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Characteristics of Pork Fed Potato Chipper By-Product

W.C. BRISENDINE, M.A. BUMGARNER, and D.M. KINSMAN

University of Connecticut, Storrs, Connecticut, 06268, U.S.A.

A by-product of the potato chip industry, known as potato chipper by-product, has a valuable potential as a livestock feed. The objective of this study was to test this product as a sole ration or combined with grain as compared to grain only for growing-finishing hogs. Eighty-two cross-bred pigs consisting of 38 barrows and 44 gilts averaging 33.2 kgms were randomly assigned to six pens receiving a control (grain) ration, 50% chips: 50% grain, and 100% chips (by-product), replicated. All rations were balanced according to NRC standards for protein, mineral and vitamin levels. All hogs were slaughtered when that pen averaged 95.5 kgms. Average daily gain for these rations was 0.67, 0.67, and 0.53 kgm per day respectively. Kgms of feed per kgms gained from start to finish was 2.77, 3.09, and 4.03 respectively. The control ration hogs had a significantly lower ($P < 0.5$) dressing % than the other groups (68.2% vs. 71.1% vs. 70.7% respectively). There was a significant difference ($P < 0.5$) in backfat (3.18 vs. 3.45 vs. 3.76 cms respectively). Length of carcass was not significantly different between the three groups. The longissimus area (cms^2) was greater ($P < 0.5$) in the controls than the 50:50 group (24.5 vs. 22.3) and highly significantly greater ($P < 0.1$) when compared with the 100% group (24.5 vs. 19.1). The trimmed ham and loin % was significantly greater ($P < 0.5$) for the controls (46.1% vs. 43.5% vs. 42.1% respectively). The control group carcasses were significantly ($P < 0.1$) firmer than the potato chip ration fed hogs which were slightly soft at both levels. The PSE scores favored the control group. Marbling scores were higher in the controls but not at significant levels. Color ratings were significantly ($P < 0.5$) more desirable in the control group. There was less ($P < 0.5$) surface moisture observed on the longissimus muscle of the controls than in the other two groups. Proximate analysis of the longissimus muscle samples from each group showed the following comparisons for controls vs. 50% chips vs. 100% chips: for protein, 22.9% vs. 22.48% vs. 20.90% ($P < 0.1$); for moisture, 68.95% vs. 61.37% vs. 62.19% ($P < 0.5$); for fat, 2.06% vs. 3.54% vs. 5.71% ($P < 0.5$); for ash, 1.14% vs. 1.11% vs. 1.09%; and for pH, 5.60 vs. 5.58 vs. 5.64. Additionally, fatty acid composition and degree of saturation is being determined for backfat samples from each group and sensory evaluation is being conducted. The grain (Control) fed pork was more desirable in all characteristics measured with the 50:50 ration fed hogs generally ranking second best, and the 100% potato chipper by-product pork, although acceptable, being the least desirable.

1.02

" Effect on chick performance of low protein diet "

ABDELHAMID MOHAMED ABDELHAMID

Department of Animal Production - Faculty of Agriculture - Mansoura - Egypt.

Summary: Two dietary protein levels (8 and 23%) were fed to egyptian (Dandarawi) and standard (Leghorn) chickens for the measurement of the performance . Dandarawi chickens tolerated the low protein level than Leghorn . Live body-measurements for Dandarawi were higher than those of Leghorn, on the low protein diet . Positive correlations between live body-weight and live body-measurements and between live body-weight and carcass weights were found . Chemical analysis of blood, meat and bone and the statistical analysis were discussed . Economical efficiency, protein efficiency ratio, feed efficiency, growth measurement as well as mortality were calculated .

1.03

" Effect of different dietary protein levels on some ingredients of blood, meