled by excision.
Results from trial I showed that the most contaminated sites were not the same for all the carcasses. Consequently, sites had to be sampled. The restriction of sampling to 3 defined carcass areas (outside of the neck, central pos shoulder, forerib) and a single sample (by bulking the 3 sites before bacteriological analysis) was acceptable. Cor coefficient of this subset of sites to the mean of the 20 single sites (used as the bacteriological index of the whole c was 0,93 for TVC, 0,91 for PS and 0,87 for CF.
In trial II, it was found great variation in microbial load between different carcasses in the same batch. Contaminatio normally distributed for TVC, but not for PS or CF. Consequently, average contamination could not be estimated by s a limited number of carcasses when PS or CF were used as bacteriological index. With TVC as index, precision on a contamination was 1,2 log/cm^2 when only one carcass was sampled, 0,5 log/cm^2 for 4 sampled carcasses, and 0,3 for 12 sampled carcasses.

YERSINIA ENTEROCOLITICA 0:3 AND SALMONELLA SSP. ON FRESH PORK COLLAR

H. CHRISTENSEN, R. SØRENSEN AND H. LÜTHJE
Danish Meat Research Institute, Maglegaardsvej 2, DK–4000 Roskilde, Denmark

The presence of *Yersinia enterocolitica 0:3* and *Salmonella* ssp. on the surface of deboned and derinded pork meat was surveye collar was chosen as the object of the survey. Samples were taken from collars after deboning and derinding and reference sampl taken from tonsils at the veterinary inspection. 304 tonsil samples were examined for *Yersinia enterocolitica 0:3* and 1124 collar s for *Yersinia enterocolitica 0:3* and *Salmonella* ssp. Three pig abattoirs participated in the study.

The three abattoirs showed (A) 12%, (B) 0% and (C) 11% *Yersinia enterocolitica 0:3* positive pork collar samples, respectiv corresponding amount of *Yersinia enterocolitica 0:3* positive samples in tonsils were 58%, 59% and 36%.

Salmonella ssp. were not detected in the 1124 pork collar samples investigated.

It is surprising that abattoirs A and B showed equal *Yersinia*–frequency in tonsils but differed significantly in *Yersinia*–frequency on This finding indicates that – despite the fact that Danish pig abattoirs are considered very uniform – local differences in s techniques or equipment can significantly affect contamination and/or survival of *Yersinia enterocolitica 0:3* on fresh pork mea slaughter, refrigeration, handling and storage.

The complete absence of *Salmonella* ssp. in the samples surveyed supports the perception that *Salmonella* ssp. is not a major pro fresh Danish pork meat.

LOW MOLECULAR WEIGHT PROTEINS FROM PSYCHROTROPH *PSEUDOMONAS* OVEREXPRESSED AT LOW TEMPERATURE.

M. HEBRAUD*, E. DUBOIS, P. GARRY and J. LABADIE.
SRV-Unité de Recherches de Microbiologie. INRA de Theix. 63122 CEYRAT, France.

A psychrotrophic bacterium, *Pseudomonas fragi* K1, isolated from minced beef, was cultured at low and optimal g temperature (4°C and 30°C). The comparison by 2-D SDS-PAGE and autoradiography of intracellular proteins labelled wi methionine has revealed some qualitative and quantitative differences between the two physiological conditions. Several pr were overexpressed or specifically expressed at optimal growth temperature whereas about twenty other proteins overexpressed at low temperature. Among these latest, two low molecular weight proteins, named C7 and D7, were partic important.

Eight other *Pseudomonas* (*P. fragi* and *P. fluorescens*) isolated from different food products, meat, milk or cheese, presen same characteristics. The cartography of their intracellular proteins, extracted after a culture at low temperature (4°C or 10°C optimal growth temperature (from 26°C to 30°C) and labelled with ^{35}S-methionine, has shown similar qualitative and quan differences to those observed for *P. fragi* K1. The two low molecular weight proteins, identified as C7 and D7 in the K1 were also strongly overexpressed in the eight other strains cultured at low temperature.

The spots of these two proteins have been extracted from about 400 2-D electrophoresis of intracellular proteins from the *P.* K1 strain. They have been used to raise antibodies into rabbits. The anti-C7 and anti-D7 sera recognized specifical intracellular proteins from the eight *Pseudomonas* tested. For each strain, the positions in 2-D gel electrophoresis of recognized proteins were identical with those of C7 and D7 proteins from *P. fragi* K1.

The proteins C7 and D7 have been partially copurified by gel filtration chromatography from crude extracts of *P. frag* intracellular proteins. These are monomeric proteins of 7,2 kDa and 8,0 kDa respectively.

The works now in progress aimed at knowing the nature and the conditions of overexpression of these small peptides and are really overexpressed in all the *Pseudomonas* species cultured at low temperature and also in other psychrotroph bacteria.

* : Corresponding author.

EVALUATION OF SPOILAGE MICROORGANISMS ON PORK CARCASSES DURING SLAUGHTER FABRICATION IN 3 U.S. PORK PACKING PLANTS

D. G. HOMANN, C. L. KNIPE, E. A. MURANO AND R. E. RUST
Meat Export Research Center, Iowa State University, Ames, Iowa, U.S.A.

Microbial quality of pork was evaluated at four consecutive sites throughout the slaughter and fabrication processes of typical U.S. pork plants. The objective was to identify the point(s) in pork processing where contamination was greatest, in order that selected areas could be changed to decr contamination. One ham and one loin from each of fifteen carcasses were swabbed at the following immediately after carcasses were singed and polished; after the final showering during slaughtering after 18 hours of chilling, immediately prior to fabricating. The final sampling site was immediately before packaging of boneless loins only. Standard methods were used to quantitatively evaluate the following types of bacteria: aerobic, anaerobic, lactic acid, psychotrophic and coliform bacteria. The greatest contamination, due to psychrotrophic and coliform bacteria, was found during the cutting and counts at this point were significantly ($P<0.05$) higher than those found at the first sampling site the slaughter floor. Psychrotrophic and coliform numbers declined after polishing of carcasses until immediately prior to packaging. Aerobic and anerobic counts were highest after polishing, and decr as the carcasses progressed through the processes. Lactic acid bacteria showed no change in numbe throughout the processes. Assuming that the psychrotrophic data is the most important of the orga evaluated, cutting and fabrication caused the greatest increase in contamination to U.S. pork.

UDY OF A TRADITIONAL PORTUGUESE BLOOD SAUSAGE "MOURA"

TÓNIO INÊS, LUIS PATARATA and CONCEIÇÃO MARTINS
versidade de Trás - os - Montes e Alto Douro, P - 5001 - Vila Real, Portugal

tugal has a large variety of traditional blood sausages. "Moura " is one of them, produced in a small area at the North of the country. composition differs according to the producers, but it's basically made with: pork meat and fat, chicken, beef, bread, blood, salt, garlic, rika, and red wine. This sausage is eaten boilled or grilled and it's highly appreciated by the consumers. It's a cheap product and in the last years its demand has been increasing considerably.

aim of this work was to study the chemical and microbiological composition of this type of blood sausages, and to control some parameters tability at different stages of processing. The experiments were conducted at a comercial meat plant, following the traditional recipe, in four this wheighting 100 kg each. The sampling for chemical and microbiological determinations were made at different times: 1) on the paste ore stufing, 2) 5 days after smoking, 3) 10 days after. At the last time the blood sausage had good taste and firmness after boilling, which is lar to the traditional ones.

chemical composition on the final product showed the following mean values: aw - 0,87 ± 0,03; pH - 4,89 ± 0,26; moisture - 27,19 ± 3,45 rotein - 22,15 ± 1,43 %; fat - 28,20 ± 0,82 % ; NaCl - 3,79 ± 0,36 %; ash - 4,60 ± 0,37 %; nitrogen free extract - 17,87 ± 3,26 %.

most all final samples were free from *Staphylococcus aureus, Salmonella* and sulfite - reducing *Clostridium* spores.

th the time of processing and the drying effect of smoking the aw and pH values were reduced. This two parameters of stability , mainly the value makes "Moura" a stable product classified as an Intermediate Moisture Food.

sidering that chemical and microbiological determinations are an indicator of the quality of raw material and technological process, this study shown the possibility of making safety products similar to those of the traditional type, if the critical points during the processing are troled.

VIVAL OF YERSINIA ENTEROCOLITICA IN MINCED MEAT STORED AT DIFFERENT TEMPERATURES

ARAPINAR and Ş.A.GÖNÜL
University, Engineering Faculty, Department of Food Engineering, 35100, Bornova, İzmir, TÜRKİYE

rvival of Yersinia enterocolitica 19174 in minced meat stored at 5°C, -10°C and -25°C was evaluated by culating the test organism into 250 g of freshly ground beef samples. Two different inocula levels (ca. and 10^8 cells per g) were used. At both inocula levels number of Y.enterocolitica cells increased two logs samples held at 5°C for 3 days. Viable cells in numbers corresponding to the initial inocula levels were ll detectable in minced meat samples stored at -10°C for 4 weeks. Although 1 or 2 logs decreases were served in the final number of cells depending on the initial inocula size the organism survived up to 6 ths in the samples held at -25°C.

INFLUENCE OF COMPETITIVE FLORA AND STORAGE CONDITIONS ON GROWTH OF LISTERIA

M. K. B. KEMNER and H.-J. SEIDEL NIELSEN.
Biotechnical Section, The Engineering Academy of Denmark. DK-2800 Lyngby. Denmark.

Objective: To investigate growth of *Listeria monocytogenes* as influenced by level of natural occurring microflora or adde acid bacteria on different types of products and storage conditions.

Materials and Methods: Cured pork loin or pork back fat was inoculated with suspensions of either *Pediococcus pentosac* *Listeria monocytogenes* or both. Storage temperature 5 and 10°C, either vacuum pakaged or incubated in normal atmosph in anaerobic storage vessels. Total counts as well as number of lactic acid bacteria, *Brochothrix thermosphacta*, listeria and negative bacteria were observed during storage for 6 - 7 weeks.

Results: In cured pork the natural microflora consisted mainly of lactic acid bacteria and after a few weeks a considerable ber of *B. thermosphacta*. The total count reached 10^6cfu/g. Gram negative flora were negligible at 5°C, and only reached a 100 cfu/g at 10°C. The inoculated listeria rapidly disappeared within 1 week at 5°C, but at 10°C growth took place during reaching numbers of 10^4 to 10^5 cfu/g. After 4 weeks growth stopped and the number of bacteria fell to less than 10 cfu/g. The pure pork fat was heavily contaminated from start (10^7 cfu/g), the normal flora consisting of mainly Gram negative ba and lactic acid bacteria. The total count in aerobic incubation reached 10^{10} cfu/g, while the number of bacteria under ana incubation remained nearly constant. When inoculated with a high level of listeria (10^3 cfu/g) growth took place during st storage, the number reaching 25 x 10^4 cfu/g in 3 weeks. Under anaerobic conditions growth was much slower, the level o remaining nearly constant at about 10^3 cfu/g throughout the period.

Conclusion: Addition of the starter culture *P. pentosaceus* seems to suppress growth of both *B. thermosphacta* and espe listeria slightly at both incubation temperatures. No inhibition due to growth of normal flora - mainly lactic acid bacteria Gram negatives - could be observed on samples of pure pork fat.

TOTAL SCREENING, IN VITRO, OF INHIBITORY AND STIMULATORY EFFECTS OF NATRIUM CHLORIDE, NA NITRITE AND TRIPOLIPHOSPHATE ON PATHOGENIC AND SAPROPHYTIC MEAT MICROFLORA

P. KITZMAN
Department of Quality and Hygiene Control, MEAT AND FAT RESEARCH INSTITUTE, 36 Rakowiecka
02-532, Warsaw, Poland

About 3600 growing curves got by turbidity measurements technique in "Cobas-Bact" instr were tested by the potency of "single" chemicals and "in combination" to inhibit and/or s late bacterial growth in Nutrient Broth No 2 (Oxoid). Six bacterial strains: Escherichia Salmonella agona, Proteus vulgaris, Streptococcus faecalis, Bacillus subtilis, Staphyloc aureus were examined. Very strong inhibitory action of tripoliphosphate (0,5%) was detect Staphylococcus aureus, weaker on Bacillus subtilis, Proteus vulgaris and Streptococcus lis. No action was noticed on Escherichia coli and Salmonella agona. Stronger inhib action was noticed in application of NaCl (1,5% and 3,0%), then of $NaNO_2$ (0,005% 0,0125%), except of Staphylococcus aureus, where stimulatory effects resulted. "In nation" NaCl and $NaNO_2$ were acting stronger inhibitory then in "single" application, and stimulatory to Staphylococcus aureus. Stronger inhibition or less stimulation was noticed the pH 6,5, then 5,5. Other additives: sodium ascorbate and sodium citrate brought addi inhibitory effects to the agents mentioned above.

1. NaCl could act stronger inhibitory then $NaNO_2$, especially in higher pH.
2. Stimulatory effects of NaCl and $NaNO_2$ on Staphylococcus aureus could be canceled by poliphosphate, sodium ascorbate or sodium citrate.
3. Tripoliphosphate could be considered as the potential chemical agent for partial ment of NaCl and $NaNO_2$ in meat products due to it´s strong bacteriostatic activity on positive microflora and with the condition that it could act as efficiently in meat ment as in nutrient broth.

PURIFICATION AND PARTIAL CHARACTERIZATION OF A SECRETED COLLAGENASE FROM THE PHYTOPATHOGENIC BACTERIUM *CLAVIBACTER MICHIGANENSE*

J. LABADIE. and M. HEBRAUD. Station de Recherches sur la Viande.
INRA de Theix. 63122 St Genes Champanelle. (France)

lavibacter michiganense is a pathogenic coryneform bacterium which is pathogen for a variety of plants of agricultural importance uch as tomato, potato, and maize. In this paper, the purification and the general properties of an extracellular collagenase from *michiganense* are presented.

Material and methods

The strains used in that study are taken from the French National Collection of Phytopathogenic bacteria (INRA d'angers, France). ultural conditions and purification protocols are made according to previously published methods.

Results and conclusion

The purification steps include ammonium sulfate precipitation DEAE cellulose chromatography and Sephadex G200 hromatography. The purified collagenase migrate with a Mr = 105 000 upon sodium dodecyl sulfate-polyacrylamide gel electrophoresis. The enzyme displays a broad pH activity profile in the neutral to basic range. It is not inhibited by histidine, slightly by cysteine and strongly by EDTA and 1,10-phenanthroline suggesting that it is a metalloprotease like the other known collagenases. The inhibition data show many properties similar to those of other known bacterial collagenases particularly the enzyme from *Corynebacterium rathayii*. This new collagenase is able to degrade collagen and gliadins extracted from wheat indicating that the enzyme could be necessary for the bacterium to multiply into seeds from which it is frequently isolated. Works are in progress to improve the collagenase synthesis and to sequence the collagenase gene that was recently cloned.

FECT OF PACKAGING ON FRESH LAMB CUTS SHELF LIFE

LEGRAND
rvice Qualité des Viandes, INSTITUT DE L'ELEVAGE, 14310 VILLERS-BOCAGE, France

ckaging and storage time of lambs cuts were examined for their effects on the appearance of meat, the development of the cro-flora, and the eating quality.

esh lamb chops and leg steaks were either wrapped up in high oxygen permeability film, or in modified gas atmosphere ntaining 60% O2, 29% CO2 and 11% N2, or under vacuum, and stored at 0/+2°C for periods from 0 to 21 days. The last y of storage, cuts were transfered to a retail display cabinet operating at 7/8°C under continuous lighting. Storage times re 2, 5 and 8 days for cuts wrapped up in film ; 2, 5, 8 and 14 days for packaging in modified gas atmosphere ; and 5, 8, 14 d 21 days for vacuum packaging. Controls and analysis were made after opening packaging.

eat appearance and microbiological growth, the two variables that determine shelf life, are directly related to the packaging atment and, for each packaging, to the storage time.

lor and microbiological counts of cuts wrapped up in high oxygen permeability film quickly caught unacceptable levels. e longest shelf life observed did not go over 5 days.

her a storage of 8 days, cuts held in modified gas atmosphere remained acceptable, but after 14 days, even if bacterial unts were correct, we observed unacceptable colors.

acuum packaging gave the best results, in particular concerning appearance. After 14 days of storage, bacterial counts re still acceptable. Deboned cuts could be stored for up to 21 days, whereas cuts with bone were spoiled by putrid odors the same time. These odors were attributed to the development of Brochotrix thermosphacta and Enterobacteriaceae.

ackaging treatment and storage time influenced taste panel assessments on lamb chops. One more time, vacuum ackaging gave the best results ; flavour and tenderness increased with storage time. The same trend was observed on cuts rapped up in high oxygen permeability film. On the other hand, there was no organoleptic change as time goes on for meat ored in modified gas atmosphere : after 2 days, these cuts were rated lower than others.

ffects observed are complex and many factors influenced them, like chilling conditions, initial microbiological spoilage, uality of the films used, so that further work is necessary to be more specific about these results.

AFLATOXIN PRODUCTION IN A MEAT MIX MODEL SYSTEM IN THE PRESENCE OF PEDIOCOCCUS AND LACTOBACILLUS: LEVELS OF GLUCOSE NECESSARY TO INDUCE PRODUCTION.

R. H. LUCHESE, J. F. P. MARTINS and W. F. HARRIGAN
Department of Food Science and Technology, University of Reading, Reading RG6 2AP, UK.

Aflatoxin production has been related to the presence of readily utilizable sugars. study was conducted in an axenic cultural system in APT (modified) and PMS media. Irrad meat was also employed in the formulation of a meat medium. The medium composition and incubation temperatures were simulations of Brazilian salami processing conditions. Eig individual strains of Pediococcus and Lactobacillus were used. Toxin and residual sugar were determined by ELISA and HPLC, respectively.

All single cultures of Aspergillus parasiticus supported aflatoxin production. Aflat was not detected when A. parasiticus was grown with lactic acid bacteria, although visi mould growth was observed in all such cultures. There was a correlation between the lev toxin produced and the concentration of glucose to which the mould had been exposed in pre-incubation period. The combination of lower levels os sugar, low temperature of incubation and the presence of an active competitor, probably had an effect on the leve sugar that were taken up by mould, thus compromising aflatoxin production.

Effect of Time Length of Frozen Storage and Vacuum Packaging on Survival of *Vibrio vulnificus*

E.M. MAURER and A.B. CHILDERS
Department of Veterinary Anatomy and Public Health
Texas A&M University, College Station, TX 77843-4468

Vibrio vulnificus, an exceptionally virulent and invasive gram-negative bacteria, is found in warmer environments worldwide. *Vibrio vulnificus* infection manifests itself in three clinical forms. Primary septi following ingestion of contaminated seafood is the most serious and fatal of the three. Wound infec sometimes accompanied by a secondary septicemia, and gastrointestinal illness may also occur. Presenti programs exist to limit harvesting of shellfish to areas free of *V. vulnificus*. Therefore, public education is of utmost importance. Shellfish consumers, especially those with liver or other chronic under illnesses, need to be aware of the dangers of eating raw or undercooked seafood.

For this study, oyster samples were split into 2 treatment groups: those used for controls and inoculated with $1x10^6$ CFU/g of *V. vulnificus*. Half of the samples in each group were then normally heat se The other half were heat sealed under vacuum. Oysters were then frozen at -20°C for 7, 14, 30, and 70 da

Concentrations of total aerobic bacteria were estimated at each interval using the FDA-BAM 3-tube Probable Number determination. Length of storage had a significant effect ($P<.05$) on decreasing total bacc The type of seal had a less significant effect ($P=.08$) on decreasing counts.

Concentrations of *V. vulnificus* were also estimated using the 3-tube Most Probable Number determin with positive confirmation on *V. vulnificus* selective agars: Cellobiose-polymyxin B-colistin (CPC) and Mod CPC (Mod. CPC). Length of frozen storage, treatment group, and type of seal all had significant effects (P on survival of *V. vulnificus* in the oysters. Statistically significant decreases in *V. vulnificus* were at each successive time interval. Greater numbers of *V. vulnificus* were, not surprisingly, found to surv the inoculated samples than in the control samples. Vacuum packaged samples also showed significantly lower concentrations of *V. vulnificus* over the length of the study than did the normally sealed samples.

These results show that storage of samples in vacuum packaged bags at -20°C over 70 days is a effective method of reducing *V. vulnificus* concentrations in oysters.

ROBIAL LIPOLYSIS IN BEEF ADIPOSE TISSUE UNDER REFRIGERATION

. MASANA and J.A. LASTA

tituto de Tecnología de Carnes CICV-INTA, CC 77, 1708, Morón,
nos Aires, Argentina.

aim of this study was to evaluate the relative importance of microbial growth in the rolysis of lipids in bovine adipose tissue under refrigerated storage.

rteen samples of bovine brisket fat, first to fifth sternebrae, from a recently (2 hours) ughtered animal were refrigerated at 5 °C in an aerobic environment. Identical number of ples were treated with a tetracycline solution to stop microbial growth.

samples were analyzed for psychrotrophic (5°C) and lipolytic (25°C) counts at 0, 2, 4, 9, 11, and 14 day. Simultaneously the concentration of free fatty acids (FFA), using Regouw method modified by Margaría and García, and the lipid content were determined.

ults show that psychrotrophic (8.20 log 10/cm²) and lipolytic microorganisms (9.30 log cm²) were able to reach high count number on refrigerated bovine adipose tissue. The hest levels of FFA observed, 34 and 26 µmoles of FFA /gram of lipid, matched with the hest psychrotrophic counts.

increase of 1.35 µmoles/g/day of FFA was calculated by regression analysis. There was o a less significant increase in the FFA levels for samples with no apparent microbial wth (0.7 µmoles/g/day).

data obtained allow us to conclude that in refrigerated bovine adipose tissue the robial growth mostly contributed to the hydrolysis of lipids, specially after reaching h counts.

MPARISON OF ORGANIC ACIDS FOR *CLOSTRIDIUM BOTULINUM* CONTROL IN AN UNCURED TURKEY PRODUCT.

THUR J. MILLER, JEFFREY E. CALL, and RICHARD C. WHITING

DA-ARS, Eastern Regional Research Center, 600 E. Mermaid Lane, Philadelphia, PA 19118 USA

lth concerns have led consumers toward purchasing nitrite-free and low salt meat and poultry products. Lacking these barriers to trol growth of bacterial pathogens such products carry heightened public health risks, especially if temperature abused. To dress this threat 5 organic acid salts were evaluated as potential antibotulinal agents. Ground turkey breast was formulated with 5% NaCl, 0.3% sodium pyrophosphate, 0,2 or 6% organic acid salts and 10% ice, then mixed. The pH level was adjusted to . Five hundred spores/g of a 6 strain proteolytic *Clostridium botulinum* mix were added to the product, which was vacuum kaged in high oxygen barrier material. Packages containing 10g of product were heated in 80°C water for 20 min, cooled, and bated for 0-18d at 28°C. Samples without acid were positive in 2d. With 2% acid neurotoxin was detected by mouse bioassay 4,5,5,6d for pyruvate, lactate, acetate, citrate, and propionate, respectively. With 6% acid, neurotoxin was detected at 9d with ruvate and >18d for the remaining compounds. Antibotulinal efficacies of these weak acids varied directly with their dissociation stants (pK_a). This study reveals that a variety of organic acid salts possess activity that can be used alone or possibly in mbination to enhance food safety.

CHILLING AND TRANSPORT OF PORK

P.C. MOERMAN
TNO Nutrition and Food Research, Department Netherlands Centre for Meat Technology, P.O. Box 360, 3700 AJ ZEIST, THE NETHERLANDS

ABSTRACT

To provide consumers with meat in a good hygienic condition both temperature and distribution time had be reduced. For prevention of the growth of micro-organisms the surface temperature is far more importa than the deep leg temperature.
It has been shown in previous investigations that transport of pig carcasses with a low surface temperature, but with an internal temperature above + 7°C, has no adverse effect on hygienic condition of the meat. Therefor this kind of transport is allowed in the Netherlands for the market. The objective of this study was to develop a monitoring system to guarantee that chilling and transport has been carried out correctly.
The monitoring system was based on the experience with the transport of partly chilled pork from about 25 slaughterhouses to meat cutting and packaging plants.
It appeared that temperature measurements in some well defined sites give a good insight in the performance of the chilling procedure in the slaughter- house.
It is concluded that shipping of meat before the deep leg temperature has reached + 7°C gives no additional risks for the hygienic condition of the meat. This makes it possible to reduce the distribut time considerably and debone the carcasses at the cutting plant the day after slauhtering. However the results only can be obtained if chilling procedures and chilling equip-
ment of slaughterhouses and refrigerated vehicles fulfil special requirements.

IDENTIFICATION OF SOME LACTIC ACID BACTERIA FROM CO_2 PACKED MEAT BY 23S RRNA-TARGETE OLIGO NUCLEOTIDES PROBES

H. NISSEN and R. DAINTY
MATFORSK, Norwegian Food Research Institute, Oslovn. 1, 1430 Ås, Norway

Storage of raw, cured or fermented meat and meat products in atmospheres of CO_2, CO_2/O_2 or in vacuum packs leads to a flo dominated to a greater or lesser extent by lactic acid bacteria (LAB). To evaluate the relative importance of different LAB to and/or fermentation processes and to determine the microbial consequences of changes in product formulation, processing pa etc., it is important to have rapid, reliable, easy to perform identification tests. Present tests are often difficult to interpret wit changes in medium composition and/or growth conditions giving equivocal results. As an alternative we have evaluated the u RNA-targeted oligo nucleotide probes labelled with ^{32}P, using a colony hybridization technique.

Of 96 LAB strains isolated from CO_2 packed pork 25 hybridized with the probe for *L. sake*, 17 with the probe for *L. curvatus* with the probe for *L. pentosus/plantarum*. With a few exceptions the identities coincided with these obtained from tests of morphology/Gram reaction, the ability to grow on acetate agar and to produce CO_2 from glucose and NH_3 from arginine. Of 52 strains 25 were shown by the same tests to be *Leuconostoc* spp, the remainder being unidentified.

Results from the identification of the LAB with the oligo probes were available within 4 days and the availability of probes f other common meat LAB will make this assay an easy and reliable, if somewhat more expensive, way to classify LAB spoila bacteria. Preliminary work shows that commercial fluorescein labelled probes can reduce detection time to 2 days as well as b more user friendly.

eudomonas GROWTH AS INFLUENCED BY AUTOCLAVING OF STERILE BEEF EXTRACT

ERBERT WOOD OCKERMAN and JIN GAB KIM

ept. of Animal Science, The Ohio State University, Columbus, OH 43210 U.S.A. and the Ohio Agricultural esearch and Development Center, Wooster, OH 44691 U.S.A.

BSTRACT: Non-autoclaved sterile beef extract (SBE) medium and autoclaved sterile beef extract (SBEA) edium were prepared and inoculated with *Ps. fluorescens* and these samples were also compared to controls at were not inoculated with *Ps. fluorescens*. The *Pseudomonas* count, pH, glucose and total volatile nitrogen TVN) were measured at 0, 6, 12, 24, and 48 hours of incubation. In uninoculated media all variables except ucose were very stable and no microorganisms were detected during the incubation time. The results dicated that autoclaving caused an increase in the pH, glucose and TVN values. There was a significant crease of *Pseudomonas* numbers due to autoclaving when non-autoclaved and autoclaved media were mpared at 0 to 12 hours. Significant difference in pH was also observed at 24 to 48 hours. Glucose and VN also showed significant differences at 0 to 24 hours. *Pseudomonas* was significantly correlated with pH d glucose in both SBE and SBEA. A significant correlation was also observed between *Pseudomonas* and VN in SBE.

FLUENCE OF PREVIOUS BACTERIAL GROWTH ON THE BIOCHEMICAL AND MICROBIOLOGICAL OPERTIES OF BEEF EXTRACT MEDIUM

ERBERT WOOD OCKERMAN and JIN GAB KIM

pt. of Animal Science, The Ohio State University, Columbus, OH 43210 U.S.A. and the Ohio Agricultural search and Development Center, Wooster, OH 44691 U.S.A.

STRACT: Uninoculated sterile beef extract (SBE) and previously inoculated with "normal flora" and claved beef extract media (IBE) were prepared and then inoculated with *Ps. fluorescens* and these ples were also compared to controls that were not inoculated with *Ps. fluorescens*. The *Pseudomonas* nt, pH, glucose and total volatile nitrogen (TVN) were measured during 48 hours of incubation at 25 °C. In dia not inoculated with *Pseudomonas* the variables were stable and no microorganisms were found. IBE tained less glucose than SBE resulting from the previous inoculation with "normal flora". But in both dia inoculated with *Ps. fluorescens* a normal shaped growth curve for *Pseudomonas* was obtained. Glucose reased significantly ($P<0.05$) after 24 hours due to *Pseudomonas* growth. *Pseudomonas* also caused a nificant increase ($P<0.05$) of pH and TVN values after 12 and 24 hours of incubation. There was a nificant ($P<0.001$) correlation between *Pseudomonas* numbers and pH or glucose.

LACTIC ACID AND NISIN EFFECT ON BEEF SPOILAGE BACTERIA ATTACHMENT

H. W. OCKERMAN, AN. SCI. DEPT., OSU, 2029 FYFFE ROAD, COLUMBUS, OHIO 43210, USA
H. R. RODRIGUEZ AND N. A. PENSEL, INSTITUTO de TECNOLOGIA de CARNES CICV-INTA, C.C. 77, 17[illegible] MORON, BUENOS AIRES, ARGENTINA.

An experimental model involving the use of sterile beef longissimus dorsi (LD) muscle, lactic acid, 10^3 IU/ml nisin or a combination of 500 IU/ml nisin plus 1% lactic acid and attachment medium was utilized. LD was immersed in the different antimicrobial agents then placed in contact with approximately $1x10^7$ CFU/ml of Pseudomonas fluoresce Lactobacillus casei, Brochothrix thermosphacta or Escherichia coli at room temperatu attachment was checked up to 120 min. and the organisms were enumerated. Lactic acid pr to have a strong inhibitory effect on the attachment of P. fluorescens but did not exe marked reduction of the attachment of E. coli; nonetheless, it was the most effect treatment for E. coli. Lactic acid did not show any effect against L. casei. Nisin pr to be effective in preventing the attachment of L. casei but did not have an effect o fluorescens or E. coli. The combination of lactic acid-nisin reduced the attachment o fluorescens; however, its effect was not as marked as 2% lactic acid.

ATTACHMENT OF SPOILAGE BACTERIA TO BEEF MUSCLE TISSUE

H. W. OCKERMAN, AN. SCI. DEPT., OSU, 2029 FYFFE ROAD, COLUMBUS, OHIO 43210, USA
H. R. RODRIGUEZ AND N. A. PENSEL, INSTITUTO de TECNOLOGIA de CARNES CICV-INTA, C.C. 77, 1[illegible] MORON, BUENOS AIRES, ARGENTINA.

Sterile beef longissimus dorsi muscle was exposed to a liquid attachment medium contai approximately $1x10^7$ CFU/ml of
Pseudomonas fluorescens, Lactobacillus casei, Brochothrix
thermosphacta or Escherichia coli at room temperature and adherence was monitored at 0, 60, 90 and 120 min by enumerating the microorganisms firmly attached. There were differences in the attachment of P. fluorescens, E. coli and L. Casei at 0 min. There no differences in the percentage of attachment, calculated considering inoc concentration, between P. fluorescens and L. casei for every attachment time tested. data suggest that P. fluorescens was the most readily attached and L. casei was the le E. coli was intermediate. The strain of B. thermosphacta used in this assay did not attachment. SEM studies at 120 minutes of attachment time showed well-defined attach fibrils. The importance of preventing or blocking bacterial adherence become evident the spoilage bacteria tested in these experiments were greatly attached to the muscle su at "zero" min.

FECTS OF THE ADDITION OF ACETILATED MONOGLYCERIDE ON THE MICROFLORA, WEIGHT LOSSES AND LOR BLOOM OF VACUUM PACKAGED BEEF

B. PASSOS DE OLIVEIRA[1] and P.R. MASSAGUER[2]

Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

Faculdade de Engenharia de Alimentos - UNICAMP, Caixa Postal 6181, Campinas, São Paulo, Brazil

In order to establish the effects of the addition of acetilated monoglyceride 2% w/w, Dermatex Food Grade FG) - on the microflora, weight losses and color bloom of vacuum packaged beef, eighty four cuts of Longissimus H < 5.8) were packed in 2 - commercially coextruded films with or without DFG (42 cuts of each). Packages re stored at 0 - 2°C for 60 days. Microbial surface counts (25 cm²) were carried out for aerobic mesophilic, ichrotrophic, lactic acid bacteria. *B.thermosphacta*, *C.perfringens*, *S.aureus* and *Y.enterocolitica* every 12 ys. *Salmonella* investigation was tested in 25 g. Samples were weighted before and after storage period once e meat pieces were dried. Color bloom was visually evaluated on a lean surface after exposure to cold air ring 20 min. No differences ($p > 0.05$) were detected among treatments on the mean counts of spoilage and thogenic microorganisms. The highest count was 6.92 logCFU/cm² for lactic acid bacteria on the 52nd day of orage. *B.thermosphacta* increased up to the 24th day; after this period a decrease in counts was observed. *lmonella* and *Y.enterocolitica* were absent in all samples; *C.perfringens* counts were < 2 logCFU/cm² and *aureus* was not detected after 24 days of storage. Weight losses increased with storage time and at the end re about 4-6%. No differences ($p > 0.05$) were observed among treatments, however numerical values were wer in those treatments using DFG. A slight decrease in pH was observed during storage time, but no gnificant differences were detected. Also the average values for color bloom did not show significant diferences ong treatments. The results showed that DFG had no effect on the microbial counts, pH decline or color generation.

EAT RESISTANCE OF TWO STREPTOCOCCI ISOLATED FROM THE CORE OF COOKED MEAT PRODUCTS MADE OF OARSELY GROUND PORK

, PETÄJÄ

epartment of Food Technology, Meat Section, University of Helsinki, Viikki E-building, 00710 HELSINKI, Finland

he thermal death of two streptococci strains isolated from the core of cooked meat products made of coarsely ground pork was vestigated during heating at 72°C and during the heat treatment used for the heat processing of cooked sausages (diameter 75 m). Both heat treatment tests were made in APT-broth and in coarsely ground cured pork.

t 72°C the number of colony forming units (cfu) of the strains decreased in APT-broth more steeply than in coarsely ground cured ork in which the decrease was about 1 log unit over 15 min. When heated in APT-broth according to the heating process used for ooking sausages thermal death began steeply at 60°C (strain 3b1) and at 65°C (strain 7b1) diminishing when the maximum mperature of 72°C had been attained. Strain 3b1 did not survive after the heating process in APT-broth. When heated in coarsely found cured pork according to the heating process for cooking sausages the thermal death process happened more slowly than in APT-broth, the cfu number decreasing by 3 (strain 3b1) and 2 (strain 7b1) log units during the heating process. When the heat eated and cooled coarsely ground cured porks were stored for 4 weeks at 4°C the cfu number rose by a maximum of 1 log unit. cooked meat products lactic acid bacteria appear which survive the cooking process. However, these bacteria probably do not onstitute a spoilage problem because their cfu number decreases some log units during cooking and rises only a little during orage.

Bacterial adhesion to cooked sausages: development of a model experimental system

[1]J.-P. G. PIETTE and [2]J.-Y. POSTEC

[1] Agriculture Canada, Food Research and Development Centre, 3600 Casavant Boulevard West, St. Hyacinthe, Quebec, Canada J2S 8E3
[2] Institut des Sciences et Techniques des Aliments de Bordeaux, Université Bordeaux I, Avenue des Facultés, 33405 Talence, France

A study was undertaken to determine the events leading to the contamination and colonization of cooked sausages by bacteria prior to packaging. In a first phase, a model system was developed to study bacterial adhesion to processed collagen casings. Square pieces (ca. 1 cm^2) of the casings were introduced into a specially designed flow chamber and exposed for 20 min to concentrated suspensions (ca. 10^8 $CFU.mL^{-1}$) of *Brochothrix thermosphacta* and of a *Lactobacillus* sp. The flow chamber was then rinsed under controlled conditions so that bacteria in contact with the casing surface were submitted to a constant shear stress of 0.05 $N.m^{-2}$. The remaining (adherent) bacteria were stained with basic fuchsin and subsequently observed and enumerated under light microscopy.

Typically, *Brochothrix thermosphacta* cells adhered to casings in large numbers (ca. 10^5 $CFU.cm^{-2}$), regardless of the casing composition (100% collagen or collagen-sorbitol-cellulose) and mode of rehydration (30 min in water or 5 min in a 10% NaCl solution; room temperature). During the same time, the *Lactobacillus* sp. adhered in lower numbers (ca. 10^4 $CFU.cm^{-2}$). This was shown to be due to a lower sedimentation rate of the *Lactobacillus* sp. rather than to a difference in adhesive properties between the two organisms. In all cases, about 10% of the cells which reached the casing surface remained adherent after rinsing. There was no preferential location for the adhesion of both organisms and adhesion was not affected by the presence of NaCl (100 mM) in the adhesion medium. This study illustrates that the model system developed is indeed convenient to study bacterial adhesion to cooked sausages.

Antibacterial effectiveness of a pediocin AcH-based biopreservative against spoilage and path bacteria from vacuum packaged refrigerated meat.

Bibek Ray and R. A. Field
Department of Animal Science, University of Wyoming, Laramie, WY 82071

Refrigeration in combination with vacuum packaging has been a popular means of extending shelf-life of unproc processed meat products. However, good manufacturing practices, vacuum packaging and refrigeration at low temperatures f selective growth advantages to some spoilage and pathogenic bacteria that were not of major problems in products stored i overcome these problems use of a suitable preservative has been advocated.

Among the bacteriocins of lactic acid bacteria, pediocin AcH from Pediococcus acidilactici H, beside nisin, has been th studied for its physical and chemical characteristics, stability, toxicity and antigenic properties and mode of bactericidal activ be produced in large quantities in media containing food-grade ingredients. The trait is plasmid encoded, the gene co nucleotide bases and codes for a 62 amino acid prepediocin molecules which is not bacteriocidal. Following translation the undergoes an enzymatic posttranslation modification that removes an 18 amino acid leader segment from the NH_2-terminal en a 44 amino acid molecule.

The 44 amino acid molecule of molecular weight 4,628 Dal is pediocin AcH and has bacteriocidal property against many and pathogenic bacteria that can grow in vacuum packaged unprocessed and processed meat. By some combination a pedi based biopreservative has been prepared that is bacteriocidal to both gram-positive and gram-negative spoilage and pathogeni that can reduce the shelf-life and safety of vacuum packaged refrigerated meat products.

F SLAUGHTER HYGIENE MONITORED BY CARCASS BACTERIAL CONDITION

R. RODRIGUEZ and J. A. LASTA

tituto de Tecnología de Carnes CICV-INTA C.C. 77 1708 Morón, Buenos Aires, Argentina.

robial condition of meat and meat related surfaces is of prime interest to all the meat ustry. Association of meat with food-borne diseases and the need of increasing meat lf-life have suggested monitoring microbial carcass condition. Sampling techniques for robiological studies must be accurate and precise to make valid microbiological com- isons of either processes along the slaughterline or abattoirs. Several techniques have n applied to evaluate carcass contamination. However, due to an uneven distribution of cass bacterial contamination it seems to be appropriate to consider sampling area size as ey factor in determining carcass bacterial status. The aims of this paper are to discuss significance of sampling size, in relation with beef carcass contamination and abattoir iene condition, and the feasibility of using a precise, rapid, safe, and inexpensive sam- ng technique that consider the whole carcass area. Studies on 613 beef carcasses have n conducted at Argentine abattoirs evaluated as having different visual hygiene condi- n. Data gathered showed that no differences were found on carcasses from different abat- rs when analyzing small sampling areas. Differentiation of carcasses from abattoirs close ated in GMP's were attained by using a polyurethane sponge to sample the whole carcass a. This sampling technique should allow QC people and meat inspectors to establish robiological guidelines on beef carcasses, to monitor processes and to control manufac- ing practices. It would allow also to compare abattoirs, which might be important in s of domestic and international meat trade. In addition, the sponge technique might vide a tool for ecological studies during carcass chilling and carcass fabrication. ally, meat safeness and consumer confidence on meat products should be increased anytime t the slaughter process might be strictly controlled.

MBINED PROCESSES TO INHIBIT *Clostridium botulinum* TOXINE PRODUCTION IN A BEEF PRODUCT TORED AT ROOM TEMPERATURE

R. RODRIGUEZ, J. A. LASTA, C. A. MARGARIA, M. M. GALLINGER and C. ARTUSO.

tituto de Tecnología de Carnes CICV-INTA, C.C. 77 1708 Morón, Buenos Aires, Argentina.

Combined process involving curing, cooking, vacuum-packaging and gamma irradiation was ap- lied to a beef product stored at 28°C to prevent C. **botulinun** toxine production. Beef fore ank samples were cured by pumping and inmersion (7.7% NaCl and 0.064% $NaNO_2$). Samples were cked to an internal temperature of 75°C during 20 min in brine (5% of NaCl and 0.064% NO_2) and challenged with a composite of three different strains of type A C. **botulinum** in o different levels: 2.0×10^3 spores/g and 2.0×10^5 spores/g. Samples were vacuum-packed two different plastic containers composed by (from outside to inside): A) EVA- lyethilene-EVA-SARAN-EVA and B) NYLON-adhesive-SARAN-adhesive-LDLP. Finally, samples were ozen and irradiated to a 7.5 and 15 kGy and stored at 28°C. They were weekly monitored to ck for swollen packages or any other organoleptic change. Inoculated samples were monthly alyzed to check for cell viability and toxine formation. In addition, non inoculated mples were prepared and monthly analyzed to check their microbiological condition, lipid dation, a_w, clorures, residual NO_2 and, organoleptic characteristics. Samples subjected a 10^3 spore inoculation and 15 kGy irradiation did not show toxine production up to 2 nth storage, at 28°C, for the two analyzed packages. While, viable cells (unable to duce toxine) were detected. Low TBA numbers, off-flavors, and no differences in tender- ss were found on non-inoculated samples for both irradiation doses. Based on the ex- rimental data a process involving curing, cooking and irradiation might be safe to prevent *botulinum* toxine formation in beef inoculated with 10^3 spores/g.

EFFECT OF USING SORBIC ACID ON THE SHELF LIFE OF CHILLED TURKEY MEAT.

M.SERDAROĞLU, S.O.TÖMEK and A.BULGAY

Ege University, Food Engineering Department, Bornova, İzmir, Türkiye

Spoilage due to growth of bacteria during the storage in strech film packaged turkey meat in p container is a concern of the industry. The inhibition of the aerobic psychrotroph microorganisms ha economic importance by extending the shelf life.

In this study, the effects of sorbic acid on inhibiting microbial growth and on lipid oxidation in s film packaged turkey breast and thigh were investigated. For this purpose 16 of turkey were slaugh thigh and breast meats were deboned and dipt in a 0,5% sorbic acid solution and then packaged with s film in plastic con[illegible]. Control and sorbic acid treated samples were stored in a refrigerator at +4 10 days. Total via[illegible]e count and TBA values were determined at the beginning and at the end of the stora 10 days.

As a result, it was observed that treatment with 0,5% sorbic acid solution slows down the microbial g The TBA values slightly increase on all samples during storage.

MICROBIOLOGICAL STABILITY OF VACUUM-PACKED POULTRY LIVER PATÉ

N.F.A. SILVEIRA, E.T.F. SILVEIRA, M.K. BARBIERI, I. SHIROSE, V.C.A. JUNQUEIRA and M.T.E.L.

Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

The present investigation was undertaken to determine the effect of 2% sodium lactate, 1,2% propylen and 1,2% glycerol on the microbiological stability of vacuum-packed poultry liver paté stored at 7°C weeks. The physical and sensory characteristics were also evaluated during storage time.

Microbiological results showed the effectiveness of propylene glycol and glycerol in retarding growth acid bacteria and psychotropic aerobic and anaerobic bacterias, kept within the initial level of counts CFU/g. The inhibitory effect of lactate was more pronunced only for lactic acid bacteria, keeping its n the level of 10^2 CFU/g. Results suggest that the humectants evaluated had a inhibitoty effect on the g the tested bacterias by lowering the aw from 0,96 to 0,94.

Objective measurements of color for the treatments studied revealed that the lightness increased sig with the storage time while redness decreased and yellowness did not change markedly. The sensory results indicate that storage time did not affect significantly the taste and overall acceptability for all tr but off-flavour developed significantly for the products containing the humectants tested after 28 storage.

HERMAL DESTRUCTION OF LISTERIA MONOCYTOGENES IN MEAT PRODUCTS

N. SOFOS, G.R. SCHMIDT, N. BOONMASIRI and L. YEN

Departments of Animal Sciences and Food Science and Human Nutrition, Colorado State University, Ft. Collins, CO 80523 USA

isteria monocytogenes is a human and animal pathogen which has caused some recent foodborne infection outbreaks fatal to ensitive individuals. The organism is found widely in nature and in meat plant environments contaminating meat products. Thus, egulatory authorities, food microbiologists, meat processors, health professionals and consumers are concerned about the fate f the organism in meat products and its potential to result in food safety concerns. In addition to being able to proliferate at efrigeration temperatures and in vacuum packages, *L. monocytogenes* has been presented as more resistant to thermal destruction han other vegetative cells. This heat resistance is usually higher in the presence of curing ingredients and following product empering. Since there is a tendency in recent years to develop meat products low in fat and high in moisture, studies in our aboratory have examined thermal destruction of *L. monocytogenes* in ground pork formulated with variable levels of fat, water nd nonmeat ingredients. Inoculated ground pork of the appropriate formulation was cooked in small (140 g) glass jars to various nternal temperatures in heated water baths. The rates of heating were recorded and surviving organisms were detected and numerated after thermal processing. The results indicated that even though variable fat and moisture levels affected heating ates, cooking to constant final temperatures resulted in similar extents of destruction of *L. monocytogenes* cells among various meat formulations. Although curing ingredients reduced the extent of thermal destruction of *L. monocytogenes*, their effect was nore pronounced at temperatures below 65°C. Cooking uncured or cured ground pork of variable fat and moisture levels to emperatures of 63°C and higher resulted in reduction of *L. monocytogenes* cells by more than 6-7 log/g of meat.

YGIENIC QUALITY OF FROZEN BEEF IMPORTED IN SENEGAL

M. SEYDI - technical collaboration : A.L. KONE and A.N.BA

cole Inter-Etats des Sciences et Médecine Vétérinaires (EISMV) - BP 5077 - Dakar (Sénégal)

BSTRACT

ince august 1986, senegalese business men are regularly importing frozen beef from the E.E.C. Canada and S.A.. In doubt of the true origin and conditions of preservation of this meat, Dakar Port veterinary uthority has imposed its bacteriological examination. In order to assess their hygienic quality, 400 samples f frozen packed beef have been examined by our laboratory, using french official method. The counts carried ut are : aerobic plate, fecal coliform, anaerobic sulphite reducing organisms, staphylococcus aureus. almonella were also searched. The following results have be obtained :

235 samples (58.75 p.100) are SATISFACTORY

132 samples (33.00 p.100) " ACCEPTABLE

33 samples (08.25 p.100) " UNACCEPTABLE

he survey of the unacceptable samples revealed that storage conditions were faulty (defreezing-freezing perations- bad storage temperatures).

mported frozen beef have in the whole, a good hygienic quality.

HURDLE TECHNOLOGY APPLIED TO THE PRODUCTION OF CANNED POULTRY LIVER PATÉ

E.T.F. SILVEIRA, D.C.P. JARDIM, N.F.A. SILVEIRA, M.K. BARBIERI, H.K. ARIMA and I. SHIROSE
Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

ABSTRACT: Processing conditions to reach a minimum heat treatment for canned poultry liver paté (83x format) were optimized. Poultry liver, pork back fat, milk, egg, wheat flour and cognac with or additions of various combinations of the humectants sodium lactate (1 to 3%), propylene glycol (0,5 to 3%), (0,5 to 3%) and glucono-delta-lactone (0,2 to 0,5%) were used to formulate the patés, that were prepared tested within one week. Products were evaluated for proximate composition, sensory quality and microbio characteristics.

Preliminary trials revealed that the preserving effect of humectants tested was best maintaine control of the water activity of the product through regulation of added water or the use of gluconor -lactone.

Preference tests results showed that the paté processed with sodium lactate, propylene glycol, and glucono-delta-lactone at levels of 2%, 0,8%, 0,8% and 0,3% was the most prefered among the trea investigated. Water activity (aw) and pH values of the selected product varied from 0,91 to 0,92 and 6,17 respectively and Fo-value of 0,73 was enough to inhibity the *Clostridium sporogenes* PA 3679 inoculated at of 10^2 spores per gramma.

On the basis of the results obtained, it can be drawn that the hurdles investigated (Fo, and Eh) leads to quality improvement of canned poultry liver paté.

EXTENSION OF POULTRY SHELF-LIFE BY AQUEOUS CHLORINE AND ORGANIC ACIDS

N. N. TERRA, R. V. MELLO
Department of Technology and Food Science, University of Santa Maria, 97050 Santa Maria, RS, Brasil

Freshly processed poultry carcasses were dipped into chlorine solution (5 and ppm), association of ascorbic acid 1% and lactic acid 1% and distilled water. storage temperature was +5ºC. Changes in aerobic plate counts, coliforms and ps chrotrophic bacterias were monitored. The association of acids treatment provi ded an effective inhibitory system against the poultry spoilage organisms. shelf life of the association acids samples was extend 6 days over the control distilled water.
The treatments did not affect the organoleptic quality of the samples.

DENCE OF BACILLUS CEREUS IN SOME SELECTED MEAT PRODUCTS

EIN YOUSSEF, ALI LOTFI, SHAWKAT FATHI, GALAL ALI
l University, Faculty of Veterinary Medicine, Dpt of Food Hyg. ASSIUT, Egypte

l of 220 random samples of some selected meat products (70 samples from manufactured raw minced meat and 50 samples from of sausage, luncheon and basterma) were collected from different shops and supermakets, Assiut city, Upper Egypt and subjected for eration and isolation of Bacillus cereus.

ean value of B. cereus count was 2.2 x 10_5, 7.8 x 10_5, 5.8 x 10_5 and 3.8 x 10_5 per gram of examined raw minced meat, sausage, eon and basterma respectively.

e produced at pH 9 and pH 6.7 increased by 44.23 % & 80.77 %, 10.71 % & 28.57 %, 4.17 % & 66.67 % and 35.71 % & 50 % of s isolated from manufactured raw minced meat, sausage, luncheon and basterma respectively ; while TNase was produced at pH 9 2 % and 7.14 % of strains isolated from manufactured raw minced meat and sausage respectively.

ROBIAL BEHAVIOR OF FRESH SAUSAGES CONTAINING LAMB OR GOAT MEAT

ZAPATA, V. MATOS, F. TELLES, Z. GUEDES and M. VASCONCELOS
artamento de Tecnologia de Alimentos, Universidade Federal do Ceará, Caixa Postal 12168, 021, Fortaleza, Ceará, Brasil

tudy to evaluate the bacterial content of fresh sausages manufactured with lamb or goat t and stored for 30 days was conducted. Meats were used to formulate sausages containing levels of pork fat (16% and 27%) and two sodium nitrite concentrations (0 ppm and 100). Sausages stuffed into natural casings and packaged into nylon/polyethylene film with uum (76 cm Hg) or without vacuum were stored at 5 °C. Mesophiles, psycrophiles, coliforms, aureus and bacteria from genus Salmonella, Clostridium and Yersinia were searched for on meat and on the sausages with 0, 15 and 30 days storage.

sults indicated initial levels of mesophilic bacteria of about 10^4 CFU/g in lamb and goat meat and 10^2 MPN/g coliforms in goat raw meat. After 15 days storage sausages packaged thout vacuum had increased mesophiles, coliforms and S. aureus bacteria to levels of 10^5 /g, 10^2 MPN/g and 10^2 UFC/g, respectively, and psycrophiles to 10^6 to 10^7 UFC/g.

er 30 days storage without vacuum lamb sausages presented obnoxious odours and faded col s and goat sausages reached levels of about 10^7 UFC/g, 10^2 MPN/g, 10^7 UFC/g and 10^3 UFC/g mesophiles, coliforms, psycrophiles and S. aureus, respectively.

orage with vacuum packaging kept levels of bacteria in both lamb and goat sausages around 3 UFC/g, 10^2 MPN/g, 10^5 UFC/g and 10 UFC/g for mesophiles, coliforms, psycrophiles and S. eus, respectively, to the end of the 30 days storage period.

usage fat content seemed not to affect the growth of bacteria in this study. Although no ganisms from the genus Salmonella, Clostridium or Yersinia were found in this experiment ium nitrite (100 ppm) did not inhibit S. aureus growth in lamb or goat sausages.

Session 7

FERMENTED PRODUCTS

NFLUENCE OF STARTER CULTURES ON THE VOLATILE CONTENT AND AROMA OF DRY AUSAGE.

ERDAGUÉ J.L., MONTEL C.,TALON R., MONTEIL P.
ation de Recherches sur la Viande, Laboratoire Flaveur, INRA Theix, 63122 - CEYRAT, France.

The purpose of this work was to study the impact of starter cultures on the production of flavour compounds in y sausages.

The effect of six starter cultures corresponding to different combinations of lactic acid bacteria (*Lactobacillus ake L110, Pediococcus acidilactici 725, Pediococcus pentosaceus 716)* and different *Staphylococcus* species *taphylococcus carnosus 833, Staphylococcus warneri 863, Staphylococcus saprophyticus M31*) strains were tested l a total number of 30 dry sausages without spices.

At the end of ripening, volatile components from the sausages were extracted by a dynamic headspace method nd identified by gas liquid chromatography-mass spectrometry.

Type of starter and especially the type of *Staphylococcus* species were proved to have major effect on the level f volatile compounds in the dry sausages. Sensory analysis showed that the butter odour of the sausages was largely ependent on the catabolism of carbohydrates, and that curing and rancid odours were correlated with typical ompounds of lipids oxydation.

This study has shown that sausage flavour is highly modified by microbial combinations.

FFECT OF MEAT SPECIES ON PROTEOLYSIS DURING DRY SAUSAGE FERMENTATION

. DEMEYER, S. ÖTLES* and L. CARON
esearch Center for Nutrition, Animal Production and Meat Technology, University of GENT, elgium * OECD Research Fellow

roteolysis during fermentation and drying of dry sausage seems to involve the collaborative nd consecutive action of both muscle and bacteria proteases. Muscle proteinases of the athepsin D type, are mainly active during fermentation, whereas both bacterial and muscle eptidases, are mainly active during drying (Verplaetse et al, this conference). Eventual ifferences in meat species proteinase activity may exist analogous to differences in the alpain/calpastatin system observed by Ouali & Talmant (Meat Science,28, 331, 1990). Such ifferences should then be reflected in different patterns of proteolysis in fermented ausages, prepared from different meat species but using the same inoculum. Sausage batters 10 kg, standard formulation without lard) were prepared consecutively from frozen horse, ork and beef, using a 3d. old sausage mix (1%) as starter. Sausages (90mm, ca. 1 Kg) ere fermented and dried up to 21 days after filling. Samples were taken for determination f pH, lactate, myosin and actin (SDS-PAGE), free and peptide bound α-NH_2-N, ammonia and athepsin D activity 0, 1, 2, 3, 7, 14 and 21 days after filling. The results indicate that otal exo- and endopeptidase activity is equivalent to 400, 249 and 243 mmoles of released N er Kg DM in horse, beef and pork sausages respectively. In horse sausages, and to a less xtent, in beef sausages higher amounts total free and peptide bound α-NH_2-N are produced ith higher proportions of peptides, more actin and myosin degradation and higher cathepsin) activity than in pork sausages. Differences are apparent, mainly during the fermentation eriod. No differences were observed in rate of pH drop and amounts of latate produced iffered only slightly. Such differences in pattern of proteolysis, independent of bacterial inoculum may contribute extensively to flavour development.

EFFECT OF THE ADDITION OF THE ASPARTYL PROTEINASE FROM *Aspergillus oryzae* ON DRY FERM SAUSAGE PROTEOLYSIS DURING RIPENING

O. DIAZ, M. FERNANDEZ, G.D. GARCIA DE FERNANDO, L. DE LA HOZ and J.A. ORDOÑEZ
Departamento de Nutrición y Bromatología III (Higiene y Tecnología de los Alimentos), Facultad de Veterinaria, Universidad Com 28040 Madrid (Spain).

Proteolysis is a phenomenon leading to the release of small molecular weight compounds, which are precursors of, or directly pa in, the final flavour of dry fermented sausages. The present work is an attempt to enhance the proteolytic activity during ripenin sausages by using the aspartyl proteinase (AP) from *Aspergillus oryzae*.

Three batches of dry fermented sausage ("salchichón") were made using the common industrial method and adding no pr (control, C), 800 (P1) or 4500 (P2) enzyme units of AP. One unit represented the amount of enzyme that produced an increase of 1 un absorbance at 440 nm per hour, using azocasein (Sigma) as substrate (0.8% in TRIS buffer 0.2M, pH 6.5). Ripening was carried ou days, controlling the temperature, the relative humidity and the air flow in a laboratory ripening cabinet.

Microbial, pH and moisture changes showed a similar pattern in all batches, and also similar to that observed in conventi fermented sausages. However, water activity (Aw) was similar in C and P1 batches, while Aw of P2 batch was lower throghout probably due to the accumulation of proteolysis products. All nitrogen fractions, i.e. water soluble (WSN), non protein (NP phosphotungstic acid soluble (PTN), 5% sulfosalicylic acid soluble (SSN) and total volatile basic (TVBN) nitrogens were much greate proteinase added batches than those in the control. At the end of the ripening, the values (g nitrogen/100 g dry matter) reached in the batch for the above mentioned fractions were 1.26, 0.48, 0.33, 0.23 and 0.12, respectively. The same nitrogen fractions reached, in re the control batch, values about 150, 300, 250, 350 and 200% for the P1 batch and 250, 350, 300, 600 and 250% for the P2 batch.

At the end of ripening, sausages were organoleptically judged by a 20 members panel. The added proteinase amounts and the ripening conditions used in this work produced an excessive proteolysis which led to a remarkable softening in the proteinase added This effect was in accordance with the nitrogen fraction increases observed throghout the ripening process.

THE INFLUENCE OF NITRITE ON THE FORMATION OF BIOGENIC AMINES IN DRY SAUSAGES

S. EEROLA, R. MALJALA, P. HILL

National Veterinary Institute, Departement of Chemistry, Helsinki, Finland.

Dry sausages were manufactured in the pilot plant with three different levels of nitrite (1 = 50mg/kg $NaNO_2$, 2 = 120mg/kg Na 3 = 200 mg/kg $NaNO_2$). The fermentation was performed with five commercial starter cultures : Backtoferment 62, Duplofe Pentoferment 85, Condi-Rasant 820/10 and Flora-Carn SL. Amines, nitrite, nitrate, pH, aw and microbiological counts were during ripening of sausages. Nitrite eliminated during fermetnation process. After 49 days of fermentation the nitrate concentra less than 10mg/kg in all samples. The amines of different nitrite levels were compared to each other by calculating biogenic am (=BAI) for each sausages. Addition of nitrite had no effect on amine formation when fermentation was performed with oth cultures than Pentoferment 85. With this starter culture the lowest BAI was achieved as 200 mg/kg $NaNO_2$ was added.

RMETS OF 3 BACTERIA ISOLATED FROM DANISH CURING BRINES IN A STERILE MEAT MODEL SYSTEM.

Sven, L.L. & Andersen, H.A.

of Dairy and Food Sciences, The Royal Veterinary and Agricultural University, Thorvaldsensvej 40, DK-1871 Frederiksberg, Com rk.

ffects of *Vibrio proteolyticus* (168), *Halomonas elongata* (16) and *Staphylococcus carnosus* (65) isolated from danish curing brines been examined in a sterile meat model system by monitoring pH, nitrite and nitrate changes, by head space gaschromatography C) and semiqualitative sensory analyses by smell. The effect of disrupted bacteria was examined as well. Microbiology was ored by standard plate counts.

e sterile meat cuts were injected with brine containing bacteria, disrupted bacteria or control. The meat cuts were subsequently mpacked and stored at 20°C for 14 days.They were sampled 2, 6, 8, 10 and 14 days after production. Smell analyses were carried out 4 days.

oduced nitrite and reduced nitrate, while there was no effects from 16 and 65. No effects of the bacteria on pH could be observed. C analyses showed that 168 produced 2 peaks after 6 days, while there was no effects of 16 and 65. The smell analyses showed that ad a characteristic smell called cheesy, but it was not possible to smell difference between 16 and 65 and their controls, respectively. counts showed that 16 and 65 did not grow in the meat, but remained at approx. 10^5 cfu/g, while 168 died out after 8 days. This ided with changes in nitrite, nitrate and HSGC which became significant after 6 days. Injection of disrupted bacteria did not produce effects, and 168 was therefore probably entering a state of dormancy after 8 days.

uld be concluded that 168 was able to induce effects in a sterile meat model system, but whether these effects had a positive influence e overall flavour is still not known.

HEMICAL CHARACTERIZATION OF LACTOBACILLI FROM DRY FERMENTED SAUSAGES

UGAS, M. GARRIGA, T. AYMERICH and J.M. MONFORT.

. Meat Technology Center. Granja Camps i Armet s/n. 17121 Monells. SPAIN.

characterization of 254 strains isolated from dry fermented sausages from 15 different essors at different stages of ripening time is presented.

species identified were L.sake 55%, L.curvatus 26%, L.bavaricus 11% and L. plantarum 8%. The criteria for the identification of isolates to species level were: production of lactic isomers, presence of mDpm acid in cell walls, deamination of arginine and fermentation of bitol and melibiose.

l processors L.sake was the main species present followed by L.curvatus. In the rest of facturers L.curvatus was the predominant species. In every stage of sampling L.sake was the ies most frequently isolated.

deamination of arginine was tested in aerobic and anaerobic cultures and in different media checking the production of ammonia and detecting the production of citrulline. In 94% of ains tested both methods agreed. In two L.sake strains arginine catabolism was dependent on ture media, in two other L.sake strains the deamination of arginine only occurred when oxygen scarce.

EFFECT OF STARCH ADDITION IN THE QUALITY OF FERMENTED SAUSAGES

VICTOR KURI H., EDITH PONCE A., ISABEL GUERRERO L. and FRANCISCO GALLARDO E.

Departamento de Biotecnología, Universidad Autónoma Metropolitana-Iztapalapa, Apartado Postal 55-535, Mexico D.F., Mexico.

Fermented, shelf stable meat products, such as salami, represents a safe alternative for protein sour tropical zones where refrigeration facilities are not easily available. However, because of raw mater production costs, this type of product in not accesible for low-income populations.

The addition of low cost starch materials to cooked meat products is commonly done in order to decrea to the producer and the consumer. Although there are many reports in the literature regarding microbi chemical changes associated with lactic acid fermented meats, the information about the effect on qua fermented meat products extended with starches is very limited.

The objective of this work was to study the changes in quality (volatile production, sugars and fat o in fermented sausages extended with starch, during the fermentation and ripening processes.

Fermented sausages were prepared in a traditional way, imitating Italian salami. Part of the meat was substituted with potato or corn starch up to 4% w/w. Production of short-chain fatty acids and lactat followed during a 30 day ripening period. Other response variables were pH, acidity, colour (by Hunte and diamine production; this last as an indication of decomposition.

During the initial fermentation period, the samples did not show significant differences for any of t variables. However, colour and texture (evaluated by a taste panel) as well as fatty acid production significant differences at the end of the ripening process.

It is assumed that during the fermentation period (first 24 hours) the metabolic pathway of lactic ac bacteria was not altered by the presence of starch, due to the fact that these microorganisms make use of the sugar added to the meat formulation (sucrose). However, at the end of the ripening period, pro due to the presence of moulds, production of lactic acid became of second importance due to the produ of some metabolites which produce off-flavours and aromas, as well as colour fading.

Predictive Microbiology: Targeted Control of Fermentation Processes

A. Landvogt and B. Landvogt

NORDRECO AB, Box 520, S- 26700 Bjuv, Sweden

In the production of dry sausage it is important to adjust the ripening conditions precisely to the selected starter optimum acidification performance has to be achieved. However, the effect of ripening parameters are not suffici known, and so far is has been impossible to achieve targeted control during the fermentation process. Therefo concept of determining the acidification performance of starter cultures in dry sausage was developed. It is distin the fact, that the chosen experimental conditions correspond largely to the conditions present during dry sausage rip thus provide results, that can be applied under practical conditions. The combined influence of temperature and wat as ripening factors on the lag-phase and acidification capacity of different strains of *Lactobacillus* and *Pediococcus* stigated. By applying the modified linear Arrhenius model of DAVEY on the data it was possible to predict the effects of temperature and water activity on the acidification performance and the lag-phase. The model is easy to by using linear least squares regression procedure of nearly every spreadsheet. Therefore, the acidification po during ripening can be predicted and influenced in a targeted way by means of a simple mathematical model.

acteriophages in Commercial Meat Fermentations

Barbara Marchesini, Walter Gaier, and Rod Moreton
Nestlé Research Centre, Vers-chez-les-Blanc, Lausanne, Switzerland

Bacterial strains used as starter cultures for fermented meat products are susceptible to bacteriophage lysis. The presence of bacteriophages has now been shown in starter cultures themselves as well as in commercially fermented meat products form Germany, Italy and Spain. Phages lysing strains of *Lactobacilli*, *Micrococi* and *Staphylococci* used as starters have been isolated and characterised by electron microscopy, microbiological and biochemical techniques. Despite the widespread distribution of these phages they do not apparently cause such serious problems as with fermented milk products -or do they?

It was shown that a *Lactobacillus plantarum* strain isolated from a commercial starter culture is lysogenic. The phage released was partly characterised and compared to a virulent phage lysing the same strain. The virulent phage was isolated during a commercial production of fermented raw sausage. The fact that phages can be isolated from starter cultures and fermenting sausages shows, that there is an influence which may explain the poor competivity of many commercial starter strains. The growth of the indigenous flora may mask the action of phage lysis of the starter strains. These circumstances should be taken into consideration when choosing starter cultures.

MEAT-BASED MODEL SYSTEM FOR FERMENTATION STUDIES.

J. F. P. MARTINS and W. F. HARRIGAN
Department of Food Science and Technology, University of Reading, Reading RG6 2AP, UK.

The simulation of raw meat fermentation attempts to deal with difficulties related to solid-state fermentation systems. A liquid model-system was devised using pork, beef, sucrose, glucose, manganese, phosphates and nitrite. Refrigerated lean pork tender loin and beef topside were minced, vacuum packed in double layer plastic bags and irradiated to 4.5kGy by the submersion technique. A solution was prepared with salt, sugar, and water ingredients and sterilized by autoclaving at 121°C for 15 min. The cold meat (5°C) was mixed with the cold (4°C) salt-sugar solution and homogenized in a Waring blender. Filter sterilized nitrite solution was added to the medium to a final concentration of 100 ppm immediately before inoculation. The pH, buffering capacity (B), and a_w of the particualte medium were simulations of those found in salami mix. Pediococcus sp. CCM 822, P. pentosaceus NCFB 1220, P. pentosaceus NCFB 559, and two commercial strains (Chr. Hansen's P. pentosaceus and Lactobacillus bulgaricus) were subcultured as axenic cultures into the liquid system and showed similar pattern of growth compared to laboratory-prepared salami mix. Similar results were also observed with a cocktail culture of Staphylococcus aureus strains. A further development to allow simulation of water losses during early stages of fermentation was tested against those strains and commercial cultures of Lactobacillus alimentarius and L. sake. The pH profiles were similar in both media.

ORMATION OF HISTAMINE IN VACUUM PACKED FERMENTED SAUSAGES

. PIPEK, F. BAUER and G. SEIWALD

stitute of Meat Hygiene, Meat Technology and Food Science, University of Veterinary Medicine,
nke Bahngasse 11, A-1030 Vienna, Austria

During the fermentation of raw sausages different amounts of histamine are formed due to the age of the raw material and the esence of histidine decarboxylating microorganisms. The increasing number of self service shops and a changed consumer haviour require sliced and vacuum packed fermented sausages. The objective of this study was to investigate, whether histamine ll be formed during storage in vacuum package und the causes of its formation. Investigated materials were raw sausages rmented under different conditions and stored up to 8 weeks in vacuum package - sliced and unsliced - at 5°C or room mperature. Additionally pH-value was measured and a bacteriological examination was carried out.

The content of histamine of vacuum packed fermented sausages did not increase during storage regardless to storage mperature and the initial amount of histamine as long as the water/protein ratio remained below 1.3. Differences between sliced d unsliced vacuum packed sausages and non vacuum packed samples could not be obtained. If the water/protein ratio exceeded 8 (fermented sausages ripened for a shorter period) the formation of histamine increased more than sixfold (e.g. from 22 mg stamine /kg dry matter to 145 mg/kg). Storage of fermented sausages in vacuum package also did not affect the pH-value or fluence the count of microorganisms significantly.

It can be concluded that only long ripened raw sausages are suitable for vacuum package. Regarding the formation of histamine rmented sausages with a water/protein ratio of above 1.8 cannot be recommended for this kind of storing conditions.

STUDY OF A "UŽICE BACON" – TRADITIONAL FERMENTED MEAT PRODUCT : PROCESSING AND CHARACTERISTICS

R. RADOVANOVIĆ, D. ČAVOŠKI, P. BOJOVIĆ, M. PERUNOVIĆ, D. VELIČKOVIĆ and G. ČARAPIĆ *

Meat Science Department, Institute for Food Technology and Biochemistry,
Faculty of Agriculture, 11080 BELGRADE – ZEMUN, Nemanjina 6, Yugoslavia;
* IM "Čajetina.., 31310 Čajetina / Zlatibor, Yugoslavia

rocessing of well–known fermented meat products of beef, pork and mutton has a long and very rich tradition in the region of ountain Zlatibor in Yugoslavia (south–west of Serbia). Proccesing process is seasonal and lasts from November to February. Usually, it s an additional activity for farmers households, but sometimes it is also a part of manufacturing program of export slaughter–house IM "Čajetina", situated in a small mountain town Čajetina. In the structure of these high quality and in Yugoslavia widely appreciated nd demanded products, the significant portion is taken by "UŽICE BACON" (about 25%) which is the object of the present study. "UŽICE BACON" is processed according to traditional technology that has been used for many decades and passed on from generation generation. This shelf–stable fermented product is made of whole, boneless and formed pork sides with skin, including bladebone artilage (cartilago scapulae) and tip of breast bone (cartilago xypoidea), but without head, forequarter hock, hindquarter hock and ail. Processing lasts approximately four weeks (7–10 days salting; 21 days drying and smoking) and in that period weight loss or rocessed pork sides is usually from 17–20%. Final product has extraordinary favourable sensory characteristics and optimum salt NaCl) content of about 3%.

PEPTIDASIC ACTIVITIES OF STARTER CULTURES

M.C. MONTEL, R.TALON, M. CANTONNET and J. CAYROL.
Station de Recherches sur la viande INRA Theix 63122 Saint-Genès Champanelle, France

During the ripening of sausage the levels of free amino acids increase. Some amino acids have an effect on the fla
of meat products by themselves or because they are metabolized into carbonyl compounds. Besides endoge
peptidasic activities the peptidases from the bacterial starter cultures could be also involved in the production of a
acids. This study was undertaken to determine what are the proteolytic system of the species of *Lactobac*
Pediococcus, Staphylococcus used as starter cultures.
Proteolytic and peptidasic activities were measured in resting cells and in supernatant cultures. Specificit
aminopeptidases was determined with amino acid naphtylamide or notroanilide derivatives as substrats.
None species tested hydrolysed hemoglobin, casein, bovine albumine. Only *Lactobacillus plantarum* showe
activity on azocasein.
Each species was characterized by arylamidase pattern. *Pediococcus pentosaceus, L. plantarum* and *Lactobacillus s*
were active on a large number of substrates, whereas *Carnobacterium piscicola* and *Staphylococcus carnos*
Staphylococcus xylosus, Staphylococcus saprophyticus only hydrolysed a few.
In particular *L. sake* showed a high activity with hydrophobic amino acid (leucine, alanine or phenylalanine)
diaaminomonocarboxylic (Lysine or arginine). Some activities were released in the supernatant by lysis of bacteria
The peptidase activities were more important in lactic acid bacteria than in *Staphylococcus* strains but their effe
occurence in the production of amino acids in sausages remains to demonstrate.

FERMENTATION OF DRY SAUSAGE - THE EFFECT OF ADDED PROTEINASE AND LIPASE FROM LACTOB

H. Næs, B.O. Pedersen, A.L. Holck, L. Axelsson, V. Holten and H. Blom
MATFORSK, Norwegian Food Research Institute, Oslovn. 1, 1430 Ås, Norway

Various groups of microorganisms are used to ferment dry sausage. The lipolytic and proteolytic activity of the involved microorganisms contribute to flavour formation. Thus, experiments where proteinase (from *Lactobacillus paracasei* ssp. *paraca* NCDO 151) and lipase (from *Lactobacillus plantarum* MF 32) were added to the sausage mix were performed. Colour develo (L*,a*,b*), pH, degradation of water soluble proteins, NPN, individual amino acids and total fatty acid composition were follo 42 days, after which sensory analysis and triangle test were performed. In the triangle test experiment, the proteinase sausage found significantly different from the control and lipase sausages. With the addition of proteinase, colour developed differently compared to control and lipase sausages, although after 42 days all three colour coordinates were equal to those found in the c and lipase sausages. Proteinase also caused a rapid decrease in pH, down to 4.5 in three days as compared to 4.95 for the cont lipase sausages. NPN showed no differences between the three sausages at any stage of the fermentation and maturation period Degradation of water soluble proteins as determined from SDS-PAGE revealed differences when comparing the proteinase sau with both the control and lipase sausages. Extraction with saline buffers did not disclose any significant differences in the prot patterns of the three sausages. The amounts of free individual amino acids as quantified in percentage of internal standard, afte extraction and analysis on HPLC, are of equal quantities, developing at the same rate in all three samples. Fatty acid analysis s large differences. Proteinase and control sausages have the highest quantities of all the fatty acids analyzed, from C-14 to C-18 first 21 days. After 42 days, virtually no differences appeared between the three sausages.

ENTIFICATION OF VOLATILES FROM ITALIAN DRIED SALAMI

STAHNKE AND P.ZEUTHEN

partment of Biotechnology, The Technical University of Denmark, block 221, DK-2800 Lyngby

part of an on-going project concerning the development of aroma in fermented sausages ifferent types of commercial Italian dried salami were investigated.

olatile compounds from salami without casing were collected on adsorbent tubes by a flow of itrogen and the adsorbed compounds extracted from the tubes with a minute amount of ethylether. The resulting extracts were analyzed by gas chromatography and mass spectrometry. ost of the identified volatiles were classified as either ketones, aldehydes, alcohols or cids. Many of the compounds were common for all the different salamis, some, however, seemed be specific for a particular type. While some of those evidently came from added spices, thers may have originated from the action of bacteria or fungi.

IPOLYTIC ACTIVITY OF *MICROCOCCACEAE*

. TALON, M.C. MONTEL AND M. CANTONNET

ation de Recherches sur la Viande, INRA Theix, 63122 Saint-Genès-Champanelle, France.

icrococcaceae are used as starter because of their ability to reduce nitrate, to produce catalase and to contribute to avour. Lipolytic activities are often mentioned to play a role in flavour. However few data are available on these ctivities and most of the strains studied were not identified. So, fifty two strains of *Micrococcaceae* identified in the boratory have been studied for their lipolytic activities.

he screening was done by the method of Kouker and Jeager (1987) using three substrats : tributyrin, triolein and pork t.

ipolysis of pork fat by the most lipolytic strains was measured at 0, 3, 10, 17 and 30 days incubation by titrimetry ccording to the method of Flechet and Chilliard (1985).Viable counts were enumerated with Chapman medium incubated 24°C for 48h.

saprophyticus , *S. warneri* and *M. varians* , strongly lipolytic on triolein and pork fat, were selected to measure the polysis of pork fat during long incubation period.

hese species showed different patterns in lipolysis of pork fat. The strains of *S. saprophyticus* released the fatty acids uring all the incubation period. For the strains of *S. warneri* , after an increase in free fatty acids (FFA) during the first ree days of incubation, the FFA stayed at the same level during the 7 following days and rose again until the end of ncubation. Only the sample inoculated with *M. varians* had a level of FFA that dropped after 10 days of incubation.

PROCESSING OF FERMENTED SAUSAGE USING STARTER CULTURES

N. SHARMA and R. MUKHOPADHYAY

National Research Centre on Meat, Indian Veterinary Research Institute, Izatnagar, U.P. India.

In India the meat fermentation technology has not been developed and commercial starter is not available for the production of fermented sausages. The purpose of the present research employ the starter cultures used by the dairy Industry and to study the relative effects of starter over the natural fermentation for processing of fermented sausages. Three strains of lactic acid namely Lacto bacillus acidophilus, lacto bacillus plantarum and Streptococcus lactis were used. titrable acid and percent loss of weight were monitored during ripening.

The type of starter culture and duration of fermentation significantly affected the pH, acidity and percent loss of weight of sausages during ripening. The control group of sausages with starter showed highest ultimate pH and L. acidophillus showed lowest utilimat pH. Titrable acid (Lactic acid) was found highest in the sausages treated with L. plantarum followed by S. lactis, L. phillus and control group. Sausages had lost their weight significantly during fermentation and phase. The lowest weight loss was recorded in control group. Among the starter cultures, the weight was highest for the sausages made with L. plantarum and no significant difference was between the groups containing L. acidophillus and S. lactis. Treatment with L. plantarum produced acceptable sausage over the other two starters and natural fermentation.

OCHRATOXIN A PRODUCTION IN DRY SAUSAGE BY PENICILLIUM VERRUCOSUM VAR. CYCLOPIUM STRAINS

M. ŠKRINJAR and T. HORVAT-SKENDEROVIĆ

Faculty of Technology, University of Novi Sad, 21000 Novi Sad and D.D. 29, 24000 Subotica, Yugoslavia

The objective of present study was to examine the possibility of ochratoxin A (OA) production in „tea sausage", a sausage, by four P. verrucosum var. cyclopium strains.

Penicillium strains tested were isolated from the air in smoke-house and from the surface of a dry sausage. In experiments this fungal strains were analyzed on OA production in laboratory conditions growing on ground and st grains at 26 to 28°C for 20 days. In further experiments, the possibility of OA production in dry sausage during the r storage periods by toxigenic P. verrucosum var. cyclopium strains were investigated.

After filling, sausage surface was inoculated with a suspension of fungal conidia (10^6/mL). Sausage was dipped i suspension for 10 to 15 min, and than strained and smoked for 2 to 3 days. Mycotoxicological analysis were done and 20th day of the ripening and on the 10th and 15th day of the storage period. Experiments were carried processing plant. All tests were done in triplicates. Determination of OA was performed by using a method accordi et al. (1978), which was slightly modified.

The results obtained indicated that dry sausage was a good substrate for fungal growth and for toxin production fungal strains tested produced OA already after ten days of the ripening (12.0 to 20.0 µg/kg). The highest concentra (50.0 µg/kg) was found at the end of ripening period synthesized by P. verrucosum var. cyclopium, strain L II 14A.

BIOCHEMICAL CHARACTERISTICS OF DRY SAUSAGES IN RELATION WITH STARTER CULTURES

R. TALON, M.C. MONTEL, J.L. BERDAGUE AND M. CANTONNET
Station de Recherches sur la viande , INRA Theix, 63122 Saint-Genès-Champanelle, France.

Starter cultures are extensively used in the manufacturing of dry sausages. They consiste of lactic acid bacteri *Micrococcaceae*. Their metabolic activities play a role in acidification and could be involved in the flavour o products. So it is important to know their effects in the products.

Three strains of lactic acid bacteria - *Lactobacillus sake, Pediococcus acidilactici, Pediococcus pentosaceus*- and strains of *Staphylococcus* -*Staphylococcus carnosus, Staphylococcus saprophyticus, Staphylococcus warneri*- selected for their acidifying properties, peptidasic and lipolytic activities. They were inoculated in sausages mixtur 40 days of ripening, in control and inoculated sausages, the following measures were done : pH, D and L la acetate contents by enzymatic methods, free fatty acids by titrimetry.

At the end of ripening, the sausages inoculated with different starter cultures and the control were well discrimina biochemical characteristics studied. It appeared that sausages inoculated with *L. sake* had the higher D lactate co and the lower pH. these two parameters seemed well correlated. Sausages inoculated with *S. saprophyticus* characterized by a high acetate content. Lipolysis occured in control sausages but was greater in those inoculated *S. warneri.*

The effects observed in the sausages were in agreement with the biochemical properties of the starters studied *in v*

COMPARISON OF THE RATES OF pH REDUCTION AND LACTIC ACID ACCUMULATION DURIN GLUCOSE FERMENTATION IN BEEF SAUSAGE

M. J. TSOU, W. C. BRIDGES, Jr., R. L. DICK and J. C. ACTON
Department of Food Science, Clemson University, Clemson, South Carolina, 29634, USA

The rates of glucose fermentation by Pediococcus acidilactici, Pediococcus pentosaceus a Lactobacillus plantarum were studied in ground beef mixes at temperatures from 24.3 to 45.0 using general chemical reaction kinetics. Fresh ground beef sausage mixes containing cu agents, seasonings, salt and 1.0% glucose were inoculated with one of the respective sta cultures, stuffed into casings and then placed at one of five temperatures for fermenta Fermentation measures of pH reduction (hydrogen ion concentration) and lactic acid accumula (g/100 g mix) at each temperature were generally found to fit first order reaction rates for ea of the bacterial species during their active growth phase. Arrhenius plots of the two fermenta measures did not agree when resulting activation energies were compared. Activation energ determined from pH reduction were 2.4 to 4.3 times higher than the activation energies determ by lactic acid accumulation. These results indicated that the buffering capacity of mus proteins and other sarcoplasmic substances for hydrogen ions is an important variable measuring the extent of fermentation through pH reduction.

DOGENOUS AND BACTERIAL PROTEOLYSIS IN DRY SAUSAGE FERMENTATION

VERPLAETSE*, S. GERARD, ELKE BUYS and D. DEMEYER
esearch Center for Nutrition, Animal Production and Meat Technology, University of GENT,
lgium * Ter Beke NV, Waarschoot, Belgium

PN concentrations up to 20% of total N (TN) have been reported repeatedly for dry
usage. Major production of NPN takes place during the fermentation period, whereas in the
ying period there is a shift in NPN composition from peptide N to amino acid and ammonia N
d from nucleotide to nucleoside N. Proteases comprise two groups called proteinases or
dopeptidases and peptidases or exopeptidases. The former seem to be active mainly in the
rmentation period, the latter in the drying period.In dry sausage, both may be of
cterial and/or endogenous origin. Using antibiotics and specific protease inhibitors it
s tried to evaluate the relative importance of bacteria and muscle enzymes in both
ptidase and proteinase activity. Sausages were prepared using backslopping as starter,
th and without an added antibiotic - antimycotic cocktail (streptomycin, penicillin G and
photericin). The cocktail was used with and without glucono - delta - lactone (GDL),
hereas the specific protease inhibitors pepstatin and leupeptin were used with GDL. After
3 and 21 days of ripening, meat proteins were analysed by semi-quantitative SDS-PAGE and
actate, acetate, ammonia, free and peptide bound α - NH_2 - N determined. Results show that,
n the presence of GDL, myosin degradation is inhibited (ca. 80%) by pepstatin but not by
ntibiotics. Total NPN production is inhibited by antibiotics and GDL (ca. 60%) and by
epstatin with GDL (ca. 70%). Both, antibiotics and pepstatin, shift NPN composition to
ore peptides, less free α-NH_2-N and less ammonia, but the effect is more pronounced with
ntibiotics. Results are consistent with a collaborative and consecutive rôle of muscle
athepsin D and bacterial enzymes in proteolysis, the former preparing peptide substrates
or the latter.

Session 8

THE BIOCHEMISTRY OF MEAT AND MEAT PRODUCTS SHELF LIFE

(CONCURRENT SESSION)

-ENZYMIC CATALYSIS OF MICROSOMAL LIPID PEROXIDATION BY ACTIVATED-METMb. DETECTION MYOGLOBIN-DERIVED RADICALS BY ESR SPECTROSCOPY.

ANTON, Ph. GATELLIER & M. RENERRE
on de Recherches sur la Viande, INRA, Theix, 63122 St-Genès-Champanelle

branal lipid peroxidation and myoglobin oxidation are closely coupled in beef meat but the basis of these relationships are always largely own. Enzymic system(s) and "activated-metmyoglobin" leading to free-radical chain reaction, are involved in lipid peroxidation and lopment of WOF in raw meat.

aim of this experiment was to study the non-enzymic catalysis of microsomal lipid peroxidation by "activated-metmyoglobin". two bovine muscles (*longissimus lumborum and psoas major*) different from the viewpoint of colour stability, microsomes were ared (Apgar and Hultin, 1982) and oxymyoglobin, purified on a Mono-Q column (Gatellier et al., in press), was transformed in myoglobin. After interaction of H2O2 with metmyoglobin, to obtain "activated-metmyoglobin", non-enzymic lipid peroxidation of osomal fraction (Kanner and Harel, 1985) was followed by the determination of TBA-reactive substances (Sunderman et al., 1985). ction of myoglobin-derived radicals was recorded by optical and electron spin resonance spectroscopy (Davies, 1990). ESR spectra were rded at room temperature using a Brucker ER 200D after mixing of metmyoglobin, H2O2 and the spin-trap DMPO.

as shown that non-enzymic lipid peroxidation followed during 24 h was much more prononced with microsomes extracted from *psoas* r muscle which is more color-labile. By optical spectroscopy, it was noted that myoglobin (IV) species may be formed. The addition of osomal fraction to the mixture H2O2-metmyoglobin gave rise to a competition between the spin-trap and membranal phospholipids ards free-radicals species leading to a decay of ESR signal. The protein-derived radical may be responsible for initiating membranal lipid xidation in muscle.

OLUTION OF INTRAMUSCULAR LIPIDS DURING PROCESSING OF DRY-CURED HAM

ange BUSCAILHON, G. GANDEMER and G.MONIN
ion de Recherches sur la Viande, INRA, Theix, 63122 Ceyrat, France

The quantitative and qualitative evolutions of intramuscular lipids were studied during the processing of "french " dry-cured hams. The amounts and the fatty acid composition of glycerides, polar lipids and free fatty acids (FFA) e determined in the *Biceps femoris* muscle at different times in the course of processing. Thirty fresh hams were yzed. The 30 symetric hams were processed, and groups of 10 were taken at 2, 6, and 9 months after the beginning rocessing.

Lipolysis occurred and continued during the whole processing time, as shown by the increase (+ 80 %) in level. This phenomenon seemed to affect chiefly the polar lipids, since this fraction decreased dramatically (- 70 %) ng processing. By contrast, the amounts of glycerides, which represented 86-88 % of the intramuscular lipids in the h meat, did not change significantly. This indicated that glycerides were little hydrolyzed.

No significant change was found in the composition of any fraction. This observation indicated that bably the fatty acids underwent little oxidation.

THE EFFECT OF DIETARY α-TOCOPHEROL AND SUNFLOWER OIL ON THE OXIDATIVE STABIL CHICKEN TISSUES.

S. Brandon *[1], P.A. Morrissey[1] and D.J. Buckley[2].
Departments of Nutrition[1] and Food Technology[2],
University College Cork.

The effects of feeding fresh or heated sunflower oil on the α-tocopherol status and on the o stability of chicken muscle and organ tissues were investigated.
Chicks were fed fresh or heated sunflower oil (140°C x 24 h; 54 meq peroxide oxygen/kg) co basal levels of 30 mg of α-tocopheryl acetate/kg feed or supplemented levels of 200 mg/kg ove week period.
The consumption of heated sunflower oil resulted in significant reductions in α-tocopherol c dark and white broiler muscle and in heart, lung, liver and brain. Heated sunflower oil res increased rates of oxidation in all the tissues studied.
However, overall dietary α-tocopheryl acetate supplementation had a significant protectiv against peroxidation in these tissues.

SPANISH DRY-CURED HAM : PHYSICAL AND PHYSICOCHEMICAL STUDY

A. D. CAMPO-FERNANDEZ, J. A. PEREZ-ALVAREZ, M. E. SAYAS-BARBERA, M. J, V. CATALA

Departamento de Tecnología de Alimentos. Universidad Politécnica de Valencia. Camino d 46022 Valencia Spain

ABSTRACT

The Spanish processed meat industry traditionally made Dry-Cured products like " Ch Salchichón ", but the most important of these type of products is the Dry-Cured Ham. The Spa the highest consumption of this product in the world. In 1991 the Spanish processed mea 173,000 Tm.

The aim of this work is the study of physical and physicochemical parameters in the dry stage. The study was made with 6 female hams. The zone under study were delimited between part of the femur bone and the perpendicular zone at that bone. The muscles under study we were : **Semimembranosus**, **Semitendinosus** and **Biceps femoris**. The samples were take after the beginning of the process. The physical parameters under study were CIE L*a*b* nitrosation (nitrosation index), pigment discolouration (red colour stability), and the phys parameters were water activity, pH, fat, salt concentration, residual nitrite level, and moist **Semimembranosus** ·muscle showed different behavior in all parameters except in pH and res level. Water activity, moisture and salt concentration showed a gradient between all muscles regression analysis were made for L*, a*, b*. L* was related to water activity and moist correlation coefficient of 0.823, a* was related to residual nitrite level and red colour stabi correlation coefficient of 0.907, b* was related to red colour stability and water activity with coefficient of 0.890

CTS OF SOME FOOD ADDITIVES ON MUTAGEN FORMATION DURING FRYING OF GROUND BEEF

HEN, A.M. PEARSON and J.I. GRAY

rtment of Food Science and Human Nutrition, Michigan State University, East Lansing, igan 48824 USA

ave shown earlier that several of the synthetic antioxidants (BHA, PG and TBHQ) ease meat mutagen formation, apparently by blocking free radical pathways. Not all cooking of mutagen synthesis, however, is due to the free radical pathway. Thus, we have ed different food additives to ground beef and determined their effects on mutagen ation during frying. Mutagenicity was assessed using the Ames Test. The food itives utilized included bisulfite, nitrite, pyrophosphate, citrate, ascorbic acid, vitamin E and liquid smoke. All of the food additives studied inhibited formation of the t mutagens in variable amounts at different concentrations, except for pyrophosphate at pm which was ineffective. Bisulfite at 10ppm was the most effective blocker of mutagens was followed in order by liquid smoke (100ppm), ascorbic acid (100ppm), vitamin E (10% fat), nitrite (10ppm) and citric acid (100ppm). Results suggest that blocking of meat agen formation may occur through a mechanism that inhibits lipid oxidation or formation Maillard reaction products. Another explanation could be the effect of the different itives in stabilizing the sugars in meat to prevent free radical formation during the ly stages of the browning reaction.

V. SICAL AND PHYSICOCHEMICAL STUDY OF SPANISH " SALCHICHON " DURING RIPENING

A. GAGO-GAGO, J. A. PEREZ-ALVAREZ, M. E. SAYAS-BARBERA, M. J. PAGAN-MORENO, de RODRIGUEZ-LOPEZ, A. BALLESTER, V. ARANDA-CATALA

rtamento de Tecnología de Alimentos. Universidad Politécnica de Valencia. Camino de Vera 14 46022 ncia SPAIN

ABSTRACT

" Salchichón " is a Spanish dry fermented sausage that has a similar processing to Salami. In Spain is popular than " Chorizo ", but now has a significative increase in production.
The aim of this work is to study the differences of diameter in raw fermented sausage in the ution of physical and physicochemical parameters during the " Salchichón " process. The study was ire with 50 " Salchichón" samples. The " Salchichón " samples were filled with artificial casings with meters of 55 and 65 mm, the weights of " Salchichón " samples were 500 g approximately. The sausage e collected at different times : at mixing time, and 0, 1, 2, 4. 11, 18, 25, 30 days after stuffing. The sical parameters under study were : CIE L*a*b*, pigment discolouration, pigment nitrosation, and the sicochemical parameters were : water activity, moisture, pH , nitrite residual level, salt concentration, lactic acid percent.
Visually the samples darkened, L* vs process time shows no correlation, b* decrease during stuffing found no significative differences between the different diameters. For the other parameters under only Lactic acid percent and pH show no significative differences between diameters.

HEME PIGMENTS EVOLUTION DURING RIPENING OF DRY CURED IBERIAN HAM

C. GARCIA, J.J. CORDOBA, M.A. ASENSIO, E. BERMUDEZ, T. ANTEQUERA and J. VENTANAS
Higiene y Tecnología de los Alimentos. Facultad de Veterinaria. 10071 Cáceres. Spain.

In the elaboration of dry cured ham, nitrate and nitrite are generally applied to the surface of the thighs obtaining a stable red co
time is necessary to allow these salts to reach deep muscles. However, the high content of both inter- and intramuscular fa
down the diffusion process. Knowing the rates of nitrate and nitrite diffusion and myoglobin nitrosylation would be nece
suggesting any change to the processing of dry cured ham.
The aim of the present work was to analyze the evolution of heme pigments during ripening of Iberian ham, and its relati
conditions of processing.
Twenty five thighs from pure Iberian and 25 from IberianxDuroc (75/25) pigs were rubbed with a mixture of salts containing
nitrite. Then, they were processed at environmental conditions, following the traditional method for 18 months. Sampling wa
at different stages of processing at both superficial (*semimembranosus*) and deep (*biceps femoris*) levels. Moisture, lipid, chl
and nitrite content, and pH were determined. Total heme pigments, nitrosyl and metmyoglobin were quantified after extractio
and acetone/water (40/10).
According to the levels of nitrate and nitrite found in deep muscles, curing salts diffuse faster in Iberian thighs probably due
weight. In spite of that a relatively high content of nitrate and nitrite was reached in both muscles on the 15th day of salting
formation of nitrosylmyoglobin was found even after 75 days of processing. This could be due to the unfavourable pH (co
temperature (5°C) for the transformation of nitrite in nitric oxide. However, when the temperature rises a high
nitrosylmyoglobin was observed, reaching in less than 100 days a level of myoglobin nitrosylation of about a 70% of th
Therefore, from the point of view of the colour, there is no reason to extend the maturation process for more than 9-10 mon
that the temperature of maturation be of 20-30°C.

FACTORS AFFECTING PROTEIN AND LIPID EXTRACTABILITY IN MEAT PRODUCTS

C. GARCIA, J.J. CORDOBA, M.A ASENSIO, L. MARTIN, A. FALLOLA* and T. ANTEQUER
Higiene y Tecnología de los Alimentos. Facultad de Veterinaria. 10071 Cáceres. Spain.
*Servicio de Investigación Agraria. Badajoz. Spain.

In a study of the evolution of different components of dry cured hams during ripening an unexpected redu
extractability in protein and lipids was observed. The main factors related with this are the presence of salt
the time of processing. To evaluate the possible influence of these factors, 75 *Logissimus dorsi* wer
simulating the first stages (salting and postsalting) of dry cured ham processing.
Moisture, NaCl, lipid and Non Protein Nitrogen (NPN) content, and the amount of protein soluble in 0.6M
+ 1.1M IK buffer were determined. The pellet obtained in the extraction of soluble proteins was s
hematoxilin-eosin and observed by light microscopy.
Data obtained confirms the decrease in the extractability of both proteins and lipids during ripening. H
amount of fat extracted after 60 days at refrigeration temperatures reached the initial levels.
No correlation between salt content and reduction of extractability was found. However, the time of pro
the amount of protein extracted are correlated (-0.91).

ATION OF RARE AND MEDIUM ROASTED NORMAL AND DFD BEEF

perlin, B. Žlender, F. Bučar

rsity of Ljubljana, BF, Jamnikarjeva 101, 61000 Ljubljana, Slovenia

act:

olour of rare (T_j= 50°C) and medium (T_j= 65°C) roasted m. longissimus dorsi (LD) of normal and uality of young bulls after aging (10 days at 2°C) was investigated with instrumental (Minolta -b chromometer, FOP apparatus) and sensory methods, before and after oxygenation (at -5°C, The depht and area of oxygenated layer and pH of meat were also measured.

oxygenation b-values of rare and medium roasted normal and DFD meat always increase (p≤0,001). wer a-values for colour of rare roasted normal and DFD samples increase (p≤0,01). Only roasted normal beef shows optimal oxygenated bright red colour.

epht and area of oxygenated layer in roasted DFD meat is brigher than in roasted normal meat erences are nonsignificant). FOP-values at roasted DFD meat are significantly (p≤0,001) lower at normal meat. This results for DFD samples are probably consequence of the relation H (50°C/6,6), which inhibits myoglobine denaturation.

ATIONSHIPS BETWEEN LIPID OXIDATION, ANTIOXIDANT ENZYME ACTIVITIES AND COLOUR BILITY IN RAW BEEF MEAT DURING STORAGE

GATELLIER , M. ANTON, FATIMA CHRAITI & M. RENERRE

on de Recherches sur la Viande, Theix, 63122 St-Genès-Champanelle

s well established that beef muscles exhibit a wide range of colour stabilities, the mechanisms involved are not yet well determined. globin autoxidation, in relation with lipid oxidation, is one of the main factor responsible of these oxidative processes. aim of this experiment was to appreciate with two bovine muscles different from the viewpoint of colour stability (*M. longissimus orum and psoas major*), the relationships between lipid oxidation and haeminic pigment oxidation. In addition, the antioxidant enzyme ities were carried out during meat storage.

steaks were packed on fibreboard trays and overwrapped with PVC meat grade film. Reflectance spectra were obtained by tocolorimetry. Colour coordinates were calculated from the spectra in the L*a*b* system and metmyoglobin content was measured rding to Krzywicki (1979) on days 1, 3, 7, 10, 13 storage. During the same time, lipid oxidation was followed by the determination of ereactive substances (Sunderman et al., 1985).

athione peroxidase, SOD and catalase activities were measured spectrophotometrically, on days 0 and 8 storage, by using the techniques ectively described by Agergaad and Thode Jensen (1982), Marklund and Marklund (1974) and Aebi (1974).

ng the considered period, and whatever the examinated muscle, concentration of TBA-RS and metmyoglobin accumulation were ased about two-fold between days 1 and 13 . After a storage of 13 days, it was shown that *psoas major* muscle displayed a greater t of lipid oxidation and was more color labile than *longissimus lumborum* muscle; the two phenomena were highly correlated. Although ecay of antioxidant enzyme activities between days 0 and 8 storage was not significant, there were some significant differences between les after a storage of 8 days.

HOW TO PREPARE LIPOSOMES TO STUDY OXIDATION OF MUSCLE PHOSPHOLIPIDS ?

C. GENOT, B. METRO, M. VIAU, A. MEYNIER, G. GANDEMER

Laboratoire d'Etude des Interactions des Molécules Alimentaires, INRA, B.P.527, 44026 NANTES Cédex 03, France

Phospholipids are the major substrate for lipid oxidation in meat and meat products. To study phospholipid oxidation, attractive model systems. In reason of the high content in long chain polyunsaturated fatty acids (PUFA) of muscle phos methods used to prepare the liposomes as well as the experimental conditions must be controled to avoid lipid degradation.

Three methods (vortexing, sonication, and extrusion) were used to prepare liposomes made of phospholipids extracted fro (*Longissimus dorsi*) dispersed in degazed cacodylate buffer (0.05M, pH=5.8, NaCl 0.05M). They were compared in t degradation which was checked by determination of PUFA proportions, relative proportions of phospholipid classes, T conjugated dienes after liposome preparation and after 7-14 days of storage in the dark at 4°C. Other parameters as lipid yield for preparation and physical stability of liposome were also evaluated.

In all cases, degradations of lipids just after liposomes preparation and after 7 days of storage were very low. The lowest measured by TBA value and conjugated dienes, was observed for vortexed liposomes and the highest for sonicated liposome was not totaly deoxygenated ; extruded and degazed sonicated liposomes had intermediate oxydation level. No losses observed.

In conclusion, it appears that vortexing, extrusion or sonication do not induce sensible degradation of muscle phospholipid conditions are carrefully controled. The liposomes can be used few days after preparation. Other criteria as structure of lipo stability and easiness of preparation have to be taken into account to choose the preparation mode. However, in the ca oxidation, the influence of preparation technique and consequent structure of liposomes should be reexamined.

CONSERVATION OF MEAT SAMPLES FOR PHYSICAL ANALYSIS

S. GIGLI, F. NAPOLITANO, A. CARREITA, S. FAILLA, M. FIORETTI, and D. CENNAMO

Istituto Sperimentale per la Zootecnia, Via Salaria, 31 - 00016 Monterotondo Scalo - ROMA, Italy

To analyze immediatly meat samples from carcass dissection of trial animals is difficult fo problems: the fast transport of samples, the need to analyze together more samples for difficulty o standardisation. Nevertheless we can storage samples only if there aren't significant differen value of collected parameters, during conservation. The aim of this work is to estimate the chan physical characteristics due to the conservation.

The trial was carried out on 12 Friesian young bulls slaughtered at about 550 kg. From right h stored into fridge cell for 7 days at 2°C were dissected 3 muscles (Longissimus dorsi, Semit Gluteobiceps). From each muscle were taken six slices for physical determinations of: pH and colo b*, C, H illuminant C with MACBETH 1400) on raw meat, water holding capacity and tenderness (Warn Shear with Instron 1011) on raw and cooked meat. One slice was analized immediately after (control), while the others were stored in plastic film (2, into fridge to 4°C) or in vacuum packa freezer to -20°C); and at defined distance from dissection: **a)** at 4 and 10 days these fresh; **b)** at months those freezed were analyzed.

In this note we report only data on Longissimus dorsi muscle. Essentially the conservation affe raw meat for freezed samples, the water holding capacity (1,29% vs 2,78%) and colour, in partic (34,6 vs 38,2) and the Saturation (26,8 vs 22,4).

INFLUENCE OF BLOOD PLASMA ACIDIFICATION ON HAEME PIGMENT NITROSATION AND CURED COLOUR DEVELOPMENT IN PLASMA GEL /LIVEX/.

A.JARMOLUK, Z.DUDA, and A.MAJEWSKA-KAWIŃSKA

Department of Food Technology of Animal Origin, Agricultural University, 50-375 Wrocław, Poland.

The objective of this study was to determine the curing efficiency of pig blood plasma acidified to pH=6.3 by 10% solutions of: lactic, propionic, acetic formic and hydrochloric acids. Plasma was cured at 4-5°C for 1 hour using $NaNO_2$ and the molar proportions of ascorbic acid: sodium nitrite : hemine was 9:3:1. Cured plasma samples were thereafter destabilized according to the Polish Patent No.148961 and the resulted gel was pasteurized at 80° C for 30 min.

In the obtained thermally denaturated plasma gel /livex/ the degree of the haeme pigment conversion to the nitrosopigments /by Hornsay/ and the physical parameters of the colour were determined using reflectance colorimeter /Minolta CR-200b/.

The results show that acidification of plasma increases the pig blood plasma haeme pigments conversion to nitrosopigments. In the control sample /non-acidified/ the degree of pigment conversion to nitrosopigments averaged 12.2% while in the experimental acidified samples the degree of conversion ranged from 13.9% /propionic acid/ to 15.2% /formic acid/. Although the increase in pigment conversion was slight the colour of the formed gel was substantially and significantly better when compared with the control sample.

The values for L^*, a^* and b^* as well as the saturation of the colour of gels processed from acidified plasma averaged: 68.5; 10.6; 9.2 and 14.1 respectively. In comparison with the control sample the increase was: 1.2; 2.8; 2.0 and 2.3 times higher respectively. It was also observed that curing of acidified plasma resulted in approx. 1.3-fold decrease in the "hue" values which for the control sample was as high as 51.9.

Summing-up it could be concluded that plasma acidification to pH=6.3 prior to curing increases the degree of haeme pigment conversion to nitrosopigments by approx. 20% and the finished products thus obtained e.g. livex exhibits zhe colour sensorically required typical of cured, cooked meat products.

OXIDATIVE PROCESSES IN MEAT AND MEAT PRODUCTS.

J. Kanner, S. Harel and R. Granit

A.R.O. Volcani Center, Department of Food Science, Bet Dagan, Israel 50250

Oxygen is a vital component of several exerogenic biological reactions in which, step wise, enzymatically controlled oxidation of biomolecules is used to release energy and compounds essential for life. Where cells are injured, such as in muscle foods after slaughtering, the normal control mechanism may be perturbed and rampant, lipid peroxidation is favored and traces of O_2^-, H_2O_2, as well as traces of lipid peroxides are formed. The stability of a muscle food product will depend on the "tone" of these peroxides and especially from the involvement of metal ions in the process. Ferryl-myoglobin is generated in muscle tissues; it oxidizes cytosolic-reducing compounds but not membrane lipids. Free iron ions are the main non-enzymic catalyzers of muscle lipid peroxidation. The main source of free iron seems to be ferritin, but myoglobin is also a source. The cytosol contains prooxidants and antioxidants, and the "tone" of both affect not only lipid peroxidation and flavor, but also the color, texture and nutritive value of meat and meat products.

THE USE OF SOME ANTIOXIDANTS FOR THE STABILIZATION OF MEAT PRODUCTS COLOR.

L.H.KOMISSAROWA, E.G.ROZANTSEV, G.W.GURINOVICH.

Institute of Chemical Physics, Russian Academy of Sciences, Kosygin str. 4, Moscow 117977.

It was shown Sen et al (1974) that the use of ascorbic acid and its derivatives for the stabilization of standard color of meat products in a presence of nitrites can be lead to an increase of content of carcinogenic N-nitrosocompounds there. It was a reason for search of a new substances with antioxidant properties. By using the reaction of nitrite oxyhemoglobin oxidation Komissarowa et al (1988, 1990) showed that the oxy- and amino- derivatives of benzoic acid as well as iminoxyl radicals are an active antioxidants. Accordingly some from the oxy-derivatives of benzoic acid were used for the stabilization of meat products color. These substances were added on the step of cutteration to the meat raw material, containing the isolate of soy-bean protein [30 %] in a presence of sodium nitrite [5 mg/%]. That was resulted to the standard pink color of the obtained meat product. The desirable color of meat products was reached with using of the concentration of these substances in 5-10 times less than that for ascorbic acid. Thus, some antioxidants from the oxy-derivatives of benzoic acid can be used for the stabilization of combinational meat products color in a presence of nitrites instead of ascorbic acid.

CAUSES AND SOLUTIONS OF IRIDESCENCE IN PRECOOKED MEAT

D. KROPF, H. WANG, M. HUNT and C. KASTNER

Department of Animal Sciences and Industry, Weber Hall, Kansas State University, Manhattan, Kansas 66506-0201, USA

Physical and chemical treatments of iridescent cooked meat showed that pigment bleaching of meat slices with 30% hydrogen peroxide did not remove iridescence. Removing lipid by ethyl ether from meat surface had no effect on iridescence. Iridescence was eliminated by dehydration or freezing but reoccurred upon rehydration or thawing. Soaking iridescent meat samples in formaldehyde, formamide, methanol, hexane, and ethyl alcohol had no apparent influence on iridescence. Slicing longitudinally or at an angle less than 40° to the muscle fiber of beef semitendinosus eliminated iridescence.

Beef semitendinosus (ST) and Biceps femoris (BF) muscles were injected with 3% or 10% water and 0.3% phosphate versus non-injected controls and were precooked in smoke house to final internal temperatures of 54.4°C (held for 121 min.), 60°C (held for 121 min.), 62.8°C, or 68.3°C, sliced at -1.1°C, 7.2°C, 48.8°C, 54.4°C, or 62.8°C by either a dull or a sharp slicer. The lower added water (3% compared to 10%) resulted in less visual iridescence score when added level of phosphate was .3%. More iridescence occurred with cooking to 62.8°C final internal temperature or slicing at 48.8°C, or with a sharp slicer blade. Less iridescence appeared at low cook temp. (54.4°C held for 121 min.) or lower slicing temperature (-1.1°C). In most experiments, 0.3% added phosphate reduced iridescence compared with control. Iridescence varied ($P < 0.05$) among muscles from different carcasses under same cooking condition. BF muscle showed much less iridescence than ST muscle.

EFFECT OF DIETARY VITAMIN E ON LIPID AND COLOR STABILITY OF FROZEN BEEF FROM HOLSTEIN STEERS

M. C. LANARI, R. G. CASSENS, D. M. SCHAEFER AND K. K. SCHELLER

Muscle Biology Lab., Dept. of Meat & Animal Sci., Univ. of Wisconsin, Madison, WI 53706, USA.

Recent reports concluded that dietary supplementation of Holstein steers with vitamin E produced a considerable improvement in lipid and color stability of fresh retail cuts.

This study examined the influence of storage time, film permeability and light on the color of frozen beef from Holstein steers supplemented with vitamin E.

Meat samples were obtained from longissimus dorsi (LD) of Holstein steers fed a high-corn diet. Three animals per treatment received 0 or 2000 IU of α-tocopheryl acetate per head daily for 126 days prior to slaughter. At 24 h post-mortem the LD was removed, vacuum packaged and aged during 10 days at 4°C. After this, samples were cut, exposed to air during 48 h, wrapped in polyethylene or vacuum packaged, frozen and stored at -20°C in the dark or under illumination. Metmyoglobin concentration, tristimulus color coordinates (L, a, b) and TBA analysis were measured during storage.

Vitamin E supplementation produced a considerable increase in lipid and color stability ($P<0.001$). Cuts wrapped in polyethylene had a better color retention during storage and display. After 3 months of frozen display and using polyethylene as packaging film, TBA, metmyoglobin and chroma levels for control samples were 1.92 mg MDA/kg, 50% and 8; and for supplemented meat these values were 0.29 mg MDA/kg, 28% and 16.

STABILIZATION OF BROILER LIPIDS (INCLUDING CHOLESTEROL) THROUGH DIETARY SUPPLEMENTATION WITH SPICE EXTRACTS

C.J. LOPEZ-BOTE, E. GOMAA, J.I. GRAY AND C. J. FLEGAL

Department of Food Science and Human Nutrition, Michigan State University, East Lansing, MI 48824, U.S.A.

Dietary supplementation of vitamin E for the subsequent benefit of increased lipid stability in animal food products has been extensively reported for poultry, pigs and veal calves. However, there is little information on the effects of other natural antioxidants on lipid oxidation in muscle systems when administered through the diet.

The objective of this study was to compare the effects of dietary vitamin E (200 IU/kg feed), oleoresin rosemary (500 mg/kg) and oleoresin sage (500 mg/kg) on the oxidative stability of broiler lipids in raw and cooked breast meat. Two groups of broilers were fed a control ration (no added antioxidants), while two groups were placed on each of the three supplemented diets. Raw meat was stored at 4°C under light for 9 days and lipid oxidation was assessed periodically by the 2-thiobarbituric acid (TBA) procedure. Lipid oxidation in cooked samples stored under the same conditions was also monitored. Cholesterol oxidation products (COP's) in cooked samples were also determined after 4 days by capillary gas chromatography.

Both spice extracts considerably reduced lipid oxidation during storage. After ° days, TBARS values of the raw meat from the broilers fed the control, rosemary, sage and vitamin E diets were 0.51, 0.30, 0.35 and 0.25, respectively. In the cooked samples, the reduction in TBARS value was less marked. Concentration of COP's in the cooked meat was also affected by the dietary regimen. The groups fed the sage and rosemary extracts showed decreases in total COP concentration of 44 and 42%. Dietary vitamin E reduced the COP concentration by 58%.

Although these results show an important benefit, the spice extracts were not as effective as vitamin E in enhancing lipid stability. However, the availability of these and other natural antioxidants and their possible synergistic effects suggest an interesting way of improving meat stability.

IBERIAN PIG DRY HAM VOLATILE COMPOUNDS FROM DIFFERENT HAM DEPTHS

M.O. LOPEZ*, L. de la HOZ*, M.I. CAMBERO*, D. LOPEZ*, G. REGLERO and J.A. ORDOÑEZ*.**
*Departamento de Nutrición y Bromatología III (Higiene y Tecnología de los Alimentos), Facultad de Veterinaria, Universidad Complutense, 28040 Madrid (Spain). **Instituto de Fermentaciones Industriales (CSIC). Juan de la Cierva, 3. 28006-Madrid (Spain)

In previous studies on volatile compounds from *biceps femoris* muscle zone (internal layer) of Iberian dry hams, m... substances (carbonyls, alcohols, aliphatic hydrocarbons, aromatic hydrocarbons, short-chain fatty acid and esters) have b... characterized. The amount and type of these substances suggest that intense lipid breakdown are produced during ripening. The objectiv... this work was to investigate the olfactive-active volatile compounds of dry hams (aged 12-14 months) from different sampling depth... know the possible role of oxigenation and fattening on the flavour development.

The studies were performed on Iberian dry hams. Samples were obtained from three different depths: external layer (about 4... in depth) composed by more than 90% of fat, medium layer (5-8 cm in depth) composed by around 50-60% fat and 50-40% muscle... internal layer (depth >8 cm) composed by around 10-20% fat and 90-80% muscle. Volatiles from 50 g of sample were swept on to a ... (30 mg Tenax GC 80-100 mesh) using a nitrogen flow (120 ml/min) for exactly 45 min. During collection the system was maintained... 29°C.

The observed differences in all three layers were mainly due to the concentrations of volatile compounds rather than to the ... of volatile substances present. A total of 64 different compounds were identified. Those accurately characterized were selected ... comparison between layers. The selected volatiles mainly included aldehydes (12), alcohols (8) and short chain fatty acids (5). ... external layer (the fattest and the most oxigenated) showed a significative ($p \leq 0.05$) higher amount of total volatiles than those found in ... other two studied layers. In general, no significative differences ($p > 0.05$) were found between volatiles from the medium and inter... layer. The results suggest that the dominant volatile compounds of Iberian pig dry hams result from the oxidation of unsaturated ... acids, which are abundant in the adipose tissue of Iberian pigs.

SPICES AS ANTIOXIDANTS IN COOKED, MINCED PORK MEAT.

HELLE LINDBERG MADSEN, LEIF H. SKIBSTED & GRETE BERTELSEN.

Royal Veterinary and Agricultural University, Department of Dairy and Food Science, Frederiksberg, Denmark.

The effect of different spices on development of Warmed-Over Flavour (WOF) was investigated in meat from pig (*Longissimus* ... both in a model system and in a storage experiment.

In the model system addition of rosemary (dried leaves of *Rosmarinus officinalis*) and of sage (dried leaves of *Salvia officinalis* ... amount (0.2%, 0.1% and 0.02%) resulted in a reduction of oxygen consumption as measured by a Clark electrode. The mod... consisted of a meat slurry (5 g cooked (80 °C for 5 min.), minced meat and 75 ml buffer solution) to which Fe(II)EDTA ... (6.0μmol) was added as prooxidant in a thermostated (25 °C) closed cell.

The spices rosemary, oregano (dried leaves of *Majorana onites*) and sage were each found to retard development of WOF in ... in a storage experiment. The spices were added in an amount, which was found to be acceptable by a sensory panel (0.02% ... weight). The meatballs were heated, 100 °C for 9 min. After cooling, they were placed in polyethylene bags and stored in dar... The development of WOF was followed by a sensory panel and by measurement of thiobarbituric acid reactive substances (T... The chemical analysis showed less lipid oxidation during the first two days for all samples with spices added compared to the ... sample. During the first four days, the sensory panel observed a significantly ($p < 0.05\%$) lower level of WOF in samples with ... or sage added. In conclusion, all three spices showed antioxidative activity in the present product, sage being the most effective ... second best and least activity was found for oregano.

THE EFFECT OF LIPID ON THE MAILLARD REACTION BETWEEN METHIONINE AND RIBOSE : A MODEL SYSTEM TO INVESTIGATE THE FORMATION OF MEAT FLAVOUR.

A. MEYNIER [2], D.S. MOTTRAM [1]

[1] University of Reading. Department of Food Science and Technology, Whiteknights, Reading RG6 2AP, UK. [2] Present adress INRA. LEIMA. BP 527 44026 NANTES Cedex 03 FRANCE

The aim of this work was to examine the effect of lipids on the Maillard reaction in order to understand the key role of phospholipids in the development of meat aroma (Mottram & Edwards, 1983 ; Farmer and Mottram, 1990). Sulphur-containing compounds have been reported to be very important aroma compounds in meat (Mottram, 1991 ; Werkhoff *et al*, 1990). To model meat, a system was prepared in buffered solution (pH 5.5) with methionine and ribose. Linoleic acid and/or ethanolamine were then added to this solution. The reaction mixtures were cooked under pressure at 140°C for 1 hour, the volatile compounds were then extracted by Simultaneous Distillation Extraction (SDE) with diethylether as solvent and, finally, qualitatively and quantitatively analyzed by gas chromatography and mass spectrometry. The results show that without fatty acid, the major compounds were 3-methylthio-propanal (494 µg/ 100mg ribose), furfural (100 µg /100 mg ribose) and dimethyl disulphide (94 µg/ 100mg ribose). The addition of linoleic acid modified the chromatogram both quantitatively and qualitatively. The oxidation products of linoleic acid such as aldehydes, alcohols and furans were formed. Moreover, the quantities of Maillard reaction products were modified and some compounds such as 2-pentylpyridine were formed by reaction of Maillard and lipid oxidation compounds. The addition of ethanolamine caused a reduction of volatile concentration. The more drastic reduction was observed for aldehydes formed by Maillard reaction or linoleic acid oxidation. This work establishes that in model system, lipid components are able to modify the reaction equilibria and consequently change the overall aroma which is perceived.

IMPROVEMENT OF PIGMENT AND LIPID STABILITY IN BEEF WITH VITAMIN C MIX, SPREAD AND DIP TREATMENTS

MITSURU MITSUMOTO[1], R.G. CASSENS, D.M. SCHAEFER, R.N. ARNOLD and C. FAUSTMAN[2]

Department of Meat and Animal Science, University of Wisconsin–Madison, 1805 Linden Drive, Madison, Wisconsin, 53706, U.S.A.

[1]Present address: Chugoku National Agricultural Experiment Station, 60 Yoshinaga, Kawai–cho, Oda–shi, Shimane–ken, 694, Japan

[2]Present address: Animal Science Department, University of Connecticut, Storrs, Connecticut, 06268, U.S.A.

The effects of vitamin C mix, spread and dip treatments on pigment and lipid stability in beef longissimus muscle were studied during 7 or 16 days of illuminated display at 4°C. 1) Vitamin C mix treatment showed low pigment and lipid oxidation in raw ground beef compared to the control, and it retarded metmyoglobin formation and lipid oxidation for 5 days compared with the control. 2) Spreading a 10% vitamin C solution in the ratio of 0.1 ml solution to 20 g meat had lower metmyoglobin than the control after 4 days of display. Vitamin C spread treatment delayed metmyoglobin formation for 3 days compared to the control. 3) Dip treatment with a 1 % vitamin C solution was effective in maintaining stability of beef pigment and lipid.

INFLUENCE OF DIETARY VITAMIN E (α-TOCOPHEROL) ON THE COLOUR STABILITY OF PORK CHOPS

[1]MONAHAN, F.J., [3]ASGHAR, A., [3]GRAY, J.I., [1]BUCKLEY, D.J. & [2]MORRISSEY, P.A.

Departments of [1]Food Technology and [2]Nutrition, University College Cork, Ireland.

[3]Department of Food Science and Human Nutrition, Michigan State University, East Lansing, MI 48824, U.S.A.

The objective of this study was to investigate the effect of dietary α-tocopherol supplementation on the surface characteristics of pork chops during refrigerated storage. The relationship between surface colour deterioration and lipid oxi was investigated.

For 10 weeks before slaughtering, pigs were fed diets containing fresh or oxidized (4.5 meq peroxide/kg diet) corn oi low (10 mg/kg diet) intermediate (100 mg/kg diet) and high (200 mg/kg diet) levels of α-tocopheryl acetate. Fresh pork chops stored at 4°C under fluorescent light for up to 8 days. Lipid oxidation (2-thiobarbituric acid-reactive substances (TBARS) valu surface colour (Hunter L, a, b values) measurements were made at 2 day intervals.

Surface redness (Hunter 'a' value) of pork chops from pigs fed the high level of α-tocopheryl acetate was significantly ($p<0.01$) than that of chops from pigs fed the intermediate or low levels of α-tocopheryl acetate after 2, 4, 6 and 8 d refrigerated storage. The extent of lipid oxidation in pork chops decreased with increasing levels of dietary α-tocopheryl a Differences in TBARS values between groups were significant after 2, 4, 6 and 8 days of refrigerated storage. Hunter 'a' showed significant ($p<0.01$) negative correlation coefficients, r, with the logarithm of TBARS values.

Hunter 'L' and 'b' values, indicators of surface lightness and yellowness, respectively, were not significantly influen dietary treatment.

The results show that dietary α-tocopherol effectively retards surface colour deterioration and lipid oxidation in pork Further studies are necessary to determine the nature of the relationship between loss of surface redness and lipid oxidation i

FAT, NITRITE AND THE FLAVOUR OF CURED COOKED HAM

M. MOULOUD, J.-P. DUMONT and R. GOUTEFONGEA

LEIMA, INRA Nantes, B.P. 527, 44026 NANTES Cedex 03

In the eighties, ado made about animal fat in human diet has resulted in a marked drop of the average fat content of cured coo produced by the meat industry. Meanwhile, a trend toward lower cured flavour intensity was observed, giving support to practitioners reports pointing that external fat plays a role in the formation of the flavour of the finished product.

Oxidative mechanism, generally put forth as responsible for flavour development, mainly involves phospholipids associated membranes and is not directly affected by external fat trimming. It seemed sensible, when investigating nitrite reaction with meat to stick to the sensitive intramuscular fat and to broaden the scope of the study in the light of experiments that evidenced a strong some nitrogen-containing derivatives to fat in nitrite-treated adipose tissue.

Experiments were carried out on cooked ham produced at a pilot plant according to the customary practise with the sole excep nitrite was added in an eight-fold excess (1000 ppm instead of 120 ppm). Lipids extracted from pork adipose tissue and pure tripal triolein were used as model samples. Treated samples were incubated with high concentration of nitrite (ratio 1/1).

IR data obtained on lipids extracted from cooked ham gives evidence that intramuscular fat from cured samples contains nitro-d and much less oxidation products than control samples. On the contrary, no difference has been evidenced regarding external fat. Nitro-derivatives have formed in model systems involving triolein or lipids extracted from adipose tissues whereas tripalmitin did Results suggest that, although it cannot be ruled out, nitrite reaction with external fat is probably not very active. The actual role of fat (barrier, solvent or precursor for active species) in the flavour formation of cured meat products has still to be established.

NATURAL ANTIOXIDANTS IN A MINCED MEAT PRODUCT

H.-J. S. NIELSEN, A. L. HANSEN and H. V. LUDVIGSEN

Biotechnical Section, The Engineering Academy of Denmark, 2800 Lyngby, Denmark.

Objective : To investigate the antioxidative properties of soy protein and pea fiber in a minced meat product, both using objective methods and organoleptic analysis as well.

Materials and Methods : The meat product consisted of lean pork loin which was minced together with app. 20% pork fat. One % NaCl was added together with a suspension of the protein (1.5%) or fiber (3%). The minced meat products were formed as meat balls, and heated in a boiling water bath. One half of the product was stored aerobically, the other under nitrogen. During storage analysis was made for TBA reactive substances, fluorescens of a methanolic and chloroformic extract, and color. Samples were taken once for organoleptic analysis. All measurements were done after the product was heated to app. 70°C in a microwave oven.

Results : The meat product stored aerobically was spoiled faster than under nitrogen as measured by TBA reactive substances and fluorescens (chloroformic phase). Measurements using the methanolic phase of the extract failed to show any difference at all.Samples stored aerobically, with added soy protein or pea fiber had (50%) lower values of TBA reactive substances than without addition, after 4 and 7 days of incubation at 5°C . Also fluorescens was less on samples with added protein or fiber. On anaerobically stored samples, fluorescens was only slightly different with/without addition. Only minor differences in color between samples were observed.The organoleptic tests performed after 3 days of incubation, showed that samples with added pea fiber or soy protein had an improved flavor compared with samples without addition.

Conclusion: Natural antioxidants, soy protein and pea fiber, were shown to exert an antioxidative effect in meat balls produced from pork meat and fat. The influence was observed both chemically and organoleptically. It is concluded, that cooked minced meat products benefit from addition of "natural" antioxidants.

INFLUENCE OF THE SEQUENCE OF TREATMENTS ON OXIDATION OF PORK MUSCLE TISSUE

H. W. OCKERMAN, OSU, 2029 FYFFE ROAD, COLUMBUS, OHIO 43210 USA

N. A. PENSEL AND H. R. RODRIGUEZ, INSTITUTO de TECNOLOGIA de CARNES, CICV-INTA, CC 77 (1708) MORON, BUENOS AIRES, ARGENTINA

Different sequences of standardized conditions commonly used in the meat industry were investigated for their effect on the oxidation of porcine muscle tissue. Samples from pork Longissimus dorsi muscle from one animal were randomly assigned to preparation and time-temperature treatments; whole uncooked, whole cooked, sliced uncooked, sliced and then cooked, ground uncooked, ground and then cooked, cooked and then sliced, and cooked and then ground were the eight different preparations tested. There were thirteen treatments and time (0,2, 6 days)-temperature (4C and -20C) combinations. The entire experiment was repeated five times utilizing a different animal for each replicate. Oxidative rancidity was determined using an extraction thiobabituric acid (TBA) method. The sequence in which the treatments were applied to the muscle samples had a significant influence on TBA numbers. Cooking and grinding followed by six days of frozen storage and six additional days of refrigerated storage was the most detrimental combination of treatments. It is necessary to know the treatment sequence that was applied to the tissue even when using standardized conditions in order to arrive at conclusions concerning the influence that different processing treatments have on oxidation (as measured by TBA method).

PHOSPHOLIPIDS AND CHOLESTEROL IN TWO SKELETAL MUSCLES AND ERYTHROCYTES OF DIFFERENT MALIGNANT HYPERTHERMIA GENOTYPES OF SWINE

W. OTTEN, J. BENEDIKT, S. HARTMANN, K. SOELLNER and H. M. EICHINGER
Versuchsstation Thalhausen, Techn. Univ. Muenchen, W-8051 Kranzberg, Germany

Phospholipids and cholesterol are the most important structural components of cell membranes. Phospholipids are also in transmembranal cell signaling, whereas cholesterol stabilizes the structure of membranes. It was the aim of this investigate the phospholipid and cholesterol content of two skeletal muscles and of erythrocytes in three different Hyperthermia (MH) genotypes of swine.

5 homozygous MH positiv, 7 heterozygous MH negative and 7 homozygous MH negative male castrated German Landr were examined. Stress free blood samples were taken with a catheter which was placed in the vena cava cranialis. Anim slaughtered after reaching 100kg body mass. Samples from musc. long. thorac. and musc. suprasp. were removed imm after slaughter. Lipids were extracted from erythrocytes and muscle samples by chloroform-methanol. Phospholip cholesterol were determined by HPLC and GC.

The more stress resistant homozygous MH negative animals showed significantly higher total lipid contents in musc. long and in the erythrocytes compared to the MH positive animals. Homozygous MH negative animals showed the lowest ch contents in both muscles and the highest contents in erythrocytes compared to the other genotypes. The erythrocyte homozygous MH negative animals contained the lowest amounts of cardiolipin, lyso-phosphatidyl-ethanolamine, lyso-ph dyl-choline and sphingomyeline and the highest amounts of phosphatidyl-choline compared to the other genotypes. No sig differences between phospholipid patterns in the two muscles of all MH genotypes could be detected.

CHORIZO : COLOUR AND PHYSICOCHEMICAL PARAMETERS EVOLUTION DURING RIPENING

M. J. PAGAN-MORENO, J. A. PEREZ-ALVAREZ, M. E. SAYAS-BARBERA, M. A. GAGO-GAGO RODRIGUEZ-LOPEZ, A. BALLESTER, V. ARANDA-CATALA

Departamento de Tecnología de Alimentos. Universidad Politécnica de Valencia. Camino de Vera 14 Valencia SPAIN

ABSTRACT

" Chorizo " is the most popular Spanish dry fermented sausage, it´s the second processed meat in economic importance. Paprika is one of the most important spices in Chorizo manufacturing spice gives the special colour and taste to this dry fermented sausage

The aim of this work is to study the differences of diameter in dry fermented sausage (Chori the evolution of physical and physicochemical parameters during the process. The study was made " Chorizos ". The " Chorizo" samples were filled with artificial casings with diameters of 55 and 65 weights of " Chorizo " samples were 500 g approximately. The dry fermented sausages were collec different times : at mixing time, and 0, 1, 2, 4. 11, 18, 25, 30 days after stuffing. The physical para under study were : CIE L*a*b*, pigment discolouration, pigment nitrosation, and the physicoch parameters were : water activity, moisture, pH , nitrite residual level, salt concentration, and lacti percent.

Visually the samples darkened, L*, a* and b* increased during ripening and show no signifi differences between the studied diameters. In the physicochemical parameters only pH and Lacti percent show no significative differences between the studied diameters

FECTS OF DIFFERENT ANTIOXIDANTS ON FORMATION OF MEAT MUTAGENS DURING FRYING OF GROUND BEEF

M. PEARSON, C. CHEN and J.I. GRAY

partment of Food Science and Human Nutrition, Michigan State University, Lansing, chigan 48824 USA

rmation of meat mutagens has been shown to occur during frying of ground beef, apparently rough a free radical mechanism. Thus, we investigated the effects of adding synthetic tioxidants (BHA, BHT, PG and TBHQ) on formation of some meat mutagens (IQ, $MeIQ_x$ and 4,8-$MeIQ_x$) produced by frying of ground beef. Ground beef patties from 0.3-0.5cm in thickness d containing 10% fat were fried in an electric frypan for 9 minutes per side at a setting 215°C. Patties with antioxidants (at 0.1% of fat) and without added antioxidants were ilized. Although raw patties contained no detectable amounts of meat mutagens, all cooked tties contained measurable quantities of the IQ-like mutagens. All added antioxidants, cept for BHT, inhibited formation of all IQ-like mutagens during frying. On the other nd, the addition of BHT to the patties before cooking resulted in a greater quantity of tal meat mutagens being formed during frying than was the case for the untreated fried ntrols. Thus, results demonstrated that formation of the meat mutagens is inhibited by ding synthetic antioxidants, except for BHT which enhanced formation of the mutagens, pecially of 4,8-$DiMeIQ_x$.

MODIFIED THIOBARBITURIC ACID-C_{18} (TBA-C_{18}) METHOD FOR MEASURING LIPID PEROXIDATION IN MEAT

. RAHARJO, J.N. SOFOS and G.R. SCHMIDT

epartments of Animal Sciences and Food Science and Human Nutrition, Colorado State University, Ft. Collins, CO 80523 USA

he thiobarbituric acid (TBA) method, with its different variations, is the most widely used test for measuring the extent of lipid eroxidation in muscle foods. However, all versions of sample preparation for the TBA reaction have been criticized as being onspecific and insensitive for the detection of low levels of malonaldehyde (MA) in meat products. Extensive studies in our aboratory have attempted to modify the TBA method so that it becomes faster, more specific and more sensitive. The xperiments were performed with model systems or meats including beef, pork, lamb, turkey and chicken. The TBA-C_{18} method eveloped and presented here is a modification of the aqueous acid extraction TBA procedure involving use of a solid phase xtraction Sep-Pak™ C_{18} cartridge. In addition, 80 mM TBA was used, instead of 20 mM TBA, for the red color formation. esults indicated that the modified aqueous acid extraction TBA-C_{18} method was more rapid (15-20 min) than other versions of he TBA test (40-60 min); the use of the C_{18} cartridge selectively separated the MA-TBA complex from other TBA-reactive ubstances present in meat extracts; and the C_{18} cartridge was also capable of concentrating the MA-TBA complex. Therefore, he aqueous acid extraction TBA-C_{18} method was not only more specific but also more sensitive for MA measurement in meat. The limit of determination of the aqueous acid extraction TBA-C_{18} method was 0.036 mg of MA equivalents/kg meat or approximately 20-25 times lower than that of other TBA methods. Overall, the newly developed aqueous acid extraction TBA-C_{18} method had better specificity, lower limit of determination and required shorter time to do the analysis than other TBA methods tested. The TBA-C_{18} method was found successful for measuring MA content in meat from all species tested.

COMPOSITION OF THE FLAVOUR VOLATILES OF COOKED PORK, BEEF, AND CHICKEN, AND OF "CURED"

N. RAMARATHNAM, L. L. DIOSADY, and L. J. RUBIN

Department of Chemical Engineering, University of Toronto, 200 College Street, Toronto, Ontario M5S 1A4.

Literature information on the quantitative composition of the meat-flavour constituents and the nature of cured-meat aroma is addition, it is still not clear which compounds are responsible for the differences among the three species, namely pork, beef, **The objective of this study, therefore, is to identify both qualitatively and quantitatively the volatile flavour components present** pork, beef, and chicken to account for the species differences, and to identify the flavour components present in cured **components from uncured and cured meat of the three species were trapped on a solid adsorbent (Fluorisil cartridges) and in org** (pentane) using the nitrogen purge-and-trap (NPT) technique. A total of 45 compounds not previously reported in the meat flavo **were newly identified. It was also evident that the meat-flavour concentrates prepared by the NPT method showed the presence of** constituents not detected in the aroma concentrates previously prepared by us using continuous steam-distillation-ext **Methylhexanal, 4-pentylbenzaldehyde, tetrahydro-2,4-dimethylfuran, and 2,4,6-trimethylpyridine may be responsible for the spec** flavour notes in pork, while 4-ethylbenzaldehyde, 1,2-dodecanediol, 2,6-bis(1,1-dimethylethyl)-4-methylphenol, 2-butylphenol, and **1H-pyrrole have been uniquely identified in chicken. The "beef-like" aroma perhaps includes 1,1,3-trimethylcyclohexane,** dimethylbenzene, D-limonene, camphene, and 2,4-dihydroxybenzaldehyde. 4-Methyl-2-pentanone, 2,2,4-trimethylpe **trimethylcyclohexane, and 1,3-dimethylbenzene could be contributing either directly as individual components or indirectly as** the formation of cured-meat aroma.

SULPHIDE EVOLUTION DURING THE COOKING OF BEEF AND MUTTON

D.H. Reid, T.J. Braggins and **O.A. Young**

Meat Industry Research Institute of New Zealand (Inc.), P.O. Box 617, Hamilton, New Zealand

Lean and adipose tissue samples from beef and mutton carcasses were cooked and the amount of sulphide ev determined. For both species, more sulphide (largely hydrogen sulphide) was generated from lean than from adip over the 2 hour cooking period. This contrasted with results obtained by others, where more sulphide evolved fro tissue. Approximately 33% more sulphide evolved from mutton lean than from beef lean. Large inter-animal diff were observed in evolution rates from mutton adipose tissue, though the average rate was higher than from beef. of sulphide evolved per gram of protein was significantly lower for lean than for adipose tissues of both species. evolved approximately 40% more sulphide per gram of protein than beef lean. Corresponding rates for adipose t highly variable, showing no significant relationship between sulphide evolution and protein content. The three mut tissue samples, though differing greatly in sulphide evolution rate, all had a strong characteristic mutton odour aft This suggests that sulphide *per se* does not contribute significantly to mutton flavour.

OLOUR AND COLOUR STABILITY OF DRY-CURED HAM

RODRIGUEZ-LOPEZ, J. A. PEREZ-ALVAREZ, M. E. SAYAS-BARBERA, M. J. PAGAN-MORENO, M. GAGO-GAGO, V. ARANDA-CATALA

partamento de Tecnología de Alimentos. Universidad Politécnica de Valencia. Camino de Vera 14. 022 Valencia Spain

ABSTRACT

The Spanish Dry-Cured Ham is an Intermediate Moisture Food and the Spaniards have the highest nsumption in the world. The Dry-Cured process can be divided in three fundamental stages : Salting, stsalting and Dry-maturation.

The aim of this work is the study of physical parameters evolution in Spanish Dry-Cured Ham during dry-maturation stage, at different lux intensities (300 - 1000). The study was made with 6 female ms. The zone under study was delimited between the central part of the femur bone and the rpendicular zone at that bone. The muscles under study were **Semimembranosus**, **Semitendinosus** d **Biceps femoris**. The samples were taken 9th months after the beginning of the process, and analysed colour evaluation at 1, 2, 3, 4, 5, 6, 7 days after the ham were cut for consumers sale. The physical rameters under study were CIEL*a*b*, pigment discolouration (red colour stability), pigment nitrosation nitrosation index). In all muscles and all the parameters under study decrease with the different lux ensities guided to a brownsih-red colour of Dry-Cured ham.

FFECTS OF FREEZING TEMPERATURE ON PHYSICOCHEMICAL AND ROCESSING QUALITY OF PORK

. SAKATA, T. OSHIDA and Y. NAGATA

aboratory of Science and Technology of Animal Products, Azabu University, Sagamihara, Kanagawa 229, Japan

eezing has many advantages for the preservation of meat and facilitates its marketing, but there is some destruction of muscle fiber due to rmation of ice crystals. This may lead to problems such as drip loss at meat thawing and oxidation of muscle pigment, (myoglobin), and duction in gel forming ability of myofibrillar proteins. A preliminary study was made of pork storaged at -18˚C~-20°C and drip loss during awing was noted to be greater for longer freezing periods, and deterioration of meat quality to occur after 9 month of storage based on color d TBA data. This study was conducted to examine the effects of freezing temperature on meat at -20 and -80°C.

ongeissimus dorsi muscle from 6 pigs (24hr postmortem) was cut into portions of similar size and shape (ca.700g) and vacuum packed in lyfilm. The muscle specimens were divided in three samples, one frozen at -20°C, another at -80°C and one to serve as the control, (not rozen). The meat sample frozen at -80°C was transferred to the -20°C freezer. After one month, both frozen pork samples were thawed at °C and drip loss(%) was measured. Hunter color, metmyoglobin formation(MetMb,%), water holding capacity (WHC), TBA, transmission alue(TM) and myofibril fragmentation were also determined. There was no significant difference in drip loss for the two frozen samples. o MetMb formation could be detected and Hunter values were also basically the same for all three samples. WHC, TBA and TM were ssentially the same for all three samples. TBA was quite low for each frozen sample, clearly indicating that lipid oxidation did not occur uring freezing. Histological examination of both frozen samples indicated inter- and intracellular ice crystal formation at -20°C, and tracellular ice at -80°C, the extent being less than at -20°C. At -20°C, ice crystals were larger and fiber diameter smaller than for the control r -80°C sample. Myofibril fragmentation in both frozen samples was significantly higher than in the control. Pork sausage was prepared rom all three samples by adding 2% NaCl and 100pm $NaNO_2$. Cooking loss and color forming ratios were essentially the same. The ausage sample made from the -20°C frozen meat was harder than that of the other two samples according to rheological measurement.

EFFECT OF VITAMIN E SUPPLEMENTATION DIETARY ON COLOUR STABILITY AND LIPID OXIDA IN TURKEY MEAT

Véronique SANTE, M. RENERRE and A. LACOURT .

Station de Recherches sur la Viande I.N.R.A. Theix F-63122 Saint Genès Champanelle

To reduce discoloration in turkey meat during ageing, dietary supplementation with vitamin E was teste known that vitamin E supplementation improves pigment and lipid stability in beef. So, this experiment de the effect of vitamin E supplementation in the diet on lipid oxidation and on colour stability.

Vitamin E was added during the last 3 weeks (supplemented animals 250 mg/kg ; controls 40mg/kg). twelve-week-old turkeys (B.U.T.) were killed and chilled in slaughterhouse conditions. Then, turkey m cut and wrapped in oxygen permeable film. Colour coordinates (L* a* b*), pH values and reflectance di at 630 and 580 nm were determined at different *post mortem* times. TBA (thiobarbituric acid) va vitamin E content were quantified just after slaughter and 7 days later.

Vitamin E supplementation resulted in a lower myoglobin oxidation ($p< 0.01$) and higher redness a* until Later, no significant difference in metmyoglobin content and redness a* was found. No difference in TB and ultimate pH were detected whatever the *post mortem* times. Although it had no effect on lipid oxidat vitamin E supplementation seemed to reduce the rate of discoloration.

THE EFFECT OF CRYOPROTECTANTS DURING FROZEN STORAGE OF MYOFIBRILLAR PROTE OBTAINED FROM MECHANICALLY DEBONED CHICKEN MEAT

F.J.G. SCHREURS, T.G. UIJTTENBOOGAART, T.L. TRZISZKA*) and H.G.M. REIMERT

Spelderholt Centre for Poultry Research, Agricultural Reseach Department, Ministry of Agriculture, NL-7361 AZ Bo Netherlands

*) T.L. Trziszka is with the Dept. of Food Technol. of Animal Origin, University of Wroclaw, Poland

The purpose of the study was to evaluate the effect of frozen storage (ca -21°C) on the properties of myofibrilla (MPI) without and with three different cryoprotectants. Two experiments have been conducted. The first experiment effect of short time frozen storage and repeated thawing and freezing, the second experiment was executed to study term frozen storage.

For the period of frozen storage (2-4 weeks) MPI was exposed to different freezing and thawing treatments in o whether and to what extent cryoprotectants are able to prevent MPI from protein denaturation.

Overall evaluation of color, weight losses of gels during cooking as well as the texture of gels proved that 4% Kara combination with 4% starch were the best cryoprotectants under study. Moreover, a positive effect was noted for 4% saccharose. In contrast, the addition of polydextrose to MPI proved to be useless.

An effect of the use of cryoprotectants has been seen very clearly during long term (up till 9 months) storage of M the gels with cryoprotectants proved to be significantly better than the properties of the gels without cryoprotectant proved to be the best cryoprotectant under study.

NTIOXIDANT ACTIVITY OF GREEN AND BLACK TEA IN MEAT MODEL SYSTEMS

. SHAHIDI[1], P.J. KE[1], Z. ZIANGDA[1,2], Z. YANG[1], and J. WANASUNDARA[1]

Department of Biochemistry, Memorial University of Newfoundland, St. John's, Newfoundland, Canada, A1B 3X9

Department of Chemistry, Anhui University, Hefei 230039, Anhui, People's Republic of China

Antioxidant activity of green and black tea as well as their extracts in meat model systems was investigated using 2-thiobarbituric acid (TBA) test. Green tea was found to possess stronger antioxidant properties as compared with black tea. Extracts of green and black tea in water, methanol, ethanol and ethyl acetate were also tested. The antioxidant effect of extracts was proportional to their total content of phenolic compounds, expressed as catechin equivalents. Tea catechins are considered as major compounds responsible for protection of meat against oxidation and flavour deterioration. Studies on the isolation of individual phenolics of tea and evaluation of their antioxidant properties are in progress.

ORAGE OF CARCASSES, CUTS AND CONSUMER PORTIONS OF LAMB IN ATMOSPHERES OF CARBON DIOXIDE

. SHAY, A.F. EGAN and B.A. BILL

IRO Division of Food Processing, Meat Research Laboratory, PO Box 12, Cannon Hill, Qld 4170, Australia

amb carcasses and primal cuts were stored in an atmosphere consisting almost exclusively of carbon dioxide (≠99.7%) for periods of to 12 weeks at 0°C. After storage under such conditions, the microbial flora on both fat and lean surfaces consisted almost entirely f lactic acid bacteria, the maximum population did not exceed $10^7/cm^2$ and the meat did not spoil.

The storage life of consumer portions of lamb from carcasses and primal cuts stored in carbon dioxide and in conventional vacuum packs was evaluated against three criteria: microbial status, sensory evaluation and colour maintenance under retail display conditions. It was found that, the storage life of consumer portions from carcasses or primal cuts stored in carbon dioxide was longer than for portions prepared from vacuum packaged meat. This was because the colour stability of consumer portions from meat stored in carbon dioxide did not decline with time of storage in the master pack.

The use of master packs made of plastic film with an oxygen permeability of 5 ml of $0_2/m^2/24$ h/atm (measured at 25°C and 75% RH) did not reduce storage life when compared to that obtained with films that are completely impermeable to oxygen.

EFFECTS OF SPICES ON COLOR STABILITY OF CHINESE-STYLE SAUSAGE

Shiu-Lan Guo, Deng-Cheng Liu and Ming-Tsao Chen

Department of Animal Sci., National Chung-Hsing University, Taichung, Taiwan 40227, ROC

Pepper, five spices powder consist of anise, fennel, clove, cinnamon and pepper are the major spice ingre used in Chinese-style sausages produced in Taiwan. Some producers think that the products added wit spices may cause the surface of product darken during storage. Thus, they won't use this kind of spic possible.

The purpose of this experiment was conducted to investigate effects of the spices on the color stabi Chinese-style sausage during storage. The product samples prepared with course ground pork mixed with and different spices, separately and cured at 4°C for 24 hr. The mixture was stuffed in natural casing and at 52°C for 72 hr and cooled. The samples were hung in air at ambient temperature. Hunter Lab metmyoglobin content (Met Mb) and TBA values of the products were determined at 0, 4, and 7 da storage.

No difference was detected in L-value of the samples between the treatments at 0 time. It was observe L-values for the control (without spices) and products with pepper and five spices dropped slowlier th products with fennel and cinnamon after 4 days of storage. The changes in lightness of the products s same trends after 7 days of storage. Changes in a and b-values for all treatments were the same trends values. However, the samples with fennel and cinnamon changed significantly, and the control re constantly. ΔE for the samples with five spices, fennel and cinnamon was higher than the control. Th also revealed that Met Mb content in sausage was at the range of 77-79%. Met Mb content in the produ cinnamon changed markedly. TBA values for all samples also changed with storage time. TBA value products with five spices and fennel, increased rapidly in first stage of storage while the control remine From the reaults we concluded that the spices used in Chinese-style sausages regularly might enhanc change and fat oxidation.

INVESTIGATIONS ON THE PROCESSING OF BOTH FROZEN AND CHILLED PORKS

TIAN AI JIA

Tianjin Food Research Institute, 26 Jinzi Highway, Nankai District, Tianjin 300381, China

China is one of the large country of meat production and consumption in the world. However frozen po now are the major raw meat food which chinese consumers purchase usually on daily life in China. years, most of the meat and meat products are packaged in chilling state in developed countries consumer's demands. In this paper, we mainly discussed a change of frozen porks during storage, thawi of frozen porks and the characteristics of chilled porks in China. We selected some carcasses after and those were stored at -21°C in freezing room. And we examined a change of the pH, acid value and value within different storage time for 0, 24h, one month, three and six months respectively. We f the pH of the carcasses increased to 6.9 from initial 5.8, figures both acid value and peroxide v increased to some extent as well. The results indicated that the carcasses of frozen porks have alre a change in quality. THerefore we can say, even if frozen proks were stored at freezing roo temperature, they would be unable to store for a long time as well. In addition the loss of the dr on frozen porks during thawing is a considerable problem. In which, a part of nutritional compo with the drip losses during thawing to decrease nutritional value of meats. During thawing, the di would lose about 6% of raw meat weight. Finally, we discussed the mojor characteristics of chill Chilling is a ripening processing of the carcasses after slaughter. It could be able to resolve protein of the carcasses into amino acids to improve nutritional value. Chilled meats could develo film on the surface of meats to prevent further environmental pollution and inhibit the g multiplication of microorganisms. About this conclusion we did, we will discuss that further on n soon. So we can say that chilled meats are good quality of fresh meats with good taste and appearance.

ASE, ESTERASE AND AMINOPEPTIDASE ACTIVITIES IN RAW PORK ADIPOSE TISSUE

OLDRA, M-J. MOTILVA, M-C. ARISTOY AND J.FLORES

stituto de agroquímica y Tecnología de Alimentos (C.S.I.C.), Jaime Roig 11, Valencia
10, Spain

TRACT

pose tissue contains different lipolytic and exopeptidase enzymes which are responsible
lipid and peptide metabolism. These enzymes might play an important role in flavour
elopment during the processing of meat products containing adipose tissue as an
portant component.

objective of this work is to study the lipase, esterase and aminopeptidase activities
this tissue in order to have an approximate idea of the hydrolytic changes which may be
ected in the processing of meat products.

assayed enzymes were neutral (pH 7.0) and basic (pH 8.0) lipases, acid (pH 5.0) and
tral (pH 7.5) esterases and leucyl, arginyl, alanyl, tyrosyl and pyroglutamyl
drolysing activities. Specific fluorescent substrates were used for each enzyme.

results indicate an important lipolytic activity : 2.1 and 0.8 U/g fat for neutral and
ic lipases, respectively, and 12.4 and 1.4 U/g fat for acid and neutral esterases,
pectively. In the case of the aminopeptidase activity, only the leucyl, arginyl and
osyl hydrolysing activities with 0.38, 0.31 and 0.11 U/g fat, respectively, are
evant. The alanyl and pyroglutamyl hydrolysing activities are very low, 0.02 and 0.005
unt fat, respectively. In view of these important levels of enzyme activities, a relevant
dition of free fatty acids and amino acids might be generated, depending on the
ed, during the processing of meat products and with special incidence on those dry-

E INFLUENCE OF ANTIOXIDANTS ON WHOLESOMENES AND SHELF-LIFE OF MECHANICALY DEBONED
ULTRY MEAT (MDPM)

VELJIĆ*, LJ. NEDELJKOVIĆ*, G. VOJINOVIĆ* and I. VELJIĆ**

ugoslav Institute of Meat Technology, 11000 BEOGRAD, Yugoslavia

ICN-Galenika, 11080 ZEMUN, Yugoslavia

e influence of the antioxidative substances on wholesomenes and shelf-life of fresh and
rozen MDPM from backs and necks on prevention of oxidative changes as well as their slowing
wn were investigated. The antioxidative substances which were investigated were following:
aCl, polyphosphate, vitamin E, rosemary extract and propyl-gallate. The results showed that
idative changes were higher in MDPM from backs comparing with MDPM from necks. Antioxidative effe-
t of added substances was successively: propyl-gallate, vitamin E, rosemary extract. Adding
ese substances can make the storage time of MDPM much longer.

Session 9

OBJECTIVE MEASUREMENTS OF CARCASSES AND MEAT QUALITY TRAITS

ULTRASONIC MEASUREMENT OF MEAT HETEROGENEITY DUE TO CONNECTIVE TISSUE

S. ABOUELKARAM[1,2], P. LAUGIER[3], M. FINK[2], J. CULIOLI[1]

[1]Station de Recherches sur la Viande, INRA THEIX, 63122 CEYRAT.
[2]Laboratoire Ondes et Acoustique, ESPCI, 10, rue Vauquelin 75005 PARIS.
[3]URA CNRS 1458 Imagerie Paramétrique, 15, rue de l'Ecole de Médecine 75006 PARIS.

Ultrasonic image analysis is proposed as a quantitative technique for assessment of meat quality. We present in this paper experimental results on the measurement of meat heterogeneity. The method is based on the calculation of the correlation coefficient of echographic signals recorded in various locations of the meat sample. In the case of a homogeneous medium (i.e. only scattering medium), theory says that the correlation coefficient rapidly vanishes with the distance. The value of the correlation coefficient depends only on the beam width. On the contrary in the case of a heterogeneous medium (rich in connective tissue) the correlation coefficient does not vanish and its value depends on the degree of heterogeneity. For echographic data recording and processing we designed a mecanical ultrasonic system which produces echographic B-scan images of the meat. A focused transducer of 4 MHz center frequency is moved in steps of 0.1 mm. Large size echogenic structures visible on the image correspond to the specular echoes of the connective tissue. The image is divided into five regions. The degree of heterogeneity is estimated by the ratio between the surface of the echogenic structure and the whole region surface. The correlation coefficient is calculated for the different regions and it is shown that this coefficient increases with the degree of heterogeneity measured by the surface ratio. Thus we propose two quantitative indicies for ultrasonic assessment of meat heterogeneity due to the connective tissue. The surface ratio is derived from the ultrasonic image and measures the visible heterogeneities. The coefficient correlation measures also the degree of heterogeneity but we think that it should be an interesting index for the measurement of other tissue features not visible on the image such as tissue anisotropy.

EVALUATION OF UREA DILUTION FOR ESTIMATING CARCASS COMPOSITION OF FAT TAILED AWASSI SHEEP . S. ALRAHEEM, N.RASHID, D.AZIZ, J.ALKASS AND K.ABOUD. Departement of Animal Science. College of Agriculture, Abu-Ghraib, Baghdad-Iraq.

Thirty Awassi ram lambs were used to evaluate urea space (US) as an estimator of carcass composition . Urea space was measured 12 min following the infusion of 20% urea (130 mg urea/kg live weight). Lambs were slaughtered after urea dilution and weights of the full and emptied gastrointestinal tract and carcasses were taken. After chilling overnight, the left side of each carcass was physically dissected into bone , fat , and lean . Urea space / live weight(LW) was related to percentages of carcass fat (PCF) and carcass lean (PCL) by the equations 21.6 - 0.03US (r^2 = 0.90 $p<0.01$) and 46.9 + 0.07 US (r^2 = 0.76 , $p<0.01$), resp. Negative correlations were obtained between US/LW or empty body weight and each of tail fat, total fat percentage and PCF (- 0.50, - 0.48 : -0.49, - 0.48 : - 0.31 and - 0.31). Positive correlation (+ 0.49) was estimated between PCL and US/LW . It is concluded that urea space measurement may be used as a practical estimator of carcass composition in fat tailed sheep .

A NOVEL, NONINVASIVE METHOD TO MEASURE FAT CONTENT OF BONELESS MEAT.

M. BARTLE and B. B. CHRYSTALL

(DSIR Institute of Nuclear Sciences, Box 31312, Lower Hutt, NZ), and (MIRINZ, Box 617, Hamilton, NZ).

Fat content of boneless manufacturing meat is the basis of its value and end use. Measurement procedures for product that is a carton vary from the tedious and inaccurate method of core sampling and chemical assessment, through to the EMME (MC instrument.

The latest and most versatile approach to measurement of fat content of cartonned product is to use the simultan transmission of neutron and gamma rays through the carton (NEUGAT) and then analysing the attenuation of the rays deter the fat content. This method has been developed in New Zealand and is now at the commercial prototype stage.

The level of radioactivity used is 10^{-9} of the amount used for food irradiation. The New Zealand Health Department does consider the use of radioactivity to constitute food irradiation because of the minute dose.

Tests comparing the fat content of cartons boneless beef or sheepmeats measured by chemical analysis with those meas with the NEUGAT principle show the instrument to be accurate over a very wide range of fat contents. The system accura measures fat content of cartonned meat over the range from 0% fat through to 100% fat in both chilled and frozen meat. At present state of development the fat content in a carton can be determined to within 1.5% in 10 seconds. Future developments enable the same precision to be obtained with measurement durations of less than 5 seconds. The error in measurement with second measurement time is currently 4%. The system, now being commercialized by AWA (NZ) Ltd will enable on monitoring of cartonned meat to meat predetermined specifications or the marking of cartons with their fat content.

COMPARISON OF VARIOUS INSTRUMENTS FOR ON LINE ASSESSMENT OF THE COLOUR OF VEAL CARCASSES.

F. BECHEREL[1], G. EIKELENBOOM[2], M. RENERRE[3], J.R. ANDERSEN[4]

(1) Equipe Qualité des Viandes de l'Institut de l'Elevage, Route d'Epinay, 14310 VILLERS BOCAGE, France
(2) DLO-Research Institute for Animal Production, P.O. Box 501, 3700 AM ZEIST, The Netherlands
(3) INRA, Station de Recherche sur la Viande, THEIX, 63122 ST GENEST CHAMPANELLE, France
(4) Danish Meat Research Institute, Maglegardsvej 2. P.O. Box 57, DK 4 000 ROSKILDE, Denmark

A total of five instruments were tested in order to evaluate their ability to assess the colour of veal carcasses early post m min) and on line. The experiment took place in Brittany (France) and involved a total of 367 veal carcasses, measure consecutive days. The colour of the Rectus abdominis (RA), after removal of the skin, was measured in triplicate w instruments : the Chromameter CR 300 (Minolta), the Surface Meat Colour Meter (Sensoptic) and the Retrolux III (Ly Invasive duplicate measurements, using fiber optics, were made in the M. Longissimus lamborum and the M. Biceps fe the Invasive Meat Colour Meter (Sensoptic) and a prototype of the Danish "Pigment Probe". Three standard measureme used as a reference : (1) independant visual assessment of veal colour (4 classes) at 45 min p.m., by four persons (m (2) ultimate colour (L, a and b values) of RA determined by spectrocolorimeter at 24 h p. m. and (3) haem content of RA method).

Surface measurements were best related to the visual judgment of carcass colour, on the same muscle (RA). Th correlation coefficients between this reference measurement and the Chromameter (L and a values combined), Su Colour Meter and Retrolux III were respectively 0.85, 0.81 and 0.76. The correlations were much lower (0.43 to 0.6 measurements with both invasive instruments, performed on other muscles (LL and BF). Similar results were obtained other references were used. A sample of 253 carcasses was selected to study the ability of both the Chromameter (L and combined) and the Surface Meat Colour Meter to correctly predict the colour classes as determined by visual assessm value). 89% and 84% of these carcasses were correctly classified respectively with the Chromameter and the Su Colour Meter. . It is concluded that, at present, the surface measurements (RA) with both the Chromameter CR 300 a Meat Colour Meter are most suitable in providing an objective on line assessment of the colour of veal carcasses.

PREDICTABILITY OF SENSORIC PROPERTIES IN BEEF BY PHYSICOCHEMICAL MEASUREMENTS

G.A. BECK, Roswitha DÜRR and H.M. EICHINGER
Versuchsstation Thalhausen, Lehrstuhl für Tierzucht der TU München-Weihenstephan, W-8051 Kranzberg, Germany

The standardisation of sensoric beef meat quality is a major objective especially for the European beef market. Nevertheless, the subjective evaluation of beef quality is time-consuming and expensive. Therefore it was the aim of this study, to examine a variety of measurements for the prediction of sensoric beef meat quality.

Samples from the m. long. thoracis of 37 young bulls and 38 heifers were used for the physicochemical measurements and for sensoric evaluations. Measurements of conductivity, pH and meat color (L*-value) were performed 1 day post mortem. Intramuscular fat content (IMF) was determined by Near-Infrared (NIR) reflectance measurements. Sensoric evaluations of tenderness, juiciness, palatability and overall acceptability were performed by a trained test panel on cooked samples. For the prediction of the sensoric properties multiple regression models including conductivity, pH, meat color and IMF content were used. Linear and curvilinear relations between the dependent and the independent variables were considered in the regression models.

The coefficients of correlation (r) between the predicted and the real evaluated sensoric properties were between 0.62*** and 0.75***. In our material conductivity and pH did not significantly increase the coefficients of determination.
We conclude, that, by using the easy to perform IMF and color measurements, a great part of the variation in sensoric beef meat quality of young bulls and heifers can be determined.

COMPARISON AND APPLICATION OF QUALITY CRITERIA FOR PSE OF PORK

J. BUDIG and I. INGR
Institute for Meat Research, CS - 612 00 BRNO, Czechoslovakia
University of Agriculture, CS - 613 00 BRNO, Czechoslovakia

There is no univocal objective evidence for the PSE quality defect in pork. This fact follows from the "normal distribution" of the spectrum of measured values of each meat property. The PSE defect is most frequently derived from the pH_1 values ($\leq 5{,}8$), reflectance (>25 %) and water-holding capacity (>5 %) of the meat. These values were investigated in 400 slaughtered pigs, their interrelationships were studied as well as their applicability in practice. The PSE defect was proved by using the pH_1 values in 22.0 % of the slaughtered pigs, by measuring the water-holding capacity in 22,5 %, and by measuring the reflectance in 31.5 %. The correlations between the three studied quality criteria were significant. Providing that at least two of the three criteria were in accordance, then 10, 11 or 12 % of the meat samples would be indicated as PSE meat if mutual combinations of the criteria were possible. The most suitable criterion appears to be the pH_1 value. If pork is to be utilized effectively, we propose to grade the PSE defect from very low to very strong, together with a respective grading of the pH_1 values. Using the three criteria, the influences of three pre-slaughter effects were evaluated in a homogenous group of 120 carcass pigs, the results being 22, 25 and 35 % of PSE meat.

SOME PROBLEMS OF THE EVALUATION OF THE WATER-BINDING CAPASITY AND WATER AKTIVITY OF TISSUE

U. Ch. CHOMANOV, A. U. KAMERBAYEV
Technological Institute of Meat and Milk Industry, Glinka Street, 49, 490050 Semipalatinsk, Republik of Kazakhstan.

Water plays a very important role in a biological systems functioning and researches of state of food products have always attracted attention. Meat and dairy products water studies make it possible to determine their processing properties.
It is water-binding capacity and water activity indices that show the state of biological systems.
Most of the methods used for determining of water-binding capacity in meat and its have a high degree of errors and take much time. This can be explained by the lack theory of bonds between water and dry framework of a product.
The methods is based on measuring free water and bound water content in meat and its p
The equation of kinetics of water activity and water content modifications in the pr isotermic drying has been solved [dAw/dt = f(W)]. The amount of bound and free evaluated by critical moisture index when a sharp dicrease of water activity is o hence water energy increases and strengthens the bonds of water and dry framew ingredients (such as salts, engymes, etc.) dissolved in water. Methods efficiency depen precision of water activity measurements and scales measuring lost mass of product process of its drying.

SEX INFLUENCES ON PIG CARCASSES GRADING

G. DAUMAS (1) **and T. DHORNE** (2)

(1) Institut Technique du Porc, Pôle Qualité du Produit, BP 3, 35650 LE RHEU, France

(2) Institut National de la Recherche Agronomique, Laboratoire de Biométrie, 65 rue de St-Brieuc, 35042 RENNES, France

Although sex effects are well known to influence the lean proportion of pig carcasses and therefore grading methods, no mod E.C. takes actually sex effects into account. In order to measure the improvement of accuracy in predicting carcass lean propor introducing sex effects, different models were fitted on a sample of carcasses partially dissected. Bias between sex has an influe residual standard deviation of the prediction models. In order to appreciate the human perception of conformation effects, an e was conducted on two samples of carcasses of the same predicted lean proportion. It is shown that the conformation parameters related with sex effects, asserting that taking sex into account in the model could lead to an improvement of the prediction.

HOW TO NORMALIZE THE METHODS FOR GRADING PIG CARCASSES IN THE COMMUNITY ?

J. DAUMAS [1], T. DHORNE [2]
[1] Institut Technique du Porc, Pôle Qualité du Produit, BP 3, 35650 Le Rheu, FRANCE
[2] INRA, Laboratoire de Biométrie, 65 rue de St Brieuc, 35042 Rennes, FRANCE

Putting into practice the conclusions of the present research concerning the harmonisation of methods for grading pig carcasses in the Community would not perceptibly improve accuracy. The average lean proportion accuracy in the national pig populations, estimated by EC authorised methods, is assessed about 2 %. Therefore the question about a normalization, i.e. accuracy between 0.5 % and 1.0 %, of these methods is to be raised. In order to normalize it is necessary to study all the methodological problems in a detail manner. These questions deal with four subjects : the lean proportion, the grading device, the prediction equation and the experimental design. Normalization could use the following means : a common experimental design, an EC dissection method combined with a clearly defined lean proportion calculation, the use of common regressors, one single equation by Member State from tissue depths measured with the same device (called reference device) for each, a common calibration procedure for grading probes in comparison to reference device, a common statistical methodology for modelisation and associated parameters estimation, a standard scheme for the required document to ask for grading methods EC authorisation. Such a program, which needs additional dissections in EC, could lead to put into practice in three or four years normalized grading methods.

INFLUENCE OF HALOTHANE SENSITIVITY AND OF MEAT QUALITY ON YIELD AND QUALITY OF COOKED HAM

DE SMET S.*, VERVAEKE I.*, VERPLAETSE A., DEMEYER D.*, PAUWELS H., EECKHOUT W. & VAN HOOF J.
* Research Centre for Nutrition, Animal Production and Meat Technology, University of Gent, Proefhoevestraat 10, 9090 MELLE, Belgium

The present study investigated the influence of halothane phenotype and of meat quality on manufacture and quality of cooked ham. Hams of the right carcass side of ninety-six pigs (Belgian Landrace or Pietrain x Belgian Landrace) were used for the production of cooked ham. Several measurements of meat quality were made 30 min post mortem on the carcass (*M. longissimus dorsi* (LD) and *M. semimembranosus* (SM)) and 24 h post mortem on the carcass and on slices of the LD. Measurements on the final product included dry matter, chloride concentration, shear force, cohesion, fat content and colour stability. Many significant differences in meat quality measurements were found between the halothane-positive (HP) and the halothane-negative (HN) animal group. However, no significant differences were found in the cooked ham characteristics studied, except for the fat content. Mean technological yield (TY) was 97.3 and 95.0 % in the HN and HP group respectively. However, when animals were divided in two groups according to low- or high-initial pH of LD or SM, TY was significantly lower in the low-initial pH group. Correlations of TY with meat quality measurements were low. In conclusion, in this experiment halothane sensitivity only partly explained differences in meat quality that were responsible for differences in TY of cooked ham manufacture.

TLC METHOD OF QUANTITATIVE DETERMINATION OF AMONIUM COMPOUND RESUDUES IN ANIMAL TISSUE

D.DIMITRIJEVIĆ, MILICA POLIĆ, GORDANA VOJINOVIĆ
YUGOSLAV INSTITUTE OF MEAT TECHNOLOGY, Belgrade, Kaćanskog No 13, Yugoslavia

TLC method for quantitative determination of quaternary ammonium compound residues QAC) in animal tissue which is a chemical mixture of: dexadecylthreemethylammoniumbromide (93%), tetradecylthreemethylammonimbromide (3,5%), dodecylthreeammoniumbromide (1,5%) and octadecycthreemethylammonium bromide (2%).

The residues of QAC have been derived from the muscle and fat tissues in the process of the extraction with methanol. The standard QAC solution and QAC residues previously derived from the animal tissue have been applied to the plates Silica gel/merck, cat. No 5626/by means of the automatic equipment (camag linomat IV). The plates have been eluated by a dissolving mixture - N - butanol: glacial acetic acid: water = 4:1:1. After developing, the plates have been dried at 150°C until the dissolver stain vanished. The spot on the plate were spraying by Dragendorf reagent. The QAC residues have been determined quantitatively in the automatic densitometer (Camag TCL Skanner and in the automatic data registration equipment (Camag integrator SP 4290). The accuracy of this method has been checked by adding 160 mg/kg of QAC to the cattle and pig muscle tissue and the fat tissue.

The results of the investigation show that the method is reliable for quantitative determination of this kind of disinfectant in animal tissue.

USE OF DIFFERENT METHODS TO ASSESS VEAL COLOUR AND PIGMENT CONTENT

G. EIKELENBOOM, W. ZHANG, A.H. HOVING-BOLINK, G.J. GARSSEN AND P. STERRENBURG
DLO Research Institute for Animal Production, P.O. Box 501, 3700 AM Zeist, The Netherlands

ABSTRACT

Using 60 veal carcasses, colour was determined at 30 - 40 minutes post mortem by assigning scores with a colour standard and measuring L*(lightness)-, a*(redness)-, and b*(yellowness)- the M. rectus abdominis (RA). Colour (L*-, a*- and b*-values) of the Mm. longissimus and semimembranosus (SM) was measured on a freshly cut surface, after vacuum packing for Also, ultimate pH was assessed and pigment content was determined in triplicate with both sey and the Nit409 method.

Both in LD and SM the Nit409 method resulted in a significantly higher pigment content the Hornsey method. The Nit409 method showed a considerably better repeatability and also relationship with the colour measurements of the same muscles, than the Hornsey method. In pigment content and a*-values were significantly lower than in the SM.

Pigment content, as assessed with the Nit409 method, was better related to the a*- than L*- and b*-values, while the reverse was true for ultimate pH. Because of the relative influence of variation in scatter due to variation in ultimate pH, it is concluded that ea mortem is the most appropriate time to evaluate veal colour, as it is influenced by (pigment content) and conditions in primary production. Early post mortem measurement of veal (RA) was better related to ultimate veal colour, than the visual evaluation using a colour dard.

MATION OF BEEF CARCASS COMPOSITION USING VELOCITY OF SOUND AND ELECTROMAGNETIC NNING

FERGUSON[1], G.W. JOHNSON[1], I.J. EUSTACE[2], P. CABASSI[2], R.J. CHANDLER[3], R.J.W. LAKE[4] AND RADBURY[4]

TO Division of Food Processing, Meat Research Laboratory, PO Box 12, Cannon Hill, Qld 4170, Australia, [2]Australian Meat and tock Corporation, Woolloongabba, Qld 4102, Australia, [3]Livestock and Meat Authority of Queensland, Brisbane, Qld 4002, alia, [4]Advance Measurement and Control Pty Ltd, Armidale, NSW 2350, Australia.

al technologies to determine carcass composition, ranging in cost and complexity, are under development and evaluation. In this the accuracy of two technologies, Velocity of Sound (VOS) and Electromagnetic Scanning (EMS), was assessed for the tion of lean percentage in beef carcasses. VOS, EMS, hot carcass weight and P8 fat depth measurements were determined for ses of twenty-eight Angus x Hereford steers, within one hour after slaughter. After overnight chilling, the sides were boned and at lean was determined chemically. The mean carcass weight (CWT) and lean percentage were 243 ± 46.8 kg and 66.7 ± 2.6%, ctively.

best single VOS measurement (at 10-11th rib) was less accurate than the best combination of VOS measurements (R^2=0.44; 1.95 v. R^2=0.62; SEE=1.62) and the latter was significantly improved when CWT was included (R^2=0.70; SEE=1.48).

ough small differences in accuracy were observed using single EMS phase curve parameters, the combination of CWT and an height parameter (H_1), was the most accurate (R^2=0.79; SEE=1.24). Although both EMS and VOS were slightly more accurate the standard measurement combination of CWT and P8 fat depth (R^2=0.68; SEE=1.59), the potential of each will only be known they have been assessed on a larger heterogeneous sample.

TD SIMULTANEOUS DETERMINATION OF FAT, WATER, PROTEIN AND COLOR IN BEEF BY A NIT-ANALYZER REUDENREICH

eral Centre for Meat Research, 8650 Kulmbach, Germany

possibilities of the application of Near-Infrared-Transmission-analysis (NIT) to the determination of quality-parameters and r of the meat are reported. The NIT-measurements were done by the Model Infratec 1255 of the Firm Perstorp, Sweden. For measurements the infrared beam passes through a 15 mm layer the sample. The NIT-spectroscopy is based on the well known uple, that molecules with different functional groups - fat, water and protein - absorb the infrared light at different wavelengths 0-1050 nm). The aim of these investigations was to get calibrations for the different meatquality-criteria of beef, moreover to pare the NIT-measurements with the reference values of the conventional analysis. During the calibration regression functions ween the infrared absorbtions and the quality parameters from the conventional analysis are to be calculated. As the main endent variable of these regression functions was considered the intramuscular fat content, determined by chemical analysis of ten samples. Further variables like protein- and water-content as well as meat lightness (L^*-value, Chroma-Meter 200b, bolta) were also included. The material of the calibration samples came from young bulls (n=68) and young cows (n=60). scle samples (M.long.dorsi) were taken 1 day post mortem in the height of the 7th rib, followed by a deep freezing. The mically determined intramuscular fat-contents had a range of 0.7 % to 8.5 %. At the verification of the calibration the variables ld be estimated as follows: intramuscular fat-content with R=0.99 and SEC=0.34 (Standard Error of Calibration), water with 0.98 and SEC=0.45, protein with R=0.93 and SEC=0.36, color with R=0.94 and SEC=0.92. A test on an independent sample 845) showed for intramuscular fat SEP=0.25 (Standard Error of Prediction), for water SEP=0.39, for protein SEP=0.27 and for or SEP=0.82. Hence, the NIT-measurements have a precision comparable with that of the conventional methods, morover, they lditre considerably less personal and time expenditures. The total avoidance of reagences should be taken into account in the vironmental point of view.

TERNATIVE METHODS FOR ASSESSMENT OF BOAR TAINT

HANSEN-MØLLER AND J. RUD ANDERSEN

ish Meat Research Institute, Maglegaardsvej 2, 4000 Roskilde, Denmark

many countries castration of male pigs has been practiced for centuries in order to avoid the occurrence of "male odour" in meat from 0% of the animals. The "male odour" is only a problem, when meat or meat products are heated by the consumer prior to consumption. of the compounds responsible for the boar taint is known to be skatole. When producing uncastrated male pigs it is important to have thod for determining the concentration of skatole in order to sort out tainted carcasses. The Danish Meat Research Institute has developed such methods; a colourimetric [1], and a high-performance liquid chromatographic (HPLC) method [2].

colourimetric method uses extraction of fat samples with TRIS/acetone mixture, - derivatization with 4-dimethylaminobenzaldehyde measurement of the absorbance at 580 nm [1]. This method has been automated to a capacity of 200 standards/samples per hour, and rrently used at slaughterhouses. The method is, however, theoretically open to interference from other indolic compounds. A HPLC- thod for separation of 13 different indolic compounds and quantitative determination of 7 of these, including indole and skatole, has been loped. Solid phase sample preparation is used for extraction of the indolic compounds. Fluorescence (Ex./Em. 280/340 nm) is used for tive detection [2].

paring the two methods on samples containing skatole gives a good correlation (r=0.973), - although the colourimetric method tends erestimate skatole content at very low concentrations. This correlation does not improve when indolic compounds other than skatole are ted into the regression, - thus it may be argued that none of the other indolic compounds contribute to the results obtained by the urimetric method.

A.B. Mortensen and S.E. Sørensen, *Proceedings of 30th European Meeting of Meat Research Workers. Gent,* 1986, p. 394.

J. Hansen-Møller, *J. Chromatography,* in press.

CONTRIBUTION OF EYE MUSCLE AREA TO THE OBJECTIVE MEASUREMENT OF CARCASE MUSCLE

OHNSON[1], D.G. TAYLOR[2] AND R. PRIYANTO[1]

t. of Farm Animal Medicine and Production, The University of Queensland, Qld. 4072.
t. of Animal Production, The University of Queensland Gatton College, Lawes, Qld. 4343.

uscle area is used in many carcase appraisal systems throughout the world in an effort to quantify carcase muscle. Recent advances in ound technology have led to the availability of imaging (Real-time) ultrasound which allows scientists to measure eye muscle area tely in cattle and carcases. However the value of the contribution by eye muscle area to the quantification of carcase muscle is not

study single and multiple regressions were used to investigate the contribution of hot side weight, 12th rib fat thickness and eye muscle the prediction of carcase muscle in three groups of carcases, one grass-fed group of 44 (97-269kg), one grain-fed group of 34 (277-) and one grain-fed group of 48 (291-512kg). A side from each carcase was totally dissected into muscle, bone, fat and connective

e prediction of both weight and percentage of carcase muscle, eye muscle area alone was an unsatisfactory predictor showing high al standard deviations and relatively low coefficients of determination.

e regression analyses showed that eye muscle area was of little value in contributing to the prediction of weight or percentage of e in lightweight carcases. In heavyweight carcases (both grass-fed and grain-fed) the use of eye muscle area gave slight to moderate vements in the prediction of both weight and percentage of carcase muscle. In all three populations studied it was preferable to predict t of carcase muscle rather than percentage because of the greater amount of variance explained by regression.

concluded that eye muscle area was of no practical value for predicting muscle in lightweight carcases, but it contributed moderately to tion in heavyweight carcases where it was best used to predict weight rather than percentage of carcase muscle.

DETECTION PSE MEAT AND INFLUENCE OF HAEM PIGMENT CONCENTRATION

Mª. D. GARRIDO, J. PEDAUYE, S. BAÑON, A.D. PEREZ, J. LAENCINA.

Tecnologia Alimentos, Facultad Veterinaria, Campus Univ. Espinardo, 30071 MURCIA, Spa

This study has two objetives, first to estimate the incidence of PSE pork meat in the other hand to study the influence of haem pigment concentration on PSE or DFD m hundred and five commercial carcasses.

The meat quality (PSE, DFD, Normal) was determinated through non destructive meth slaughter line.

Measurements of light scattering, electrical conductivity and pH were made duri abattoir working operations using Fibre Optic Probe (FOP) and Quality Meter (QM) and Measurements of FOP, QM and pH were taken at 45'and 24 h post mortem on *Semimembr* muscle and *Longissimus dorsi* (LD) muscle.

The pigment concentration in the meat was determinated by the Trout (1991) analit using SM samples.

With discriminant analysis we have tried to find the pigment concentration int might corespond to each meat quality classification behaviour analyticals and i variables between sexs, have been contrasted by a F- Test.

CHARACTERISTICS AND COMPOSITION OF LEAN AND FAT IN PORK CARCASSES

Mª. D. GARRIDO, E. MARIA DOLORES, B. LOPEZ, A. MUÑOZ, J. LAENCINA.

Tecnologia Alimentos-Genética y Mejora Animal, Facultad Veterinaria.

Campus Universitario Espinardo, 30071 MURCIA, Spain.

The aim of this study is to realize a valoration in two hundred and fiftyfive corresponding to two breeds -L: F_1 (Landrace x Large White) x Dalland), D: Dalla and fat characteristics using the Fat-o-Meter probe (FOM) inmediatly after studying the dates of lean percentage, sr (mm fat 3/4 inter rib), sl (mm fat las (lean thickness).

These measurements have been constrasted with other parameters such as car carcasse lenght, subcutaneous fat thickness in *Gluteus* and the first rib, carcasse. Also with intramuscular fat, moisture and water holding capacity de *Semimembranoso* muscle.

For the stimation of water holding capacity total (WHO) soluble sarcoplasmic an proteins were determinated (Barton Gade, 1984). Furthemor was employed the Grau method with Volovinskaya (1968) modification.

We have also investigated the influence that the breed and sex may have considered through a F-test looking at significative differences ($P<0.05$) on some of th variants, such as lenght carcasse, intramuscular fat, CRA, sl, etc.

FUTURE CLASSIFICATION SYSTEMS - REQUIREMENT SPECIFICATION FROM A MANAGEMENT PERSPEC

G; LORENZ

Institute for Business Management and Market Research of Food Processing, Federal Dairy Research Center, 2300 KIEL, FRG

The paper will describe feasible classification systems which are compatible to the overall management strategy of a slau
Additionally compatability must be gained to <u>all</u> departemental strategies, for example the marketing, production and p
strategmy - to name just the most relevant ones.

Starting with the market strategy, the requirement specification of a suited "marked orientated" classification technology will
Then, these requirements are being "translated" into possible production hardware components. The same approach will be
other relevant firm strategies, so that at the end of the analysis a "complete (hardware) picture" of future classification sy
suited for management purposes - can be drawn.

<u>Quality of Beef Produced in Estonia</u>

V.LUTS, V.KANGRO and H.KOPPEL

Estonian Development Centre of Meat and Dairy Industry,

Estonian Research Institute of Animal Breeding and Veterinary Science, EE2400 Tartu

JV "Estkompexim", EE0109 Tallinn, Estonia

The following study was carried out to evaluate the quality of carcasses and bee
young fattening bulls and heifers of the Estonian Red dairy breed from state (big)
private (small) farms. The quality of carcasses evaluated by the carcass classificat
system valid in Estonia was compared to the E.U.R.O.P. classification system. The per
tage of kidney fat was calculated. Beef quality alterations (PSE-pH<5.8 and DFD>6.2)
assessed by pH_1 and pH_{48} values in the M.Longissimus dorsi. The physical composition
les, fatty tissue and bone) of half-carcasses and chemical composition (content of
fat, water and ash) of M.Longissimus dorsi was determined.

The results show that there were no carcasses meeting the demands of the two bes
ses of E.U.R.O.P. classification (E. and U. by meatiness) due to the unsufficient d
ment of muscles. The percentage of kidney fat was 1.1 - 5.6. The quantity of PSE bee
small and that of DFD beef was bigger in state farms in comparison with private fa
(20 and 33,3 %, respectively, of the animals studied).

It can be concluded that the young cattle of the Estonian Red dairy breed produ
casses with acceptable meat quality.

ODUCTION OF A NEW METHOD FOR PREDICTING FAT CONTENT IN LAMB CARCASSES

ALMFORS

artment of Food Science, Swedish University of Agricultural Sciences, P.O.Box 7051, S-750 07 Uppsala, Sweden

obtain an optimal commercial carcass quality it is necessary to use accurate grading methods. In Sweden as in almost all tries the fat content of lamb and sheep carcasses is visually judged. Subjective judgements suffer from several dvantages, the most important is the difficulty for the grader to maintain the "true" level for carcass fatness during a long iod. Therefore there are many good reasons for developing an objective measuring system enabling the carcass composition be evaluated with higher accuracy.

the division of Meat Science we have for several years tried to develop an objective measuring method. We have looked at ous measurements of the lamb carcass which strongly correlates with the total fat content and we have found one site: The ckness of the belly between the 10th and 11th ribs, just in the middle between the spine and belly opening where the tissues are thinnest. The total fat content was determined by partial dissection and we have until now dissected approx. 1200 carcasses.

assignment from the National Agricultural Marketing Board and in collaboration with Food Technology Comp (FTC), arkholm, we have developed several prototypes for measuring the belly thickness. Today we have got an on-line measuring hern by which it is possible to explain 65 % of the total variation in fat content.

HE ROLE OF THE BITE FORCE IN HARDNESS PERCEPTION.

- MIOCHE - M. A. PEYRON - J. CULIOLI

NRA Station de Recherches sur la Viande, Theix, 63122 Ceyrat-FRANCE

Hardness or its positive aspect, tenderness, with moisture content and flavour, are the main factors determining the overall ception of the meat products. Concerning hardness perception, the role of the bite force was studied with different models enting simple mechanical behaviour but not suitable for swallowing. Elastic, plastic and brittle products were studied. For each rmation type, products differed only in hardness. Elastic models were made from silicone elastomers (n = 14); plastic models from al waxes (n = 21) and brittle models from pharmaceutical tablets (n = 5). For the elastic and plastic products, samples were divided four series. By comparing two samples of the same series, subjets had to say which was the harder. An intra-oral load-cell (12 mm 3 mm high) was put under each sample. During the comparisons, bite forces were recorded. Incisors bit either directly onto the ple (T1) or onto a thin metallic disc placed under the sample in order to record only compression forces(T2).

For all products, a good correlation was found between the bite forces and the sample strengths. However, for plastic products, bite es correlated with hardness even within each series whereas no correlation was found in any series for the elastic products for er test.

From these results, it appears that the bite forces are probably involved in hardness perception for plastic and brittle models but do play any direct role for elastic products. In this case, the resulting deformation could be the main source of information concerning dness perception.

CONFOCAL MICROSCOPY-A NEW TOOL IN THE INVESTIGATION OF MUSCLE AND MUSCLE FOOD PRODUCTS

V. SARAFIS

Centre for Biostructural and Biomolecular Research, University of Western Sydney, Hawkesbury, Bourke Stre
Richmond NSW 2753, Australia.

Confocal Microscopy is a new form of imaging involving a diffraction-limited spot scanning a specimen.
light emitted, transmitted or reflected by the specimen is collected and brought to a diffraction-limited
on a diaphragmed detector. The signal from the detector is used to modulate a monitor display and may be
jected to various software routines to enhance or modify the image obtained.

Confocal Microscopy results in an improvement of x y resolution, particularly in the fluorescence mode
it can reach twice the classical limit. Of particular interest is its z resolution which allows for
blur-free focusing on a particular plane without out-of-focus contributions from planes above and below.
allows for clear three dimensional reconstructions of imaged specimens.

Confocal Microscopy has been used to image single fixed muscle fibres and aggregates stained with Haemato
and Eosin. Fluorescence is excited with a Krypton Argon laser at 488 nm and produces a strong signal
fades slowly. Early results indicate the ability to discriminate the sarcomere structures including
lines traversing them. NBD labelled phallacidin, an actin specific fluorescent probe, has been used to
sarcomeric actin, both in vivo and after fixation and is used to demonstrate the three dimensional stru
of muscle fibres after similar excitation. The actin distribution in muscle fibre products has been fo
using this probe and 3-d examples are given from comminuted meats and fermented sausages.

A TRIAL TO DEFINE FACTORS AFFECTING PIGMEAT QUALITY

M. SEVERINI, M. TREVISANI, A.R. LOSCHI and A. VIZZANI

Istituto di Ispezione degli Alimenti di Origine Animale, Facoltà di Medicina Veterinaria, Università
Studi, Perugia, Italia

The availability of a suitable system to grade the quality of pigmeat which has to be processed is
important to attain the best cost/benefit ratio.

The Longissimus dorsi muscle was chosen as an experimental model for the present study.

Samples from Goland and Landrace x Large White pigs delivered by three different farmers
analysed for pH, WHC, swelling ability, drip loss, cooking loss and percentage of PAS-positive fibres.

Normal, PSE and DFD muscles were classified on the basis of pH and colour at 1 hour and 24 hours
plus the content of glycogen in the myofibres at 1 hr p.m..

Adopting these parameters to group the muscles, a correlation was found between the proposed
of muscles and drip loss and swelling ability.

A less significant correlation was observed with cooking loss.

However, differences were detected among the mean values recorded in muscles of the same group
animals slaughtered on different days.

APPLICATIONS OF COLORMET IN MUSCLE FOOD QUALITY EVALUATION

F. SHAHIDI and R.B. PEGG

Department of Biochemistry, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X9

Colormet is a hand-held colour analyzer designed to assist researchers and quality control personnel with objective measurements of visible light reflectance. This instrument is built by Instrumar Engineering Limited of St. John's, Newfoundland, Canada. We used Colormet for assessing meat quality and differentiating normal and PSE pork from one another. It was noticed that Hunter L value was most sensitive as an objective quality indicator for detection of PSE meat. PSE pork muscles generally had L values which ranged between 59.5 ± 2.1 and 60.4 ± 0.9 in shoulders and loins, respectively. Corresponding values for normal pork muscles were 44.8 ± 3.8 and 49.3 ± 3.6, respectively. Hunter **a** values were lower and Hunter **b** values were higher for PSE meats. The content of hemoproteins correlated well with Hunter **L, a,** Hue and Chroma values (r = 0.999). Similar correlations were obtained between pigment content and colour parameters when pigments were extracted into buffer solutions. Thus Colormet analyzer may be used for detection of PSE meat by either direct or indirect method of evaluation.

THEORETICAL and PRACTICAL ASPECTS OF THE EXPRESS-METHOD OF MEAT PRODUCTS QUALITY CONTROL

A.ZHITNSOV and B.IVANOV

Technological Institute of Meat and Milk Industry. Kazakhstan, 490011 Semipalatinsk, M. Glinki, 49.

This work deals with the problem of perfecting and further developing instumental electrochemical express-methods of substances analysis and creating on this basis a new generation of automatic means of analytical technique equipped with devices of information coding, digital indication, digit typing channel, tape recording of outlet signals etc.

On the basis of analytical studies of conductometric method we have developed the theory of phase express-method of analysis and stated the functional dependence of the amount of shift on physical characteristics and quantitative content of the analyzed product components as well as on parameters of the original measuring scheme. Experimental studies of model media (solutions of NaCl, starch, lactic acid etc.) were carried out by means of experimental sample of phase analyzer. As a result of these investigations the range of measuring substances concentration according to their electrical conductivity (from 0.001 to 1.3 $ohm.cm^{-1}$) and experimental dependence of phase shifts on concentration and physical properties of analyzed product were determined. The developed phase method and phase analyzers are notable for their high obstacle resistance regulated according to measuring ranges for their sensitivity and reflection of information about the results of analysis in a digital form.

ALTERNATIVE POSITIONS FOR MEASURING FAT THICKNESS ON BEEF CARCASES

D.G. TAYLOR[1], E.R. JOHNSON[2] AND R. PRIYANTO[2]

1 Dept. of Animal Production, The University of Queensland Gatton College, Lawes, Qld. 4343.
2 Dept. of Farm Animal Medicine and Production, The University of Queensland, Qld. 4072.

The relationship between a subcutaneous fat thickness measurement and the weight or percentage of fat and muscle in the carcas received considerable research attention and fat thickness measurements are commonly used in carcase specification and grading sch The objective of the work reported here was to compare fat thickness measurement at 10 sites for the prediction of carcase fat and m content.

Seventy-eight grass-fed steers representing three breed types with carcase weights ranging from 97 to 420 kg were slaughtered a thickness measurements were taken at 10 anatomically defined sites on the carcase. One side of each carcase was dissected into muscle, fat and connective tissue. Correlation and regression analyses were carried out on the relationships between each fat th measurement and the weight and percentage of fat and the weight and percentage of muscle of the carcase.

Seven of the sites produced correlation coefficients of 0.80 or more between the fat thickness measurement and carcase fat weight, sites produced correlation coefficients of 0.80 or more between the measurement and carcase fat percentage. Two of the sites pro correlation coefficients of 0.80 or more between the fat thickness measurement and carcase muscle weight, while none produce correlation coefficients with carcase muscle percentage. When used in prediction equations to predict carcase fat weight or percen carcase muscle weight or percentage the SEE's were similar for all the measurement sites.

It is concluded that there are many sites where fat thickness measurements can be taken to give a reliable prediction of carcass fat o content.

EVALUATION OF TECHNIQUES FOR MONITORING PORK QUALITY IN AUSTRALIAN PORK PROCES PLANTS.

GRAHAM R. TROUT

CSIRO Division of Food Processing, Meat Research Laboratory, Cannon Hill, 4170, Australia

A study was carried out to evaluate the suitability of a range of techniques for evaluating pork quality when use routine basis in pork processing plants. The measurements were carried out at approximately weekly intervals in four different abattoirs over a twelve month period. Loins were randomly selected from each plant and evaluated the following techniques: Minolta Chroma Meter, Colormet probe, fibre optic probe (FOP), visual colour and scoring, pH, protein solubility, filter paper water-holding capacity, and high speed centrifugation water-holding ca Quality was assessed by measuring 48-hour drip loss and the yield of cured cooked product. Using these two measures and sample pH, an index was developed that classified the pork into five quality groups: Extremely Dfirm and dry) ... Extremely PSE (pale soft and exudative). Statistical analysis was then carried out on the determine how effectively each of the objective techniques separated the pork into the five different quality categor the techniques evaluated, only the Minolta Chroma Meter (L value) and FOP could significantly separate the same the five quality groups ($p < 0.05$).

AN ADAPTED METHOD OF ISOLATING AROMATIC SUBSTANCES FROM MEAT PRODUCTS

K.VHULKOVA,TS.OBRETENOV,S.DANCHEV
Higher Intitute of Food and Flavour Industry,4000 Plovdiv,"Maritza"26,Bulgaria

ABSTRACT

Meat flavour bears an effect both on the organoleptic properties of the finished meat products and on the degree of their assimilation. Its current evalution is mainly organoleptic. By establishing the nature of the substances which give flavour to the meat products it will be possible to develop objective methods of evaluting their qualities and get fuller knowledge of the effect of the technological treatment upon flavour. The tests were carried out using sausage filling prepared from cattle and pork meat. Aromatic oil was isolated at pH = 4.5 and pH = 8.0 . The gas chromatographical and mass spectral analysis were made on Hewlet Packard 5971 MSD GC-MS system under the following working conditions: 2.5 m x 0.2 mm Vetra-2 capillary column; gas carrier - helium; pressure - 15 psi; injector - splitless 1:4; temperature - 290°C; injected amount - 2 ml; temperature of gas chromatographical analysis furnace: 70°C - 3 min; 70°C - 240°C - 8 min; 240°C - 280°C - 10 min; 280°C - 20 min; interface - 280°C. The test indicated that the method used is appropriate for isolating and identifying aromatic substances both in the acid and neutral range. The GC-MS results at pH = 4.5 were: furfural,3'10",96/100/,95/93/, 67/9/, 53/7/, 51/5/, 50/7/, 42/7/, 39/5/; furfuryl alcohol, 3'30", 98/100/, 97/66/, 95/11/, 81/91/, 71/91/, 70/48/, 69/59/, 55/14/, 53/75/, 52/16/, 51/36/, 50/27/, 43/18/, 42/80/, 41/68/; ect.

ANALYSIS OF VOLATILE COMPONENTS FROM BACKFAT OF PIG AND RELATIONS WITH ANDROSTENONE CONTENT

C. VIALLON[1], J.L. BERDAGUÉ[1], C. DENOYER[1], N. TRAN[1], M. BONNEAU[2], M. LE DENMAT[3]
1Station de Recherches sur la Viande, Laboratoire Flaveur, INRA Theix, 63122 CEYRAT, France
2Station de Recherches Porcines, INRA, 35590 SAINT GILLES, France
3Pôle Techniques d'Elevage, ITP, La Motte au Vicomte, 35650 LE RHEU, France

The aim of this study was to detect possible volatile indicators of the 5α-androst-16-ene-3-one (androstenone), a steroid implicated in boar taint. For this purpose, two kinds of measurements have been done :

- the volatile components from the backfat of 35 entire male pigs have been extracted by dynamic headspace method and identified by Gas-Liquid Chromatography-Mass Spectrometry,
- fat androstenone has been measured by specific immunological method.

The different chemical families identified are : aromatic compounds, aliphatic alkanes, aldehydes, alcohols, ketones and chloride compounds.

The analysis of correlations between androstenone and some volatile compounds shows highly significant relations obtained by linear stepwise regression. These relations indicate that the volatile content analysis may be an interesting way for "indirect" evaluation of boar taint.

EVIDENCE OF ANISOTROPY IN PROBE MEASUREMENTS OF PORK MUSCLE COLOUR

R.D. WARNER, G.A. ELDRIDGE, C.I. BALL and E. NANTHAN

Victorian Department of Food and Agriculture, Princes Highway, Werribee, 3030, Australia

The reflectance of meat is reported to be optically anisotropic, thus indicating that the angle of illumin of incident light onto the muscle fibre could influence measurements of reflected light and thus muscle co This trial was designed to investigate the efficacy of the Colormet optical reflectance probe for predicti meat quality, including the effect of the angle of probe insertion into the muscle (ie. anisotropy). Forty boned pork loins were selected at 24h post-slaughter to represent a range in quality of the longissimus do (LT). The quality measurements made on the LT were pHu, drip loss over 72h, surface lightness (L*) using Minolta chromameter (200b) and internal lightness (L*) using a Colormet probe inserted either from the dor surface or into the cranial end of the LT. The loin samples represented a range in meat quality from pa exudative to dark and dry. The ability of the probe to predict objective quality measurements was reduced the probe was inserted dorsally rather than in the cranial end for all quality traits (correlation coeffi (r) between probe-L* and: surface-L* 0.80 (cranial), 0.62 (dorsal); pHu, -0.76, -0.52; drip loss, 0.66, 0. P<0.01 for all). The equations for the relationship between surface-L* and probe-L* for the two insertion methods are: Probe-L* = 15.38 + 0.97 Surface-L* (R^2 = 0.64, RSD = 15.0) for cranial insertion and Probe-L* 24.30 + 0.69 Surface-L* (R^2 = 0.38, RSD = 25.7) for dorsal insertion. These results suggest that the Col probe can be used to predict meat quality, but alternative angles for probe insertion into muscles on the carcass require further research.

Session 10

MEAT PRODUCTS AND HUMAN NUTRITION AND HEALTH

-RAY ANALYSIS AND INFRARED SPECTRUM OF BEEF SAUSAGE AND CHICKEN PATTIES MANUFACTURED WITH ND WITHOUT PROTEASE INHIBITOR.

A. ABD ALLAH*; FERIAL M. ABU SALEM**; NEVERTY F. GAMAL* and NAHED M. ABD ELMAGUID**

Ain Shams University, Fac. of Agric., Food Sci. Dept., Shoubra El Khema, Cairo, Egypt.
* National Research Centre, Food Technology and Dairy Department, Dokki, Cairo, Egypt.

BSTRACT

Protease inhibitor that extracted from potato tubers (Alpha variety) by freezing at 30°C followed by blending in the presence of 1% ascorbic acid was used in its crude form the processing of beef sausage and chicken patties. The processed samples that contai- ed 0, 1, 2, 3% of protease inhibitor were stored at 4°C for two weeks through which X-ray alysis and infrared spectrum were considered. X-ray analysis indicated that the investig- ed samples containing the protease inhibitors showed a better configuration and higher tention of the responsed elements (31 elements) which correlated with the structure of th beef sausage and chicken patties. Infrared spectrum of the same tested samples proved e efficiency of protease inhibitors in controlling the activity of protease enzyme through ocessing of beef sausage and chicken patties; a trend which based on the stability of the entified functional groups through storage for two weeks at 4°C.

STOLOGICAL STRUCTURE OF BEEF SAUSAGE AND CHICKEN PATTIES MANUFACTURED WITH AND WITHOUT OTEASE INHIBITOR.

RIAL M. ABU SALEM**; M.A. ABD ALLAH*; NEVERTY F. GAMAL* and NAHED M. ABD ELMAGUID**

Ain Shams University, Fac. of Agric., Food Sci. Dept.; Shoubra El Khema, Cairo, Egypt.
National Research Centre, Food Technology and Dairy Department, Dokki, Cairo, Egypt.

STRACT

Beef sausage and chicken patties were manufactured with or without protease inhibi- r that extracted from potato tubers (Alpha variety). The added level of protease inhibi- r was 1,2 and 3% out of the recipe ingredients that used in manufacturing of the investi- ted samples. Inspection by transmition and scanning electron microscopes was used to com- re the histological structure of the same previous samples. On the other hand, changes t occur in the structure of beef sausage and chicken patties which manufactured with or thout the addition of protease inhibitor were considered during storage at 4°C for two eks. The results proved that the presence of protease inhibitor strengthen the muscle bre and so, being out of attack by protease enzymes. Such statement is mainly due to the fficiency of protease inhibitor for diffusion and distribution along the gabs available tween the structural bands of the samples, especially in parallel with sarcomeres.

POSSIBILITIES OF USING WOOL BY-PRODUCTS IN THE PRODUCTION OF SAUSAGE ITEMS

K.AMIRKHANOV, M.SMIRNOV, O.AKULOVA, E.TULEUOV, U.ILYASOV
Technological Institute of Meat and Milk Indastry, Glinka strit, 49,490050
Semipalatinsk The Republik of Kazakhstan.

Using by-products is a sinificant reserve of increasing protein production industry. Carried out investigations have shoun that it is expedient to use by in the production of meat products not in the pure form but as components of a in combination with other components.

The main demand to the functional properties of by-products food masses while them in the manufacture of sausages is that they should change the proper finished products in the desired direction or shouldn t change them at compatibility of a food product with protein components of sausage meat is achi imparting food masses the structure similar to the structure of the manu product. Wool by-products are unpractically used raw materials. It is caused by content of connective tissue resulting in their coarse texture. Apart from deter in their coarse texture. Apart from deteriorating organoleptical properties, a large amound of by-products in the formula of meat products has a negative on their biological value. The aim of these investigations is developing the te of produsing food masses from wool by-products ensuring texture improve increasing assimilability of finished sausage items. We have studied the i of added dose of food mass on the change of chemical, amino acid and structural-mechanicsl properties of sausage meat.

The manufacture of new kinds of sausages with food mass addition has sh finished products have a better texture and cut appearance.

The use of food masses improves water binding of sausage meat, decreases moistur during heat treatment and increases digestibility of finished products.

QUALITY STANDARDIZATION OF INDUSTRIALLY PRODUCED "ĆEVAPČIĆI" - NATIONAL GROUND MEAT PRODUCTS

LJ.BASTIĆ, D.LAZIĆ*, M.BASTIĆ**, S.SEKIS and M.SARATLIĆ*

Yugoslav Institute of Meat Technology, 11000 Belgrade (Serbia), Kaćanskog 13, Yugoslavia

* MeatIndustry Požarevac, 12000 Požarevac (Serbia), Yugoslavia

** Faculty of Technology, 11000 Belgrade (Serbia), Karnegijeva 4, Yugoslavia

Ground meat have a long tradition in our nutrition. They are produced previously at home, restaura rent manufactures, on the basis of experience and nutritional habits. Hovewer, there is a great tend ustrial production, as well as for standard quality. The aim of this study was the quality standardi industrialy produced "ćevapčići", one of the national ground meat products.

Bulls of the Simental breed, 24 months old, from eight different farms, were used for our study. Fo of bovine carcasswere used: shoulder, neck and part of the belly. After deboning and grinding throug with 3mm holes, meat was processed through the forming and portioning machine ("Koppens") so the pro elongated shape were obtained (ćevapčići). After that the products were thermically treated on the g for 5,5 min at 200° C, so the termperature in the center of the product was 95° C.

Composition, energy, hydroxyproline, cholesterol contents, fatty acid composition and TBK value of mically treated products were examined. The products were evaluated by sensory methods; weight loss changes of the thermically treated products were also evaluated. The same investigations were done a of 72h. The results were statisticaly evaluated.

The products (ćevapčići) of standard quality (e.g. energy contents 850 kJ/100 g, cholesterol conte 100 g, hydroxyproline contents - 0,3%, polyunsaturated to saturated fatty acids ratio), may be obtai good selection of beef that is used for their production.

LUENCE OF USING MECHANICALLY SEPARATED CHICKEN MEAT FROM DIFFERENT PARTS AND LEVELS ON CHEMICAL, PHYSICAL AND SENSORY PROPERTIES OF BOLOGNA TYPE PRODUCT

. BERAQUET, M.T.E.L. GALVÃO and R.Z.M. da SILVA
Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

his work aimed to determine the influence of using mechanically separated chicken meat (MSCM) from backs necks at the levels of 20, 40 and 100% of the meat block on chemical, physical and sensory properties of a gna type product.

Three trials were conducted and all batches were formulated to an approximate finished bologna composition 2% fat and 13% protein. Cooking loss, water holding capacity, proximate composition, pH, shear compression s determined. Firmness, juiceness, flavour and overall quality were evaluated using descriptive analysis with and line 10 cm long.

For all treatments, the cooking losses were in the range of 6,9 - 7,6%. Water holding capacity was not affected ther by the source of meat nor by its level, releasing a total volume in the range of 4,8 - 7,1%. Products taining 20% MSCM had pH around 6,2. At the 40% level the pH was 6,3 - 6,4, increasing to 6,5 at the 100%

Firmness (shear compression) decreased with the increasing of MSCM level although differences were not tistically significant when MSCM from necks was used. Subjective evaluation revealed that products elaborated h 20 and 40% MSCM from backs were firmer than the 100% ones. Products elaborated with 20% MSCM from necks re firmer than the 40 and 100% ones. No differences were found in juiceness and flavour for all treatments. products were considered slightly desirable.

nclusions: a) emulsion product type bologna with 22% fat could be produced using up to 100% MSCM from backs necks without emulsion breakage; b) sensorially acceptable bolognas could incorporate up to 100% MSCM from cks or necks; c) the source of MSCM showed no influence on any of the parameters studied.

DETERMINATION OF CARBOSSIMETHYL-CELLULOSE AS A MICRO-INGREDIENT IN SAUSAGES SUCH AS WURSTEL

BIANCHI, E.M.ZAMBINI, P.MASIOLI
ute of Food CHemistry and Technology - Faculty of Science - University of Parma, Italy

ethod has been proposed to determine the presence of sodium carbossimethyl-cellulose (CMC) in sausages-type-t products (wurstel) prior to its separation from the other components of the matrix, such as lipids and pro-ins. This is followed by the formation of a Celite-pyridine chloride complex with 0,2 M of NaCl.

is complex is adsorbed on a Celite column and successively eluted with a solution of 30% hot sulphuric acid. part of this eluate is then reacted with 2,7-naphthalenediol in concentrated sulphuric acid. The absorption e of the resulting coloured compound is spectrophotometrically measured at 540 nm.

maximum revelation point for this method is approximately 50 ppm, and therefore inferior to 0,03% (300 ppm), e limit allowed by law in Italy for skinless wurstel.

wertheless, a linear instrumental response can be obtained within a concentration range of 50 to 1600 ppm. satisfactory recovery percentage was achieved, with values exceeding 90%.

the quantities of CMC found are close to the limits established by law (within ± 10% of the determined analy-ical value), it is necessary to consider the rate of recovery and the sobstitution rate of CMC.

OPTIMIZATION OF THE USE OF ANIMAL AND VEGETABLE PROTEINS IN MORTADELLA MIXTURES

E.BIANCHI, A.CANTONI, F.LODI RIZZINI
Chair of Food Chemistry and Technology, Faculty of Science, University of Parma, Italy.

Due to their technological and functional properties, the use of proteins other than muscular proteins spread in the meat industry.

The purpose of this study is to optimize the utilization of the following proteins in the production of la: 1) isolated soy protein (I.S.P.); 2) sodium caseinate; 3) powdered pig-skin.

The term "optimization" must be defined as the pursuit of a correct combination of methods that improv mixture without altering its organoleptic qualities.

Thirty of such procedures were devised, one of them established with a control sample in wich nothing added. These methodologies were initiated on 200 kg medium-high quality mixtures produced under the ditions employed by the factory in which these tests were performed.

Sliced of the finished product were then evalueted by sensory analysis, performed by a test panel of These results were translated numerically using a parameter for overall quality (acceptability) for re utilised. Correlations between the proteins were utilized in each procedure were statistically ele results obtained conferm that the use of foreign proteins, when utilized within well-defined limits (ly 1%), do not influence the level of acceptability. Positive results were achieved using various sin proteins as well as binary and ternary mixtures of these proteins: the only exception was the binary I.S.P./sodium caseinate, which, for the small amounts of use, had no practical applications and, at time, the simultaneous use of these two ingredients is prohibited in accordance with the italian law. On the other hand, the ternary mixture has no practical applications too, considering its high cost o the results that can be obtained and given the above mentioned legal disposals.

HEAT-GELATION OF MYOSIN : INFLUENCE OF PURIFICATION, MUSCLE TYPE AND IONIC STRENGTH

C. BOYER, A. OUALI and J. CULIOLI

Station de Recherches sur la Viande- INRA Theix, 63122 St Genès Champanelle

Heat-gelation of myosins isolated from rabbit fast - twitch *Psoas major* (PM) and slow - twitch *Semimembranosus proprius* (SM studied at different stages of purification. Gelation of 10 mg/ml protein suspensions, in a potassium phosphate 0.04M (KCl 0.6M or 0.2M), was induced by heating at a 0.5°C/min rate in the 30-80°C temperature range. Rheological prope and loss (G") moduli as well as loss tangent (δ)) of the gels in formation were determined using a Carri-Med CSL oscillatory conditions. At high ionic strength, heat-gelation of myofibrils occured in two steps. First, a rigidity peak appe PM muscle and 53 °C for SMp muscle. Then, the rigidity increased from 50°C and 56°C for PM and SMp muscles, resp a maximal value near 80°C. The purification of myosin induced, on the one hand, a disappearance of the first rigidity other hand, an increase in the G' and G" moduli, while δ reached very low values (2°) which were characteristic of the hig gels. Moreover, the elimination of C protein induced a 1 to 2°C decrease in the temperature at which gelation started. Bo myosin isolated from slow - twitch SMp muscle exhibited a higher heat - stability and developped a lower gelling streng 80°C,than those from fast - twitch PM muscle . Dispersion of myosin in 0.2M KCl solution gave weak gels. However, low ionic strength (KCl 0.2M) of proteins, previously dissociated at 0.6M KCl, induced gel formation at low temperature 80°C, the corresponding gel was 2 or 3 times more rigid than that obtained at high ionic strength.The differences i behaviour induced by the muscle type and the salt content were related to the microscopic globular or filamentous struc

ERMAL DENATURATION OF ALBUMIN OF BOVINE BLOOD PLASMA

V.NUROVA, N.D.KOZLOVA, V.Ya. GRINBERG, A.D.NEKLUDOV, V.B.TOLSTOGUZOV
e All-Russian Meat Research Institute, MOSCOW, RUSSIA

rmal denaturation of bovine plasma albumin was studied by method of differential scan-
ng calorimetry. The influence of pH in 4-10 range, of sodium chloride and of fatty acid
ites on parameters of thermal denaturation of albumin werestudied. It was shown that al-
min is a micro-heterogeneous system, comprised of two conformation forms, which differ
the way of fatty acids binding and by their content. Temperatures of denaturation of
ese components differ more than by 15°C. It was shown that the main factors of structural
bilization of native albumin are hydrophobic interrelations. Linking of lipophylic li-
ds by native form of albumin causes high stabilization of its native conformation.
ctrostatic interrelations influence significantly conformational stability of native
rm of albumin, free from bound fatty acids. Stability of albumin in complex with fatty
ds changes slightly with the change of protein charge (pH) and practically does not
pend on degree of screening of electrostatic interrelation of surface charges (ionic
rength).

FUNCTIONAL AND PHYSICAL-CHEMICAL PARAMETERS OF ACTOMYOSIN FROM PORK MUSCLE OF DIFFERENT CHARACTERISTICS

J.CARBALLO, S. COFRADES, M. CARECHE and F. JIMENEZ COLMENERO
Instituto del Frío, Ciudad Universitaria, 28040 MADRID. SPAIN.

The influence exerted by variation in muscle characteristics on certain functional and physical-chemical parameters, namely apparent viscosity (V), protein solubility (S), ATP-ase activity (ATP-ase), aromatic (ANS) and aliphatic (CPA) hydrophobicity, and electrophoretic profile, was analysed. The study was carried out on actomyosin from Longissimus dorsi muscles of pork (post-mortem) which differed in pH and water holding capacity (WHC).

The muscles studied presented pH values of 6.0 and 5.4 and WHC of 91.8 and 82.5 respectively. Analysis of the parameters evaluated indicated that in the given conditions, the muscle characteristics had no observable effect on levels of solubility, ATP-ase activity or hydrophobicity. Significant differences ($P<0.05$) were found in the actomyosin from either muscle type only in respect of apparent viscosity, which was lower in the protein from the muscle with lower pH.

GELATION PROPERTIES AND BINDING ABILITY OF BOVINE MYOFIBRILLAR PROTEINS

CHRAITI F., de LAMBALLERIE M., OUALI A., CULIOLI J.
Station de Recherches sur la Viande, INRA Theix, 63122 CEYRAT, FRANCE.

Functional properties of myofibrillar proteins, including water and fat holding capacity and heat gelation, play a major role in so meat products such as sausages or restructured steakettes. These properties result from their capacity for forming a gel upon heating Our objectives in this study were : (1) to determine the optimal conditions for heat gelation of the myofibrillar proteins in model syst analyse the relationships between heat gelation properties and binding ability of the proteins in restructured meat.

Studies were carried on myofibrillar proteins isolated from *pre-rigor Pectoralis profundus* bovine muscle. Sarcoplasmic protei removed with a low ionic strength solution (0,15M NaCl, pH 6,5) and the myofibrillar proteins were extracted with a solution conta NaCl, pH 6,5. Myofibrillar proteins were then precipitated by dilution and washed with distilled water while sarcoplasmic proteins w desalted by diafiltration and concentrated by ultrafiltration. Myofibrillar and sarcoplasmic proteins were then freeze-dried. Myofibrill was dialysed against appropriate buffer solution, before being subject to the heating treatment. Thermal gelation over the range 20-8 followed by monitoring the change in storage and loss moduli of the sample, using a constant stress oscillatory rheometer. Cohesiv cooked products was assessed by a triple-beam bending test.

The results obtained provided evidence that ionic strength and pH do influence both the pattern and the values of the thermog moreover added sarcoplasmic proteins increased gel strength of myofibrillar proteins, mainly at low ionic strength. The effects of s myofibrillar proteins, alone or mixed with sarcoplasmic proteins, on the cohesiveness of cooked restructured meat products were co the effect of two commercial binders (ovalbumin and a mixture of ovalbumin and milk proteins). Water holding and binding capaci to be highly dependant on both the type and the quantity of the added binder. The greatest cohesiveness and water holding capacity obtained with 2% myofibrillar proteins. Albumin and milk proteins, although they had very low heat gelling properties in the model significantly increased the cohesiveness of the cooked products.

EVALUATION OF BIPYRIDYLIUM HERBICIDES RESIDUES IN ANIMAL FOOD

L.CUERPO,A.PIZZI,L.A.ROMERO,D.A.DAMEN and N.J.LATIMORI
INTA Instituto de Tecnología de Carnes - CICV - C.C.77 - 1708 Morón, Argentina.

New proposed use of Paraquat as bloat preventive, on pastures where species of Fabaceae are has made necessary the study of its residues in animal products. Three trials were carried out. 1: During 101 days pastures were sprayed with Paraquat at 56 g/Ha and steers were admitted to 48 hours after spraying. At the end of the period 16 animals that had grazed cured pasture were Samples of kidney, liver, meat and fat were taken and analyzed for Paraquat. No residues were by a method capable of detecting 0.05 ppm. Experiment 2 was performed with 150 days of grazing, used to treat alfalfa 48 hours before grazing was 50 g/Ha. At sacrifice, samples from 8 animals grasses containing Paraquat residues were taken. No residues above the method sensibility were In experiment 3, dairy cows were allowed to graze alfalfa treated with Paraquat at 50 g/Ha at 100 g/Ha 48 hours after spraying. Each treatment had 4 animals. Milk samples were taken days every other day. Paraquat residues over the method sensibility (0.0001 ppm) was detected milk from one animal (0.00042 ppm) the first day of grazing. Diquat residues above method (0.001) were not found. The results obtained showed that Bipyridylium herbicides don't originate in animal food above Codex LMRs, when used at low dose on pastures in order to prevent bloat animals.

UFFALO MEAT IN FRANKFURTER TYPE SAUSAGES

.C.M. DELLA TORRE, H.K. ARIMA, E.T.F. SILVEIRA, E.A. YAMADA, E.E.M. MORI and I. SHIROSE
eat Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

The objective of this work was to evaluate emulsion type sausages formulated with buffalo meats compared to eef.

Deboned shoulder from 2 lots of buffaloes (i) entire males and (ii) cull cow (15 years old) and one of egrated Zebu bovine (iii) were used. Other components used in each formulation were pork shoulder 13%, it 2.34%, spices 0,74%, corn starch 2%, sodium nitrite 0.02%, erythorbate 0.05%, and tripolyphosphate 0.5%. atters were formulated to contain 20% fat and a moisture protein ratio of 4.5. In two trials batter were comm- uted reaching a maximum temperature of 16°C, stuffed into 22 mm casings, cooked to an internal temperature f 72°C, showered for 15 min, and peeled after chilled to 10°C.

Cooking losses, ranging from 11.4% to 13.3% were not significantly different among sausages. Emulsion abilities measured by released liquid, were lower for buffalo sausages.

The pressed juice content was measured objectively ranged from 48.6% to 52.4% and differed only between (i) nd (ii). The Warner Bratzler firmness did not differ between (i) and (ii) wich were lower than (iii).

Firmness and juiceness measured organoleptically were on a scale from 0 to 10, being 5 as ideal; for the other ttributes the ideal value was 10. Scores of firmness were 4.0 for (i), 7.0 for (ii) and 5.7 for (iii), all signif- antly different. Juiciness values for the three treatments ranged from 4.0 to 5.0 and were not statistically ifferent. Treatments (ii) and (iii) had higher flavour scores than (i), but only treatment (iii) differed statis- ically from (i). Batter homogeneity did not differ between young animal (i) and (iii) but scores were statiscally ower for (ii).

In conclusion, buffalo meat presented lower emulsion stability compared to beef. Firmness and particle omogeneity were affected by the animals age, but not by species. Young buffalo meat sausages were less haracteristic in flavour. Buffalo sausages had lower scores in overall quality althought it was still acceptable.

PREPARATION FROM SKINS OF STEAM PIGS TO PUT INTO THE PRODUCTION OF SAUSAGES

S.DRAGOEV, K.WASSILEV, S.DANCHEV, M.MILANOVA and S.GEORGIEV
Higher Institute of Food and Flavour Industries, 4000 Plovdiv, "Maritza" 26, Bulgaria

ABSTRACT

It has been developed a preparation from the skins of scalded pigs, and a technology for its production. It is intended to be added into some meat products. The influence of the following factors has been established: salt concentration in the brine used for salting the pork skins, and the relationship of pork skins to flaked ice during the cutting process on the following parameters: stability of the waterholding capacity, particle diameter and salt contents of the preparation.

By means of full factor experiment with two factors (cutting time and sodium tripolyphosphate concentration) at two levels have been found adequate mathematical models describing the preparation's ability to retain water after O and 7 days of refrigeration at O°C to + 4°C with respect to both factors examined.

The adequate models thus obtained were used to determine optimal cutting conditions in relation to the mixture's stability.

The general physico-chemical composition and microbiological condition of the preparation have been established.

NEW EXTRUDED COMBINATION PRODUCTS

M.L.FAIVISHEVSKY, T.D. LISINA, S.I.KHVYLYA, T.G.KUZNETSOVA
The All-Russian Meat Research Institute, MOSCOW, RUSSIA

The aim of the present study was to develop technology for manufacturing of dietetic products, containing protein components of bones, blood of slaughter animals and veg Here are given results on research of the technology of combination products manufac the basis of extrusion of corn grits or semolina with dry bone broth, and also of d edible blood of slaughter animals with wheat flour and dry milk.

The developed technology allows to obtain highly-assimilable products with porous st showing good solubility and acceptable organoleptical characteristics. This technolo sures inhibition of pathogenic microorganisms growth and sterility of final product Thus, basis was created for the use of bones in food products and for the use of bl dietetic foods, manufactured according to simplified technology.

QUALITY AND NUTRITIONAL ASSESSMENT FOR THREE CANNED RECIPES PROCESSED FROM RABBIT M

K. HAMMADI, S. LATIF, A. DAWOOD AND S. AFIFI
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, FACULTY OF AGRICULTURE, MINIA UNIVERS EL-MINIA, EGYPT

By experiments in laboratory scale three canned recipes processed from rabbit meat have been studied. canned recipes consisted from rabbit ragout in tomato sauce (I); rabbit ragout in white sauce (II), a seasoned rabbit meat (III). The intention was to evaluate the acceptability and the nutritional value three canned recipes. The chemical composition; protein free fat ratio; in vitro-digestibility; vitam B_2, and C); minerals (P, K, Na, Mg, Fe, Mn, Cu, and Z); amino acid composition, chemical score; an value were determined as a functions of quality and nutritive value. The results showed that the qual studied recipes seemed to be acceptable, morever the recipes (I) recorded the highest acceptability s recipes possessed high contents from protein, fat, caloric value, vitamins and minerals. Essential am recorded high amounts, except tryptophan which was the indiviual limiting amino acids in all recipes (C vitro digestibility (as N.P.N. percent of total nitrogen) recorded high percentages for all studied recipes. In conclusion, these three canned recipes processed from rabbit meat have shown high accepta scores, rich in protein, essential amino acids vitamins, minerals and high digestibility. To make mor use of the meat from rabbit meat, canning process should be develop.

DEVELOPMENT OF SEA FOOD PATTIES FROM UNDERUTILIZED FISH SPECIES

S. HOSSEINI, M. MIZANI
Islamic Azad University, Dept. of Food Science and Technology, P.O. Box 19735/164 - TEHERAN, IRAN

After the world war II, most of the countries decided to supply their protein requirements from Sea Foods. Comparing the total annual catch of fish biomass in 1973 to 1982, it has a 20 % growth.

In Iran, the annual catch in 1982, totally from the Caspian sea and Persian Gulf and Oman sea was about 45000 tons/yr and the consumption perse was about 1.06kg. According to available data, more than 40 % of total fish catches in Iran are underutilized fish species ; so for this reason and also in order to use these protein supplements, since 1974, the scientists have paid more attention to use of the underutilized fish species in Iranian dietary intake.

For achieving the above goals, recently a study is done for preparation of fish patties from underutilized fish species. The purpose of this investigation was to determine the effect of corn flour on acceptibility and stability of fish patties which was prepared by adding corn flour and starch by 1%, 2%, 3% of fish patty weight to minced flesh of mackerel. Other additives which were used are as follows : seasoning and flavoring materials (e.g. ground white and black pepper, onion and celery powder, nutmeg, etc...) and preservatives. The patties were commercially sterilized in cans.

By adding corn flour as extender to this mixture from 1 to 3 percent, unpleasent smell and flavor remarkably decreased, water retention capacity increased and textural attributes improved.

CERTAIN MACRO-KINETIC APPROACHES TO THE QUANTITATIVE DESCRIPTION OF BLOOD PROTEINS HYDROLYSIS OF BEEF CATTLE

V.I.IVASHOV, A.D.NEKLUDOV, V.P.ILYUKHINA, M.I.BABURINA, R.A.KHROMOVA
The All-Russian Meat Research Institute, MOSCOW, RUSSIA

The paper deals with the method of determination of kinetic parameters of protein hydrolysis. It is shown that the process of blood proteins hydrolysis is a two-stage reaction, being composed of a "fast" and a "slow" stages.

It is established that the rate of blood proteins hydrolysis is in direct proportion to concentration of the taken enzyme, as well as to concentration of the substrate. 2% is the upper limit value for substrate concentration, above which inhibition of reaction takes place.

During tests some important values were determined, including: effective maximum rates of blood proteins hydrolysis, constants for the process development intensity, Michaelis constant, the number of links with proximate reaction ability, as well as energy values for activation of fast and slow stages of the process of hydrolysis.

HEAT-GELLING PROPERTIES OF RABBIT MYOFIBRILLAR PROTEINS : INFLUENCE OF MUSCLE TYPE

S. JOANDEL, C. TASSY, J. CULIOLI, A. OUALI

Meat Research Station, INRA Theix, 63122 Ceyrat, France

Heat-gelation of myofibrillar proteins from different muscles of various animal species have been investigated. Many studies have shown differences in gelling strength according to muscle type. The present work intended to analyse the relationship between muscle metabolic contractile activities and the heat-gelling properties of extracted myofibrils.

Metabolic and contractile type of 8 rabbit muscles [*Psoas major* (PS), *Semimembranosus proprius* (SMp), *Supraspinatus* (SP), *Longissimus dorsi* (LD), *Semitendinosus* (ST), *Semimembranosus* (SM), *Pectoralis* (PE), *Triceps brachii* (TB)] were assessed by measuring myofibrillar ATPase activity (characteristic of the contractile type), citrate synthase activity (characteristic of aerobic metabolism) and lactate dehydrogenase activity (characteritic of glycolytic metabolism). Contractile type was further characterised by densitometric quantification of myosin light and/or heavy chains isoforms. Heat gelling properties of myofibrils preparations (20 mg/ml,at pH 6.0 in 0,6M KCL - 0,04M phosphate buffer) were studied using a Carri-Med rheometer in the 30-80°C temperature range (heating rate: 1°C/min). Changes in storage (G') and loss (G") moduli as well as loss tangent (∂) were determined after every 1°C increment. Whatever the muscle, rheogrammes showed that heat-gelation of myofibrillar proteins is a two steps process. We first observed a simultaneous increase in G' and G" from 40°C (except muscle SMp), which showed a maximum value at 47-49°C for PS, LD, ST muscles and at 53°C for SMp muscle. The second step occurred at 54°C for PS, ST, LD, SM muscles and 58°C for PE, SMp and SP muscles. During this step G' increases until 70°C while G" remains constant. After heating at 80°C slow-twitch muscles with high citrate synthase activity (SP, TB, PE and SMp) formed gels with higher rigidity than those from fast-twitch muscles having lower citrate synthase activity (PS, LD, ST).

Ultrastructure (SEM) of gels obtained by gradual heating (1°C) of myofibrillar extracts from 30°C up to either the rigidity peak temperature (47-49°C or 53°C for SMp) or to 70°C was analysed for the different muscles. It would appear that gels formed with PS myofibrils have a finer network than those obtained with SMp myofibrils , the other muscles being intermediate.

EFFECTS OF PRERIGOR BEEF AND SODIUM TRIPOLYPHOSPHATE ON THE CHARACTERISTICS OF FRANKFURTER-TYPE SAUSAGE

JUSSARA C.M.DELLA TORRE[1] and P.E. de FELICIO[2]

[1]Centro de Tecnologia da Carne/ITAL, Av. Brasil 2880, Campinas-SP

[2]Faculdade de Engenharia de Alimentos/UNICAMP

Research has shown that water-binding capacity (WBC) of meat batters can be enhanced by use of prerigor meat. The Brazilian sausage industry that has been using phosphate to improve WBC could benefit from that finding if its implications were well known.

To determine the effects of prerigor beef and phosphate on pH, WBC, gelatin and fat release, yields, texture and sensory characteristics of frankfurters, four formulations were prepared: hot-processed, pre-salted beef (HPB) and conventionally chilled beef, with or without sodium tripolyphosphate (TPP). The experiment was replicated four times.

Frankfurters should contain 25-26% fat and a moisture:protein ratio of 4.5. Cow meat (% of meat block wt.) was either ground one hour post-mortem and salted (3% of meat wt.) or ground after 24 hours of chilling. Sausages were made on the fourth day using a silent cutter and a piston stuffer (Kraemer & Grebe), and a smokehouse (Becker).

HPB and TPP raised pH of batter by .4 and .3, respectively; the main effects being additive. HPB enhanced WBC, but not as much as TPP did, as measured in 50g samples of batter cooked at 70C for 60min. HPB and TPP, respectively, reduced gelatin release by 58% and 70%, and fat release by 83% in sterilized canned batter (Fo = 4 at 121C). HPB and TPP, individually and combined, caused a reduction of 13-14% in cooking losses of peeled product.HPB did not affect maximum shear force of skin-on, but decreased shear values of skinless sausage while TPP increased shear force of both. Sensory analysis results were not affected by HPB or

COMPARATIVE STUDY ON NUTRITIVE VALUE OF MEAT (Semitendinosus muscle) USING MICROWAVE AND CONVENTIONAL COOKING

Bibel KARAKAYA, Aysel KAVAS, Sedef NEHIR EL

Department of Food Engineering, Ege University, Bornova, IZMIR 35101, Turquie

In many countries, microwave ovens are used because of the convenience and time savings in cooking. Therefore, the objectives of this study were to compare the effects of microwave and electrical ovens on retention of some nutrients and to determine the differences in terms of nutritive value and consumer preference, between the meat cooked by these two methods.

Semitendinosus muscle, was cut into 2.5 cm thick slices and one half of the muscle was cooked in microwave oven for 14 minutes, the other half was wooked in electrical oven at 200°C for 35 minutes. Moisture, ash, iron, calcium were determined by the AOAC method and riboflavin, niacin and pyridoxine contents were determined by the method of Dawson et al. (1988), using High Pressure Liquid Chromatography. Protein was determined by the AOAC method, fat by chloroform methanol extraction, cholesterol content of meat was determined according to the method of Prusa and Hughes (1985). Sensory evaluation was done using the paired comparison method.

Moisture, protein, riboflavin, niacin, pyridoxine, iron, and calcium were found to be higher in the meat cooked in microwave oven compared to the electrical oven. Fat content of meat cooked in electrical oven was greater than the meat cooked in microwave oven. Cholesterol content was influenced by cooking methods. No significant differences were found between the microwave and electrical ovens as far as flavor and texture characteristics of the meat are concerned, but panelists prefered the meat cooked in electrical oven for appearance.

EFFECTS OF SOY PROTEINS ON TECHNOLOGICAL AND MORPHOLOGICAL PROPERTIES OF BOLOGNA TYPE SAUSAGE

PETSARAS, K.[1] and BUDRAS, K.-D.[2]

[1] Federal Centre for Meat Research, D-8650 Kulmbach, Germany

[2] Institute of Veterinary Anatomy, Free University of Berlin, Germany

The myofibrillar protein matrix plays a decisive role in stabilizing sausages of Bologna-type (water-fat-binding). This matrix is influenced by different factors such as type of meat, fat, sodium chloride concentration, water and degree of comminution. The effects of soy proteins on the stability of the meat protein matrix was investigated. For this purpose, fine comminuted sausages were produced utilizing soy concentrate and isolate either as powdery or rehydrated soy protein, in concentrations of 0.5, 1.0, and 2.0 %. These batches were compared with a control and a phosphate batch. Although these comparisons did not show significant differences in every case, the soy protein and the phosphate batches tended - compared with the control - to increasing the jelly deposit. Judging the mode of addition of the soy protein with regard to jelly deposit showed a tendency to better results with rehydrated soy protein. The generally low fat rendering made a comparison between different batches impossible. The texture of soy protein containing sausages was altogether only slightly lower than that of control and phosphate batches. The batches with powdery soy protein added appeared to be firmer than that ones with rehydrated soy proteins. The use of soy protein resulted, as expected, in a lighter colour in most of the batches. Sensory evaluation of odour and taste of control and phosphate batches on the one hand and soy protein containing sausages on the other hand did show detectable differences. The phosphate batch (0.2 %) exhibited the most intensive meat flavour better than control. The use of soy protein up to 1.5 % in the batter did not result in an degrading in the sensory evaluation. At higher concentration of soy protein at 2 % we detected a different flavour and devalued the samples. The microscopical investigation documented the jelly and exsit reducing properties of soy proteins; although their fat stabilising effect could not be demonstrated.

IMPROVEMENT OF THERMOSTABILITY OF PANCREATIN - ENZYME OF BEEF CATTLE PANCREAS

A.D.NEKLUDOV, V.P.ILYUKHINA, M.I.BABURINA
The All-Russian Meat Research Institute, MOSCOW, RUSSIA

The method for pancreatin immobilization on carboxylmethylcellulose is described. Optimal conditions for reaction are defined: concentrations of reagents, temperature, pH, etc. that allows to produce conjugate of an enzyme with a polymer, preserving up to 85% of tease and 92% of esterase activities.

It is shown that native and immobilized pancreatins have thermolabile and thermostable fractions with their inactivation constants.

It is established that immobilization of pancreatin increases its thermostability by 1.5-3 times.

GELATION OF BOVINE MYOFIBRILLAR PROTEIN INDUCED BY 1,5 GLUCONOLACTONE

T. NGAPO, B. WILKINSON, R. CHONG and D. HAISMAN

Department of Biotechnology, Massey University, Palmerston North, New Zealand

Gels were formed at 4°C from myofibrillar proteins isolated from bovine *m. cutaneus trunci* by the addition of 1,5 gluconolac Compression was used to study the rheological characteristics of the gels.

Levels of 0, 1, 2, 4, 6, 8, 10 and 12% (w/w) GdL were added to myofibrillar proteins (20% solids) with 30% added wate formed at levels 2% and greater. A concentration of 2% GdL (pH 4.5) resulted in formation of optimal gels. Gel rigidity displa dependence on final pH. It is suggested slow lowering of pH results in the formation of uniform myofibrillar gels below the point. No differences were observed in gelation at temperatures in the range 0°C to 20°C.

The application of gelation by addition of a slow release food acid to a whole meat system could provide a method for resis at 4°C. The effects of sodium chloride and pyrophosphate are currently being investigated.

A STUDY ON PROCESSING TECHNOLOGY OF CHILDREN NUTRITIOUS SAUSAGE

NI CHEN, ZHANG GENSHENG, MIN LIANJI
Department of Food Engineering, Heilongjiang Commercial College, Harbin, Heilongjiang, P.R. China.

Sausage products provide the consumer with luring colour, aroma, good flavour and be abound in nutrients, they have always been a favorite instant food for children. Nutrients from animal bones are similar with those of meats. It contains rich calcium as well as indispensible phospholipid and phosphoprotein that are needed by brain activity. It also promotes function of liver with its methionine, Vitamin A, Vitamin B1, and Vitamin B2, etc. Processed animal bones can be used as food additives or enhancer in food products which would be extremely beneficial to the growth and health of children. This research and development is of great significance given the existence of serious insufficiency of animal protein resources and children's lack of calcium in today's China.

Based on the study of the main characteristics of animal bones and using comparative method, this paper identified the optimum processing technology of smashed bones. By means of experiment, and adding quantity of smashed bones and proper ratios of various components added in children nutritious sausage were determined using the formula and technique of the well-known National Brand "Harbin Suasage". The original processing technique was improved by a better "Smoking Material". The result indicates that the processing technique of smashed bones is both safe and sanitary by heating ; and added smashed bones may range between 15%-20% and still guarranties product quality. The calcium content in product increased by 60 to 70 times and 100 grams per day would meet the requirement of a growing child.

Therefore, using the heating method to make processed smashed bones and adding into children sausage product is not only necessary, but also feasible.

Effects of Tumbling and Cooking Methods on the Yield and Acceptability of Cooked Ham from Thighs with Different Characteristics

A. PIZZA and R. PEDRIELLI
Experimental Station for the Food Preservation Industry - Via Tanara 31/A - Parma - Italy

Many researchers, have focused their attention on the effect produced on meat tissue by massaging and tumbling procedures. However the effects of these techniques may be strongly influenced by the type and quality of the thighs used. The relationship between the characteristics of the finished product and the use of intermittent tumbling was investigated, in respect of two cooking methods, for a batch of approximately 200 thighs, from the Cotswald breed having PSE to RFD properties evaluated through measurements of pH, Fop and Hunter parameters. The intermittent tumbling process alternated the following rotation and rest times (min): 2/190, 4/190, 8/180, 15/160. The two cooking procedures were a slower one (F70 = approximately 40 min) and another, generally adopted in Italy, giving a calculated F70 value of 110 min. at the core of the ham.

The relationship between the yield and time of tumbling was not linear, the best results being associated with 4-8 min of movement time. Both yield and cooking losses were highly influenced by tumbling parameters and thighs characteristics for the standard cooking method. For slowly cooked products the influence of thigh characteristics was less important. So yield variations as a function of post rigor pH and tumbling time, showed two considerably different patterns for slow and standard cooking conditions, well represented by three-dimensional plots generated with use of the SAS-GRAPH program.

In this work, real tumbling time was much shorter and resting time much longers than in our previous work. Resting time seems to be more important to sensory acceptability, in particular to cohesion characteristics (R = .74** for standard cooking and .87** for slow cooking).

IMPROVEMENT OF THERMOSTABILITY OF PANCREATIN - ENZYME OF BEEF CATTLE PANCREAS

A.D.NEKLUDOV, V.P.ILYUKHINA, M.I.BABURINA
The All-Russian Meat Research Institute, MOSCOW, RUSSIA

The method for pancreatin immobilization on carboxylmethylcellulose is described. Op
conditions for reaction are defined: concentrations of reagents, temperature, pH, etc.,
that allows to produce conjugate of an enzyme with a polymer, preserving up to 85% o
tease and 92% of esterase activities.
It is shown that native and immobilized pancreatins have thermolabile and thermostabl
fractions with their inactivation constants.
It is established that immobilization of pancreatin increases its thermostability by
1.5-3 times.

GELATION OF BOVINE MYOFIBRILLAR PROTEIN INDUCED BY 1,5 GLUCONOLACTONE

T. NGAPO, B. WILKINSON, R. CHONG and D. HAISMAN

Department of Biotechnology, Massey University, Palmerston North, New Zealand

Gels were formed at 4°C from myofibrillar proteins isolated from bovine *m. cutaneus trunci* by the addition of 1,5 gluconolacto
Compression was used to study the rheological characteristics of the gels.

Levels of 0, 1, 2, 4, 6, 8, 10 and 12% (w/w) GdL were added to myofibrillar proteins (20% solids) with 30% added water.
formed at levels 2% and greater. A concentration of 2% GdL (pH 4.5) resulted in formation of optimal gels. Gel rigidity displa
dependence on final pH. It is suggested slow lowering of pH results in the formation of uniform myofibrillar gels below the
point. No differences were observed in gelation at temperatures in the range 0°C to 20°C.

The application of gelation by addition of a slow release food acid to a whole meat system could provide a method for resus
at 4°C. The effects of sodium chloride and pyrophosphate are currently being investigated.

A STUDY ON PROCESSING TECHNOLOGY OF CHILDREN NUTRITIOUS SAUSAGE

N CHEN, ZHANG GENSHENG, MIN LIANJI
Department of Food Engineering, Heilongjiang Commercial College, Harbin, Heilongjiang, P.R. China.

Sausage products provide the consumer with luring colour, aroma, good flavour and be abound in nutrients, they have always been a favorite instant food for children. Nutrients from animal bones are similar with those of meats. It contains rich calcium as well as indispensible phospholipid and phosphoprotein that are needed by brain activity. It also promotes function of liver with its methionine, Vitamin A, Vitamin B1, and Vitamin B2, etc. Processed animal bones can be used as food additives or enhancer in food products which would be extremely beneficial to the growth and health of children. This research and development is of great significance given the prominence of serious insufficiency of animal protein resources and children's lack of calcium in today's China.

Based on the study of the main characteristics of animal bones and using comparative method, this paper identified the optimum processing technology of smashed bones. By means of experiment, and adding quantity of smashed bones and proper ratios of various components added in children nutritious sausage were determined using the formula and technique of the well-known National Brand "Harbin Suasage". The original processing technique was improved by a better "Smoking Material". The result indicates that the processing technique of smashed bones is both safe and sanitary by heating ; and added smashed bones may range between 15%-20% and still guarranties product quality. The calcium content in product increased by 60 to 70 times and 100 grams per day would meet the requirement of a growing child.

Therefore, using the heating method to make processed smashed bones and adding into children sausage product is not only necessary, but also feasible.

Effects of Tumbling and Cooking Methods on the Yield and Acceptability of Cooked Ham from Thighs with Different Characteristics

A. PIZZA and R. PEDRIELLI
Experimental Station for the Food Preservation Industry - Via Tanara 31/A - Parma - Italy

Many researchers, have focused their attention on the effect produced on meat tissue by massaging and tumbling procedures. However the effects of these techniques may be strongly influenced by the type and quality of the thighs used. The relationship between the characteristics of the finished product and the use of intermittent tumbling was investigated, in respect of two cooking methods, for a batch of approximately 200 thighs, from the Cotswald breed having PSE to DFD properties evaluated through measurements of pH, Fop and Hunter parameters. The intermittent tumbling process alternated the following rotation and rest times (min): 2/190, 4/190, 8/180, 15/160. The two cooking procedures were a slower one (F70 = approximately 40 min) and another, generally adopted in Italy, giving a calculated F70 value of 110 min. at the core of the ham.

The relationship between the yield and time of tumbling was not linear, the best results being associated with 4-8 min of movement time. Both yield and cooking losses were highly influenced by tumbling parameters and thighs characteristics for the standard cooking method. For slowly cooked products the influence of thigh characteristics was less important. So yield variations as a function of post rigor pH and tumbling time, showed two considerably different patterns for slow and standard cooking conditions, well represented by three-dimensional plots generated with use of the SAS-GRAPH program.

In this work, real tumbling time was much shorter and resting time much longers than in our previous work. Resting time seems to be more important to sensory acceptability, in particular to cohesion characteristics (R = .74** for standard cooking and .87** for slow cooking).

NA-23 NMR IMAGES OF SALTED HAMS

RENOU J.P$., BIELICKI, G.$, HERMAN G.*

$ Structures Tissulaires et Interactions Moléculaires / Station de Recherches sur la Viande INRA Theix 63122

* Laboratoire d'Application BRUKER Karlsruhe Germany

Magnetic Resonance Imaging (MRI) has been developed to characterize tissues by morphological studies. The determination of wa
content on carcasses or pieces is now easily achieved by cross-sectional images. Na-23 images were performed to study the distr
brine in ham.

Experiments were carried out on a Bruker Biospec 47/40 (magnetic field : 4.7T ; horizontal magnet bore : 40cm). To obtain Na-2
specific 25mm probe operating at 52.9 MHz was designed.

For these studies, five pigs (one piglet, two Large White breeds, two Pietrains halothane positive) were used. The left ham was c
carcass and immediately injected with brine (3M NaCl) at 0°C. The right ham was treated by standard method 24h *post mortem*. F
experiment the images were obtained just after injection. In the second experiment, the images were obtained on the whole Paris h
effect of churning was investigated.

Images of NaCl diffusion were compared with morphological images obtained with H-1. The Paris ham was prepared so that
could be easily identified. Thus, it was possible to study the brine diffusion within the ham and in specific muscle and to show th
was heterogeneous.

Level Effects of Modified Food Starch on the Physical and Sensory Properties of Sectioned and Formed Cooked and Smoked Ham

R. E. Rust*, M. W. Westendorf*, and J. J. Mitolo**
* Iowa State University, Dept. of Animal Science, Ames, Iowa, 50011, USA
** National Starch and Chemical Co., Bridgewater, New Jersey, 08807, USA

To test the utility of adding modified food starches (MFS) to sectioned and formed water added hams, both a
derived from waxy maze (FIRM-TEX™) and a MFS derived from tapioca (LOGEL™) were added at 0, 2, 3, a
percent of the finished product for hams injected to 135 and 155 percent. Brines were formulated for a finish
product composition of 2% salt, 1% dextrose, 0.4% sodium tripolyphosphate, and the required MFS to achie
desired treatment levels (156 ppm sodium nitrite and 550 ppm sodium erythorbate were added based on mea
Following injection, the hams were macerated, tumbled under vacuum, stuffed into fibrous casings, smoked
cooked. Parameters measured included proximate analysis for moisture, fat and protein, sensory analysis, a
at days 14 and 28. Sensory analysis was conducted using an eight member trained taste panel and a 15 cm. c
for measuring firmness, juiciness, salt flavor, and overall palatability.

Results, using S.A.S. systems package, showed the addition of modified food starch (both forms) had no effe
cooking yields. However, purge was significantly reduced by the addition of MFS - with an inverse relation
shown between level of MFS and amount of accumulated purge. Similar results for purge were observed be
35% and the 55% pump treatments. Sensory analysis of the samples showed no effect of MFS on firmness o
palatability at the 35% pump level when compared to the control treatment (0% MFS). However addition o
increased firmness ratings of the 55% pump hams when compared to the 55% pump control, with the 3% F
treatment being statistically favored ($p<.05$) and all other treatments except the 2% LOGEL being numerically
In addition, both the 3% MFS treatments and the 4% FIRM-TEX treatment were numerically favored over
for overall palatability in the 55% pump hams. Finally, in both the 35% pump and the 55% pump hams, re
sensory analysis showed strong correlations between firmness and overall palatability (.52 and .55 respectiv

The results appear to indicate that the addition of modified food starches derived from either waxy maze o
may function to reduce the accumulation of purge and improve the firmness and overall palatability of fu
extended hams (55% pump treatments)(the level where it is more common to see starches being used) - all
these characteristics being important to the retail consumer.

EFFECT OF DIVALENT CATIONS ON HEAT-INDUCED GELATION OF MYOSN

K. SAMEJIMA, T. KASHIWAKURA and M. ISHIOROSHI

Department of Food Science, Rakuno Gakuen University, Ebetsu, Japan 069

elation of protein is an important pthenomenon which takes place in all structured meat products during thermal processing. It volves both intramolecular and intermolecular changes in proteins. We pointed out that only myosin in the myofibrillar proteins d the ability to influence the heat-induced gelation of model system. However, the heat-indeuced gelation of myosin was ffected by many factors such as temperature, pH, ionic strength, protein concentration, storage period and myosin isoforms hence e molecullar structure of this protein is highly complication. In this work, we report the effect of calcium and magnesium ions the rheological properties of thermal gels of myosin since no detailed information is available on the influence of divalent tions on heat-induced gelation of myosin.

Myosin was isolated from rabbit back and leg muscles. The effects of Ca^{2+} and Mg^{2+} on the changes in properties of thermal ls of myosin were judged from the measurements of turbidity, rigidity, fluorescence intensity, differential scanning calorimetry (DSC) and scanning electron microscopic observation.

urbidity of myosin upon heating was maximum at about 5～10mM of Ca^{2+} or Mg^{2+} at 0.5 M KCl. The changes of the gel igidity on Ca^{2+} or Mg^{2+} for myosin thermal gel was similar to those of the turbidity. The results obtained from fluoroesence pectra was consistent with those of the turbidity measurements. The dramatic decrease in apparent enthalpy of heat denaturation of yosin was observed by the addition of Ca^{2+} or Mg^{2+} from the measurement of DSC. The net work structures of heat-set gels f myosin with or without Ca^{2+} or Mg^{2+} corresponded to the results of their rigidity.

rom these results, we concluded the enhancement on the rigidity of myosin thermal gel was due to the conformational changes myosin moleclule induced by the addition of calcium or magnesium.

UTILIZATION OF SEAL MEAT BY-PRODUCTS

F. SHAHIDI, J. SYNOWIECKI and J. BALEJKO

Department of Biochemistry, Memorial University of Newfoundland, St. John's, Newfoundland, Canada, A1B 3X9

Meat from seal (Phoca groenlandica) is a rich source of proteins with a well-balanced amino acid composition and contains 5-9% hemoproteins. Presence of large amounts of myoglobin in seal meat is responsible for its very dark colour. Seal meat was mechanically separated using a deboner. The bone/protein residues were then treated with proteolytic enzymes. The products so obtained, after dehydration, had a crude protein content of 85-90% and were ivory-white in colour. Hemin was separated as a by-product in the hydrolyzate preparation. The resultant hemin was subsequently used in the preparation of the cooked cured-meat pigment (CCMP). Application of CCMP to comminuted meats from different species successfully reproduced the typical colour of their nitrite-cured counterparts.

NA-23 NMR IMAGES OF SALTED HAMS

RENOU J.P$., BIELICKI, G.$, HERMAN G.*

$ Structures Tissulaires et Interactions Moléculaires / Station de Recherches sur la Viande INRA Theix 63122

* Laboratoire d'Application BRUKER Karlsruhe Germany

Magnetic Resonance Imaging (MRI) has been developed to characterize tissues by morphological studies. The determination of wa
content on carcasses or pieces is now easily achieved by cross-sectional images. Na-23 images were performed to study the distri
brine in ham.

Experiments were carried out on a Bruker Biospec 47/40 (magnetic field : 4.7T ; horizontal magnet bore : 40cm). To obtain Na-23
specific 25mm probe operating at 52.9 MHz was designed.

For these studies, five pigs (one piglet, two Large White breeds, two Pietrains halothane positive) were used. The left ham was c
carcass and immediately injected with brine (3M NaCl) at 0°C. The right ham was treated by standard method 24h *post mortem*.
experiment the images were obtained just after injection. In the second experiment, the images were obtained on the whole Paris h
effect of churning was investigated.

Images of NaCl diffusion were compared with morphological images obtained with H-1. The Paris ham was prepared so that
could be easily identified. Thus, it was possible to study the brine diffusion within the ham and in specific muscle and to show th
was heterogeneous.

Level Effects of Modified Food Starch on the Physical and Sensory Properties of Sectioned and Formed Cooked and Smoked Ham

R. E. Rust*, M. W. Westendorf*, and J. J. Mitolo**
* Iowa State University, Dept. of Animal Science, Ames, Iowa, 50011, USA
** National Starch and Chemical Co., Bridgewater, New Jersey, 08807, USA

To test the utility of adding modified food starches (MFS) to sectioned and formed water added hams, both a
derived from waxy maze (FIRM-TEX™) and a MFS derived from tapioca (LOGEL™) were added at 0, 2, 3, and
percent of the finished product for hams injected to 135 and 155 percent. Brines were formulated for a finishe
product composition of 2% salt, 1% dextrose, 0.4% sodium tripolyphosphate, and the required MFS to achiev
desired treatment levels (156 ppm sodium nitrite and 550 ppm sodium erythorbate were added based on mea
Following injection, the hams were macerated, tumbled under vacuum, stuffed into fibrous casings, smoked
cooked. Parameters measured included proximate analysis for moisture, fat and protein, sensory analysis, and
at days 14 and 28. Sensory analysis was conducted using an eight member trained taste panel and a 15 cm. co
for measuring firmness, juiciness, salt flavor, and overall palatability.

Results, using S.A.S. systems package, showed the addition of modified food starch (both forms) had no effect
cooking yields. However, purge was significantly reduced by the addition of MFS - with an inverse relationsh
shown between level of MFS and amount of accumulated purge. Similar results for purge were observed for
35% and the 55% pump treatments. Sensory analysis of the samples showed no effect of MFS on firmness or
palatability at the 35% pump level when compared to the control treatment (0% MFS). However addition of
increased firmness ratings of the 55% pump hams when compared to the 55% pump control, with the 3% FI
treatment being statistically favored ($p<.05$) and all other treatments except the 2% LOGEL being numerically
In addition, both the 3% MFS treatments and the 4% FIRM-TEX treatment were numerically favored over
for overall palatability in the 55% pump hams. Finally, in both the 35% pump and the 55% pump hams, re
sensory analysis showed strong correlations between firmness and overall palatability (.52 and .55 respectively

The results appear to indicate that the addition of modified food starches derived from either waxy maze or
may function to reduce the accumulation of purge and improve the firmness and overall palatability of fu
extended hams (55% pump treatments)(the level where it is more common to see starches being used) - all
these characteristics being important to the retail consumer.

TABLOIDS OF BLOOD AND MILK PROTEIN FOR SPORTSMEN

R. SOIDLA and M. REI

Meat and Dairy Institute, Estonian University of Agriculture, EE2400, Tartu, Estonia

Estonian sportsmen are in a shortage of special nutrient blends, therefore our objective was to work out some blends for sportsmen on the basis of raw materials which are rich in protein and are produced in Estonia. One of the protein components used in blends was blood of slaughter animal. In our republic food-blood is used seasonally for making blood sausage (blood sausage) and some other products which contain blood. For that reason it would be expediency to utilize the rest of the blood and blood plasma for the production of protein blends for sportsmen.

We made 18 variants of blends. On the basis of an organoleptic estimate two variants were selected for further testing. The formula for one variant was as follows: powdered blood - 15 %, powdered concentrate of whey protein - 7 %, milk-powder - 38 %, sugar - 14 %, lactose - 8 %, sublimated juice - 16 %, citric acid - 1 %, ascorbic acid - 1 %. The partial chemical composition was the following: the protein content - 29.7 %, fat - 8.6 %, ash content - 3.7 %.

Protein tabloids were tested on basketball players, handball players, cyclists and athletic gymnasts. Preliminary results were of positive value.

AN ATTEMPT TO UTILIZE BEEF GULLET MEAT TISSUE IN TECHNOLOGICAL PROCESSING.

T.SZMAŃKO, I.GÓRSKA, G.KRASNOWSKA

Department of Food Technology of Animal Origin,Agricultural University of Wrocław,50-375 Wrocław,Poland

The objective of the studies was the possibility of 15% and 25% processed beef substitution for in highly comminuted sausage processing.

In earlier studies,it was found,that the beef gullet meat tissue was characterized by chemical and technological value close lower quality processed meat.

The production of sausages was based on typical,industrial technology for highly comminuted product made with 15% and 25% of beef gullet was characterized by significantly lower production 1,9% and 4,1% less than control the product /without gullet/,respectively.In addition,to that the meat tissue reduces water holding capacity and texture of the sausages.The colour of the was lighter and less stable as comparison to the control product.As a result of organoleptic statistical differences were found between the products made with 15% of the gullet and beef gested that beef gullet meat tissue could,be used for tenderization or precooking in highly manufacturing as a substitute for beef procesed meat. The substitution for gullet should not exceed

fluence of temperature on protein extraction of salt treated pig muscle

RAVASINI and E. DILBER - VAN GRIETHUYSEN

ch Research Centre, Vers-chez-les-Blanc, 1000 Lausanne 26, Switzerland

ein solubilisation plays an important role in meat processing since the extraction process influences the functional properties of the final duct. Much emphasis has been given to the influence of salt and phosphates on protein solubilisation but less attention has been drawn to effect of temperature. In our experiments we have studied the influence of the temperature on the protein extraction of small cubes (~5 g) pig semiiendinosus. The samples were soaked for 24 h in a salt solution (0.5, 1 and 3 M NaCl), in presence or absence of pyrophosphate, at peratures ranging between 0°C and 20°C. The protein content of the brine was measured and SDS-PAGE was performed to identify the teins.

low salt concentration (0.5 M) the protein extraction increased with increasing temperature. In higher salt (1 and 3 M) more protein was ubilised at 0°C than at 3°C and 9°C, then extraction increased again towards 20°C. The addition of pyrophosphate resulted in a higher raction but did not modify the result observed in salt alone. SDS-PAGE showed a thick myosin band in 1 M NaCl at 0°C, thin bands were ble at 3°C and 9°C but no extraction occurred at 20°C. As expected addition of pyrophosphate enhanced the myosin extraction, but at 20°C myosin band was present only in 1 M salt. The amount of extracted myosin was always higher at low temperatures: 0-3°C.

perature influenced meat protein extraction, mostly by affecting the myosin extraction. The shape of the extraction curves was salt ncentration dependent.

XTRUSION COOKING OF MECHANICALLY DEBONED TURKEY MEAT WITH SOY PROTEIN, KAPPA-CARRAGEENAN ND OAT FIBER

N. SOFOS, A. BA-JABER and G.R. SCHMIDT

epartments of Animal Sciences and Food Science and Human Nutrition, Colorado State University, Ft. Collins, CO 80523 USA

xtrusion cooking of meat mixed with materials from plant sources may be a useful way for production of meat-based snacks, hunks or powders for soups or stews, and pasta products fortified with meat. If the extruded products are of low fat and high rotein, they should be useful in development of value-added, nutritious products. Since extrusion cooking of high-moisture and t raw meat is technically difficult, mixing with plant materials not only improves product composition, but it also facilitates the rocess. The objective of this study was to determine the effects of soy protein isolate (SPI; 16-26%), kappa-carrageenan (K-C; 3-0.9%) and oat fiber (OF; 0-3%) on extrusion-cooked mechanically deboned turkey meat (MDTM). The study was conducted s a fractional factorial experiment of 18 out of a possible total of 54 treatments. The MDTM was mixed with the appropriate gredients for 15 min and then extrusion-cooked in a single-screw Brabender plasticorder extruder (model PL-V500, C.W. rabender Instruments, Inc.). The die plate of the extruder was 5.10 cm in length and had a 0.87 cm diameter opening. The xtrusion temperature was set at 95°C in the barrel and the screw speed was 100 rpm. The extruded products were evaluated by trained panel for binding and hardness. The level of SPI was the most significant ($P < 0.05$) factor affecting the cohesion inding) of the extrusion-cooked products. Binding was also affected ($P < 0.05$) by the level of K-C and the interaction of SPI nd K-C. The OF at the levels tested had no effect on binding, but it increased product hardness. The results indicated that the ost acceptable extrusion-cooked MDTM products were formulated with 24% SPI and 0.6-0.9% K-C.

UTILIZATION OF MEAT AND EDIBLE OFFALS OF TURKEY IN SUCUK TYPE PRODUCT.

S.O.TÖMEK, M.SERDAROĞLU and A.BULGAY

Ege University, Food Engineering Department, Bornova, Izmir, Türkiye.

This research was brought up to meet with the need of rapid development of the turkey raising industry Türkiye. The most of the Turkish people have been taken beef and lamb as their major source of meat sup The consumption of turkey especially further processed turkey products is not very common in Türkiye. present study was intended to evaluate the utilities of edible parts of turkey in sucuk.

The sucuk batters were made in corporating trimming meats, giblets, fat and cooked skins, liver hearths. After stuffing to the synthetic casings sucuk chunks were waited at 4°C for 18 hours. Following that the sucuk chunks were fermented at 30 °C for 6 hours and pasteurized with light sm smoking chamber until the internal temperature was reached to 71°C.

The following variables were studied; pH, moisture, fat, protein, ash, TBA, chollesterol in final pr Firmness, juiciness, flavour and overall quality were evaluated by sensory evaluation. During fermentation pH decreased from 5.8 to 5.5 and at the end of pasteurization pH increased to 5.9. Th moisture content were decrease during pasteurizing due to dry heat. TBA values of sucuk batter and product were found different. Chollesterol values were found 94-107.5 mg/100gr at the end produc sensory evaluation results showed that using turkey trimmings, skin and edible offals of turkey in sucu found acceptable.

THE USE OF HORSE BLOOD IN THE MANUFACTURE OF MEDICINAL AND FOOD PRODUCTS

ET. TULEUOW, ZH.Z. URAZBAEW, O.G. AKULOWA, U. ILYASOW, M.A. MYRZABAEW

Technological Institute of Meat and Milk Industry, Glinka streeet, 49, 490050 Semipalatinsk - R.of Kazakhstan

Blood of slaughtered animals belongs to a number of most valuable meat products. Blood is the most valuable product in medi to its food and biological value in combination with other sources of raw materials.

It fives ground to state that it is possible to produce combined products of blood in combination with other raw material which would correspond to the demands made of food products. According to these demands we have developed the te producing food product of blood. Investigations of chemical, amino acid and mineral content of horse blood and final produc expediency of using them in the production of sausage items and half finished products. The influence of added blood pl qualitative indices of cooked sausages has been tested. The technology of producing protein enricher of whole blood has bee Possibilities of using it in the production of sausage items and half-finished products have finished products have been determined.

New sausage and half finished products with addition of blood food product has a higher food and biological value, better organoleptical indices which were not lower than those of control samples. The content of readily assimilable iron and other active substances in experimental batches of sausages and half finished products indicates the usefulness of utilizing whole and medical diet.

PROVEMENT OF PRODUCTION TECHNOLOGY OF MEAT PRODUCTS

T. TULEUOV, N. APSALYAMOV, S. BAKTAZHAROV, A. FIHTNER and A. BATYRGALIEV
chnological Institute of Meat and Milk Industry, Glinka streeet, 49, 490050 Semipalatinsk - R.of Kazakhstan

ne meat and mutton are being widely used as meat foodstuffs in Kazakhstan. Although horse and sheep by products make 16-18 per t of their carcass, they are not used efficiently in food production. By products differ from meat on their nutritive value. This can be tained by specific functions and different tissue structure of by products. Some products are known to have an increased amount of mins and minerals. Their aminoacid content is different from that of muscle protein. Hence changing proportions of meat, some by ducts and other raw materials, it is possible to obtain combined food products in which the content of essential substances would be al to the norm of meat products. Composition, nutritive and biological value as well as storage stability of protein fatty mass sisting of blood, fat and by products have been studied and the receipts have been developed. The required amount of protein food s for cooked sausages, frankfurters and half finished products has been determined. The advantages of using protein fatty mass ead of meat raw in high protein and nutritive value products have been shown. The quality and storage stability of sausage and half shed products containing protein fatty mass have been established.

required normative technical documentation has been developed.

ROPERTIES OF FREEZE-TEXTURED CONCENTRATE OF MYOFIBRILLAR PROTEINS AS AFFECTED BY SODIUM CHLORIDE ADDITION

BURCY, B. KOWALSKI, A. PISULA
artment of Food Technology of Animal Origin, Warsaw Agricultural University, ul. Grochowska 03-849 Warszawa, Poland

aim of this study was to investigate the influence of NaCl addition on texture and struc- of freeze-textured wet concentrate of myofibrillar proteins (WCMP) obtained from hanically deboned pork meat by two steps washing and screening. The amount of unfreezable er was determined in raw WCMP by differential scanning calorimetry analysis at 0, 1 and 2% salt addition. WCMP with and without NaCl was air frozen in tubes and subsequently deep- ed. Heating loss and profile texture analysis on Instron instrument were determined. rographs were made by light microscopy.

t significantly increased the amount of unfreezable water in raw WCMP (from 0.58 at 0% to g/g solids at 2%) as well as decreased heating loss and rheological parameters of eze-textured WCMP. Freeze-induced fibers became thicker upon NaCl addition.

conclusion : - salt at the level usually accepted in meat products strongly modifies ucture and deteriorates texture of frieze-textured WCMP,

bove changes are connected to the increased retention of water by myofibrillar proteins.

TECHNOLOGY FOR MEAT PRODUCTS ENRICHED WITH ASSIMILABLE IRON

VHULKOVA, D.POPOV
ther Institute of Food and Flavour Industries,4000 Plovdiv,"Maritza" 26, Bulgaria

BSTRACT

tional nutrition definitely creates the need for foods which contain the necessary amount of assimilable iron. The use of elev- amounts of blood and liver as sources of assimilable iron in meat products raises a number of technological problems and ef- s that are contrary to consumers' preferences.

e object of the present work is to establish the possibilities to enrich meat products with assimilable iron by adding $SO_4.7H_2O$. The tests were carried out with non-durable sausages prepared from cattle and pork meat, liver, whole blood from h, $FeSO_4.7H_2O$ solution and ascorbic acid.

determine the assimilable irom form a salt acid extract was prepared and run through a glass column conraining certain antities of powder cellulose, glass wool, 90-100 mesh molecular sieve (Carlo Erba, Italy) arranged in specific order. The assi- lable iron was measured photometrically with O-phenenthroline using Specol digital spectral colorimeter. It was found that the dition of $FeSO_4.7H_2O$ in cooked non-durable sausages increases the level of assimilable iron, and these sausages contained ap- ximately four times higher iron levels (4.6 mg/kg) compared to the controls (1.10 mg/kg).

NESE TRADITIONAL MEAT PRODUCTS AND THEIR PROCESSING

NG WEI
uan Provincial Research Institute of Animal and Veterinary Science, 610066 CHENGDU, Sichuan, P.R. China

STRACT : China, as one of the birth-places of meat products, has a history of over 2000 years in developing and eloying various ways for the processing of meat. Each product is distinct in its flavour and appearance, and most meats storable without refrigeration. Today in China, although some meat products have been adapted from abroad, the tradi- al Chinese meat products still occupy a dominant position both in manufacture and consumption. Most of the traditional nese meat products, including cured meats, smoked or roasted meats, dried meats, boiled meats, stewed meats, sausage ducts, raw hams as well as miscellaneous products, are unknown abroad, with the exception of only a few dried meats Chinese sausage.

effort is made to explain the processing methods and technological characteristics of Chinese meat products, in order ntroduce this knowledge outside of China, and thus to promote a better understanding and an exchange of methods used neat technology worldwide.

THE TECHNOLOGY FOR IMPROVEMENT OF FRESH SMOKED SAUSAGE QUALITY

S. VALIEV, M. SMIRNOV, A. BOLSHAKOV, E. TULEUOV and N. APSALYAMOV

Technological Institute of Meat and Milk Industry, Glinka streeet, 49, 490050 Semipalatinsk - R.of Kazakhstan

The aim of the present study is the improvement of the technology of fresh sausages preserving biologically active substrances meat is known to be a very useful raw product for treatment of obesity, atherosclerosis, anemia, kidney and other diseases. To these valuable properties in finished products, rational dressing of horse sides as well as receipts and the technology of horse sausage production have been developed. Chemical structure, physico-chemical and bio-chemical, microbiological indices were different stages of the technological process of caring (from fresh sausage meat state till 30 days).

The technology developed, one grade horse meat trimming and its use for fresh sausages production have resulted in the biological value, with required content of water, protein, fat and minerals. One grade horse meat trimming receipts and regimes have made it possible to produce products with a balanced amino acid and fatty acid composition. Structural and index and microbiological analysis have proved the reliability of the quality indices. Dark rosy, flavored hard sausage metts The technology suggested reduces production processes and labour consuming operations. Gradation is not necessary. This can serve as a basis for mechanical sausage meat production.

QUALITY ASPECTS OF A LOW FAT LINE OF TYPICAL ITALIAN PIGMEAT PRODUCTS

A. VIZZANI, A.R. LOSCHI, M. TREVISANI and M. SEVERINI

Istituto di Ispezione degli Alimenti di Origine Animale, Facoltà di Medicina Veterinaria, Universi Studi, Perugia, Italia

The composition, energy content, fat and NaCl percentage are of utmost importance in consumer towards pigmeat products. Since some typical Italian meat products are usually made with a rath percentage of fat and NaCl, the Italian industry has been trying to produce new kinds of products present dietary needs. The aim of the study was to investigate the chemical composition of some pigmeat products belonging to a new line of food. They are characterized by a lower energy conte a lower percentage of fat and NaCl compared with the same type of product processed traditionall Information on the overall nutritional quality of these products and some peculiar aspects manufactoring processes are reported.

Session 11

MEAT PRODUCTS AND HUMAN NUTRITION

ADVANCED TECHNOLOGIES IN THE MEAT INDUSTRY

DEWATERING THROUGH IMMERSION IN SUGAR/SALT CONCENTRATED SOLUTIONS AT LOW TEMPERATU AN INTERESTNG ALTERNATIVE FOR MEAT STABILISATION.

A. COLLIGNAN and A.L.RAOULT WACK.

Food Technology and Engineering Division - CIRAD-SAR-GTA, Av du val de Montferrand BP 5035 - 34030 MONTPELLIER,

Partial dewatering of meat (beef) pieces was achieved through soaking them in mixed concentrated solutions (sucrose/sal syrup/salt) at low temperature (10°C). Water loss, sugar gain and salt gain kinetics, as well as sugar/salt interactions were studied show how the presence of sugar can enhance water loss, and hinder salt entrance, which proves to be particularly interes alternative to traditional meat processing. In fact, process time duration can be reduced, and salt entrance better controlled.

PRELIMINARY PROBE MEASUREMENTS OF DIELECTRIC PROPERTIES IN BIOLOGICAL TISS MICROWAVE FREQUENCIES

J.L. DAMEZ

Station de Recherches sur la Viande, INRA Theix, 63122 Saint Genès Champanelle, France

Real-time, non-destructive, non-invasive methods are needed to bring dielectric properties into wides as quality control tools and on-line control measurements. Although methods have been attempted in the re no data are available on dielectric measurements of tissues from beef carcasses. The method used he destructive and may be used in other applications where special preparation of test sample is undesirable. it can be use on-line. The measurement system consists of a sensor and a computer-controlled networ The sensor is an open-ended coaxial line. During an experiment sample is placed against the probe to opening of the line.

The reflection coefficient is directly ascertained with the network analyzer and the permittivity calc the measured amplitude and phase of the reflection coefficient. The complex permittivity is represented a in terms of the dielectric constant ε' and loss factor ε''. The measurements are done automatically and the printed in a tabular form or plotted as a function of frequency. The first results on a number of beef tis frequency range 0.5 GHz to 6 GHz show that main tissues are easily distinguishable as the dielectric significant (for example ε'=5 for fat tissue and ε'=55 for muscle at 3 GHz and 20°C).

ER AND SALT TRANSFERS ANALYSIS IN DRYING OF SAUSAGES

AUDIN*, A.KONDJOYAN* and J.SIRAMI**

tion de Recherches sur la Viande, INRA Theix, 63122 St Genes Champanelle, France

IV, 2 rue Chappe, 63100 Clermont-Ferrand, France

lity of dry sausages is greatly affected by the drying process. The rate of water evaporation at the surface must balance the migration of from inside the sausage to the surface. When the evaporation potential is too low undesirable development of mould can occur ; on the the formation of a dry crust prevent water loss and affect badly flavour and texture.

ches of sausages were prepared from pork meat and dried for several weeks. During the experiments the drying conditions were d continuously and the evolution of the following variables were measured : (1) Sausages diameter and weight loss to evaluate the ge and drying rate, respectively and (2) the profiles of water and salt contents to investigate the internal transfers. In a separate ent the mass transfer coefficient at the interface solid-air, to which the evaporation rate is proportional, was measured for air velocities g from 0.15 to 0.45 m/s and for various sausages lenghts and diameters.

sults provide data which enable to set up further technical developments to avoid the occurence of a dry crust. The shrinkage was found to proximately proportional to the water loss. A migration of salt from the outermost part to the innermost part was evidenced. The gradients sture content were steep in the first 10 mm close to the surface while they were almost flat elsewhere indicating a very low effective water sivity. The formation of a dry crust in one experiment corresponded to the steepest moisture content gradients and to a dramatic decrease of ying rate.

FLOW CHARACTERISTICS IN A CHILLER FOR PORK OFFALS AND COOLING CONSEQUENCES

AUDIN**, V.BOUTON*, G.PROD'HOMME* and J.L.MOURLHON DALLIES*

ation de Recherches sur la Viande, INRA Theix, 63122 St Genes Champanelle, France

GF-SOGELERG, 25 rue du Pont des Halles, 94 666 Rungis Cedex, France

illers the velocity and temperature of the air flowing around the products determine their temperature and weight loss kinetics and thus process efficiency. In turn, these kinetics affect bacterial growth and meat tenderness. In practice, air circulation is often overlooked e it seems there are considerable economic advantages to be gained in systems where air flow would be well managed.

xperiments were carried out in an industrial continuous air chiller design for cooling pork offals from 40°C to 4°C in 2 hours. A box aining a small data logger was suspended from the overhead conveyer and moved through the chiller with the products. Thermocouples 'hot wire' type anemometers were used to measure continuously (1) the properties of the air flowing around the products and (2) the and surface temperatures in the livers.

air velocity variation along the conveyor at different heights from the floor were analysed. The average air velocity was about 2.4 m/s values ranging from 0.3 m/s to 9 m/s were recorded. Fast changes were observed and explained by the arrangement of the fans. stics histograms derived from 1500 measurements show that the median is the best indicator of the average conditions. The shape of ers temperatures kinetics measured was different from that obtained with constant conditions usually presented in the literature. The variations in the air velocity accounted for this difference.

ddition, air flow directions and velcities were measured at many locations of one chiller section. Uneven air distribution was enced and short cuts were detected along the walls and the floor.

RECOVERY OF PROTEIN FROM MECHANICALLY SEPARATED CHICKEN RESIDUE USING DIFFERENT METHODS OF EXTRACTION

M.T.E.L. GALVÃO and N.J. BERAQUET

Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, São Paulo, Brazil

The aim of this work was to determine, on a laboratory scale, the influences of three different methods of extraction on the recovery of food grade protein from mechanically separated chicken residue.

Bone residue resulting from mechanical deboning of skinless chicken backs was subjected to: a) alkali extraction at pH 10,5 followeed by acid precipitacion; b) salt extraction using solution 6% NaCl and c) enzimatic hydrolysis using the enzime alcalase and enzime: substrate ratio of 2g:100g protein. Five trials were conducted for each treatment. Proximate analysis was determined on the bone residue and on the slurries after the extraction.

The bone residue used in the trials had a protein content in the range of 15,9 - 19,7% and fat content in the range of 8,9 - 11,7%. The alkali extract showed great variability in its composition between the trials, particularly on the moisture and protein contents. The moisture and protein contents were in the range of 88,1 - 92,9% and 5,1 - 11,1% respectively. Fat content was around 1,5%. The extract produced using saline solution contained 4,1 - 6,3% of protein and 1,9 - 4,8% of fat. As in the alkali extract the moisture content showed great variation between the trials and was in the range of 88,1 - 91,9%. The enzimatic extraction had a degree of hydrolysis in the range of 11,0 - 14,0%. In all trials the reaction came to a halt after around 120 minutes. The protein content, in the range of 92,3 - 93,8%, was not statistically different from the alkali extract but it was significantly higher than that obtained on the salt extraction. The protein content was in the range of 4,8 - 6,4% and the fat content was around 0,8%. The results showed no differences between the source of extraction on the protein content, and the fat content was reduced to low levels in all extracts.

PRODUCT LIFE OF VACUUM PACKAGED BEEF IMPORTED INTO SAUDI ARABIA BY SEA

A.M. GAROUT and R.G. BELL

Saudi Arabian Standards Organization, P.O. Box 3437, RIYADH, Saudi Arabia

ABSTRACT: In Saudi Arabia all perishable food products including chilled meats are assigned an expiration period. These expiration periods and their associated storage requirements must accommodate the limitations of present technology to ensure public health without causing unnecessary rejection of wholesome foods. Consequently, to assess the appropriateness of current chilled beef regulations, five transport and storage trials were conducted to determine the product life of vacuum packaged beef imported by sea from New Zealand and the Republic of Ireland. The cold chains into, and within Saudi Arabia were monitored by means of miniature electronic temperature loggers placed, at packaging, into cartons of vacuum packaged half striploins. Production hygiene was assessed by determining the microbial bioload prior to packaging and on arrival in Saudi Arabia, and after various periods of storage, the meat was subjected to microbiological, sensory and chemical analysis. Product life at chilled temperatures was more often limited by microbial failure and flavour loss than by the appearance of off-flavours associated with the development of Lactobacillus- dominated spoilage microfloras. At mean transport and storage temperatures between -1.0°C product life ranged from 73 to 103 days. None of the chemical parameters examined - free fatty acids, total volatile nitrogen and meat pH - were suitable as objective indicators of the end of product life. Transport and storage temperatures are the principal factors determining product life, extension of the expiration period for vacuum packaged beef in Saudi Arabia beyond the present 70 days will require improved temperature control and assurance.

PLICATION OF DATANETWORKS AND DATABASES TO THE SLAUGHTERLINE

AUS HAGDRUP
nish Meat Research Institute, Maglegaardsvej 2, DK–4000 Roskilde

ce the middle of 1990 DMRI has worked on development and installation of a new concept for data collection and sorting of carcasses the slaughterline and in the chilling room. The resulting systems are up till now (spring 1992) installed in 10 danish production ironments. By the end of 1992 the systems will be installed in all danish abattoirs.
e system specification and development is prepared in accordance with a superior plan for implementation of Computer Integrated nufacturing (CIM) in the danish abattoirs. The CIM–analysis was carried out by DMRI in the period 1988–1990 and these new data tems for the slaughterline are the first practical implementation of this long term planning for implementation of integrated information tems in the danish companies.

e new data systems fulfil the following main objectives:
Automatic sorting of carcasses in the chilling room based on data collected on the slaughter line.
Flexible storing of production results (e.g. carcass data) which allows future applications and reporting especially with focus on production planning.
An "open" data system which allows future integration of new equipment without changes in the existing systems.

e technology used to achieve these goals are mainly:
Application of data networks installed along the individual slaughterlines.
Application of modern database techniques and graphical user interfaces.
Widespread use of existing standards and standard components e.g. application of Personal Computers (PC's).

e experience with the systems up till now has been very positive and the systems have been adopted easily by the companies due to parallel educational programme. The flexibility of the systems has been proved lately by the integration of a new system for automatic ata collection of remarks from the meat inspection on the control platforms.

e paper describes the new concept for data integration on the slaughterline, especially with focus on technology. Furthermore the perience from the danish installations will be discussed.

LOCAL ELECTRICAL STIMULATION OF LONGISSIMUS DORSI MUSCLE IN BEEF

T.L. HALD and SIGNE KLASTRUP
Danish Meat Research Institute, Maglegaardsvej 2, DK–4000 Roskilde, Denmark

The aim of this experiment was to test a method for local acceleration of rigor mortis development in the Longissimus Dorsi muscle in beef.
Such a method may make it possible to predict the ultimate pH in LD by measuring the pH as the last operation on the slaughterline.
The results may be used in on–line classification of beef carcasses for separation of carcasses with high pH.
The first study consisted of 90 carcasses which were el–stimulated (total carcass stimulation) for 20 seconds. The stimulation was carried out immediately after bleeding.
The second study consisted of 270 carcasses which were not subjected to total carcass stimulation.
After dehiding both groups were stimulated locally in the loin for 3 minutes (left loin).
Significant differences in the pH values between the reference loins (right sides) and the test loins (left sides) were observed within 25 minutes of the local stimulation.
This will satisfy the time limit required for absolute separation of dark cutting beef carcasses, provided that the complete carcass has been fully stimulated after bleeding.
Meat quality was not affected by the local stimulation if the electrodes were made from a suitable material.

LEAN, FAT, AND CONNECTIVE TISSUE FROM BEEF SHANKS PROCESSED WITH A BAADER™ DESINEWER

M. C. HUNT and R. E. CAMPBELL

Department of Animal Science and Industry, Kansas State University, Manhattan, Kansas, USA. 66506-0201.

Beef shanks are relatively low-fat, but their high connective tissue content prevents their use as a sole lean source in products. This research examines the effects of belt pressure and drum opening size of a Baader desinewing machine on the yield properties of desinewed shank lean and sinew. To achieve yields that are commercially acceptable, shanks must be run twice through the Baader. Changing belt pressure and drum opening size altered ($P<0.05$) yields and tissue composition. Maximum lean yield 93% of the shank at 10% fat using a 5 mm drum for both passes. With a 5 mm drum, yields were 70 to 75% on the first pass at belt pressure setting of 2, and 15 to 20% on the second pass with a belt pressure setting of 4. Sinew yield averaged 6.5 to 7% initial shank weight. With these settings, first pass lean was 7 to 10% fat, second pass lean was 10 to 12% fat, and mixed first second pass lean fractions averaged 10% fat. The sinew remaining after the second pass was 15 to 20% fat.

Very lean ($\leq$ 5% fat) material was produced with a 3 mm drum on the first pass. First pass lean yields were 60 to 65% shank at 5% fat using a 3 mm drum at a belt pressure setting of 3. Second pass lean with a 5 mm drum and a belt pressure of 4 was 10 to 15% fat and yielded 25 to 30%. Using a 3-mm drum at any belt setting for the second pass resulted in lower lean. Sinew averaged 6.5 to 7% of the total shank.

Sinew was further processed through an 060 head of an Urschel Commitrol®. Flaked sinew was added to the desinewed lean in natural proportions. This mixture, desinewed lean, and whole ground shanks made into 10% fat ground beef patties. Patties desinewed lean and/or desinewed lean with flaked sinew re-incorporated were more acceptable and had fewer noticeable connective particles than patties made from ground shank. Baader processing can enhance the utility of beef shanks through textural improvement and fat reduction.

INDUSTRIAL EXPERIMENTS WITH LOW VOLTAGE ELECTRICAL STIMULATION OF BEEF CARCASSES IN POL

S.KIEN

Meat and Fat Research Institute, Division in Poznań, ul.Głogowska 239, 60-111 POZNAŃ, P

ABSTRACT

Many experiments with low voltage electrical stimulation (ES) of beef carcasses using industrial equipment in 3 large meat plants were carried out. The animals in some experi were fed on the molasses solution before killing. The purpose of this work was to impro quality of export beef and possible introducing of hot meat processing. The value of m pH of the carcasses stimulated at various time after stunning, texture of muscles and traits of meat and meat products were measured or evaluated. It was found that the ES carried out not later than 5 min (preferably within 1 - 3 min) after stunning. The car of heifers and bulls fed before killing and electrically stimulated showed light-red colour fully accetable by the customers. In experiments concerning hot processing of b was stated that ES makes the cutting and deboning easier. Some muscles showed lighter colour and better tenderness compared to control muscles from non stimulated, cold boned casses. More over the meat production process was shortened and weight losses were re The quality of canned meat made of hot processed meat was a little better and were no rences in quality of frnkfurter-type sausages made of hot and cold boned meat.

THE USE OF MAGNETIC SORBENTS FOR THE MANUFACTURE OF GLOBIN AND HEME FROM BOVINE BLOOD

L. H. KOMISSAROWA, A.A.KUZNETSOV, L.K.KASARINA, A.D.NECLUDOV, S.L.BARSEGIAN

Institute of Chemical Physics, Russian Academy of Sciences, Kosygin str. 4, Moscow 117977.

In the known processes the separation of heme from globin by using of organic solvents (like acetone) is very cumbersome procedure. The present invention relates to a process of preparing an iron-rich heme part and isolate of globin from red blood cells of bovine by using of magnetic sorbents (MS). MS are the higher dispersed particles of ferromagnetic with the size not more than 1 micron. This method is based on a selective sorbtion of heme from an acidified hemolizates of red cells by particles of MS. The separation of MS is carried out by magnetic field with the intensity 50-100 mT. The desorbtion heme, carried by alkaline elution, achieved to 98 %. Using this technology we have obtained the isolates of globin and heme from bovine blood. The content of residual heme in preparation of globin did not exceed 5%. The offered technology is ecologically clean as well as it does not connect with using an organic solvents and other toxical substances. The preparations of globin and heme obtained this method can be used in the combinational meat products.

HEAT AND MASS TRANSPORT MODELLING DURING MEAT BALL COOKING

G.S. MITTAL and EDEN HUANG
School of Engineering, University of Guelph, Guelph, Ontario, Canada

The objectives of this study are: (i) to model the temperature distribution and mass loss in meat ball during convective oven cooking, broiling, oil frying and boiling, and (ii) to validate the process models against experimental results. These cooking processes were modelled by using Fourier and Fick's laws for unsteady state. These were solved using appropriate initial and boundary conditions, finite difference, and continuous system modelling program (CSMP). The effects of shrinkage and crust formation were not considered. Meat balls of 4.7 cm diameter weighing 60 g were formulated with 82% beef, 7.5% binder and 10.5% added water. The raw meat balls contained 64.5% water, 15.9% protein, 13.3% fat, 4.0% carbohydrate, and 2.4% ash. Heat transfer coefficeints were measured on an aluminum meat ball by reducing the internal resistance. A multi-mode oven at 140°C was used for baking and broiling experiments. Air speed of 0.5 to 0.9 m/s was measured at 240 cm in front of the fan in convection mode. Mass transfer were measured by using cantilever load-cell. A 12 L oil bath with circulator was used for frying. It has 1500 W heating capacity and fluid circulation rate of 15/min. For boiling process, same bath was used with a water temperature of 90°C. The meat ball was cooked upto the centre temperature of 70°C. Temperature profiles at different locations and mass loss during cooking processes were recored. This data was used to validate process models. These models can be used to optimize process conditions. Sensitivity analysis on the physical parameters were conducted to determine their effects on process simulation.

AUTOMATIC EXTRACTION OF A MUSCLE FROM A BEEF FOREQUARTER

P. SALE, J.L. DAMEZ, P.TOURNAYRE, A.LASTEYRAS
Groupe Génie des Procédés, Station de Recherches sur la Viande, INRA-THEIX, 63122 Ceyrat, Franc

Automation is a promising way to improve meat industry efficiency mainly in operations such as dressing and boning which are very labour consuming.

The aim of this study is to experiment the possibilities to remove muscles from a quarter by mea automated system in respect of butchery standard. A complete system including all the facilities needed operation was build. It includes a beef forequarter positioning frame, manual and video systems geometrical parameters measurements of the quarter, an electric robot with 6 axes equiped of differe and a computer for trajectories calculations and robot controls.

Work was done on hot meat (about two hours *post mortem*). Three kinds of problems were encou i) positionning of the quarter; ii) choice of the type of tools according to the driving system and iii) adapt the tools trajectories to the specific geometry of each carcass. A strategy for dismantlement of different was set up and the complete operation on the *supra spinatus* muscle performed. It requires complex such as tendon cutting, gripping and pulling out the muscle. It requires four working trajectories of differents tools.

All the paths for the different tools where linked to a single point. A set of paths called "reference build from the different paths obtained by manual driving of the robot. This reference set can be u different quarters after it was properly positioned on each quarter by translation and rotation of the refer

Relations between the parameters of translation and rotation and different geometrical charact the quarter were thought out. No one was accurate enough to provide a means to put the reference right place.

With a manual coordinates measurement of two quarter's points linked to the reference trajectories were correctly fitted and an automatic computer controled execution was carried out.

STUDY OF ELECTRICAL METHOD OF ATOMIZING FOOD PRODUCTS

V.YA.SVINTSOV

Technological Institute of Meat and Milk Industry. Kazakhstan, 490011 Semipalatinsk, Glinki, 49.

The object of the investigation is atomizing blocks of atomizing drying units. Expe tal studies were carried out on the laboratory unit by modernized method of stalag and on the experimental electrical atomizing block by method of rapid photographing result of experimental studies in model liquid-like media the functional dependence of rameters of atomization process: those of particles dispersity, the taper angle of zing jet, electrical power consumption as well as coefficient of surface tension on physical properties of model media, the amount of feed voltage and the diameter nozzle was determined. We have also stated the range of feed voltage (up to 15 kv it possible to regulate diameters of atomized particles from 40 - 80 to 100 - 150 ters and higher, the taper angle of a jet reaching 80° and power consumption which 1.0 to 3.0 kw per 1000 kg of atomized product. Relatively low power consumption, degree of particles monodispersity, the possibility to regulate particles diameter mized products and taper angle of a jet indicate substantial advantages of the ele method of atomization compared to the existing (nozzle and disk) ones.

KINETIC STUDIES ON SAUSAGES SMOKING PROCESSES

. TYSZKIEWICZ, M. PANASIK
eat and Fat Research Institute, 02-532 Warszawa, ul. Rakowiecka 36 Poland

he studies of blowing smoking process of sausages were caried out. The open - traditional
ycle and closed one were used as well. In experimental smoking house there was installed
he modular smoke-generator of own construction. The generator contained equal portions of
awdust in its 16 modulus equipped with individual igniter starting at predetermined time.
ausages of wiener - and mortadella-type prepared using of cured or uncured meat, were expe-
imentally smoked. Sensory evaluation of sausage surface colour using ten-points graphical
cale method was used as a criterion of smoking degree.

o optimize the process the smoke concentration in smoking house was simulated in different
rocess phases by changing the modular portion of sawdust and time of its ignition.
t was proved that there was a possibility of 70-90% reduction of amount of sawdust used in
omparison to traditional process if smoke of high concentration was generated in the first
hase followed by at least two-time lower concentration in the second one and no smoke gene-
ation in third one.

ecause of exponential character of smoke decomposition with a half-life of 5 min., it was
ossible, by extending the third phase to 15-20 min., to limit the smoke emission after the
end of the process to 10% of the concentration observed in the second phase.

INFLUENCE OF CERTAIN PROCESSING METHODS ON THE ESSENTIAL AMINO ACIDS CONTENT OF RABBIT MEAT

M. KAMAL E. YOUSSEF, S.H. ABOU-EL-HAWA, M.N. EL-RIFY and A.H. KHALIFA
Food Science & Technology Department, Faculty of Agriculture, Assiut University, ASSIUT, A.R. EGYPT.

Fore limb, loin and hind limb cuts of Californian and New Zealand White rabbits (both sexes) of a marke-
table age (2 and 3 months) were used to assess the effect of certain processing methods namely: pressure
cooking, roasting and smoking on essential amino acids content in rabbit meat. Essential amino acids assess-
ment was carried out applying thin layer chromatographic technique. Both qualitative and quantitative deter-
minations showed that there were ten essential amino acids namely: lysine, histidine, arginine, methionine,
threonine, valine, leucine-isoleusine mixture, phenylalanine and tryptophan present in the two above mentioned
studied rabbit strains. The total essential amino acids content was 49.48 and 49.14 g/100 g protein in
Californian and New Zealand White rabbit meat; respectively. Slight differences were observed between sexes,
however older rabbits contained rather high essential amino acids content. Likewise the hind limb contained
the highest levels of essential amino acids, while fore limb recorded the least levels. Essential amino acids
content decreased as a result of the studied processing methods. However, the highest losses were recorded
in smoking process, while roasting method recorded the lowest losses in the essential amino acids.

EFFECT OF CERTAIN PROCESSING METHODS ON PHOSPHOLIPID COMPONENTS IN RABBIT MEAT

PROF. DR. M. KAMAL E. YOUSSEF, PROF. DR. S.H. ABOU-EL-HAWA, PROF. DR. M.N. EL-RIFY and A.H. KHALIFA
Food Science & Technology Department, Faculty of Agriculture, Assiut University, ASSIUT, A.R. EGYPT

Fore limb, loin and hind limb cuts of California and New Zealand White rabbits (both sexes) of a mar able age (2 and 3 months) were used to assess the effect of certain processing methods namely: pressure cooking, roasting and smoking on phospholipid components in rabbit meat. Phospholipids were fractionated applying thin-layer chromatographic technique to eight fractions namely: phosphatidylserine (PS), lysopho phatidylcholine (LPC), phosphatidyl inositol (PI), sphengomylein (SL), phosphatidylcholine (PC), phosphat ethanolamine (PE), phosphatidic acid (PA) and phosphatidyl glycerol (PG). Rather slight differences bet sexes, ages and three studied cuts in their quantitative phospholipid components were observed. Phospho fractions recorded qualitatively the same pattern as that of fresh meat in the three studied processing methods of rabbit meat. However, all studied processing methods resulted in a decrement in all phospholi fraction contents, except that lysophosphatidyl choline and (phosphatidic acid + phosphatidyl glycerol) slightly increased.

PRINCIPLES OF THE THEORY AND THE DEVELOPMENT OF INTENSIVE DRYING PROCESSES WITH GRINDI OF BIOLOGICAL PRODUCTS

D.ZHAILAUBAYEV, B.OSPANOV, K.KUSMANOV, G.TUMENOVA
Semipalatinsk Technological Institute of Meat and Milk Industry, 490011 Semipalatinsk, Glinka Street 49, Republic of Kazakhstan

The current development of drying technology in meat industry is characterized by the bination of drying with other processes including the combination of drying and grindi processes of moist material in one apparatus.

System approach to the description of complex phenomena while combining drying and gr processes of moist material in one apparatus has been developed. System analysis is ap as investigation strategy and mathematical simulation as investigation method. The rem of boundary problem solution of moisture conduction in the plate with initial assymetr distribution of moisture content are given.

Change of the primary conditions as a result of division of the plate leads to the sh intensification of mass transfer process. Duration of drying in this case is thrice s which is tally with the results of conducted experiments and adequate to the solution physical model of the process.

Proceeding from the generalized equation the investigation method of dimension and sp surface alteration of the material being processed as well as thermal physical and ge ral mechanical characteristics of the material have been elaborated.

Division of the surface leads to the effectiveness of heat and mass transfer process As a result of theoretical and experimental studies a drying-and-grinding apparatus f drying moist material is designed.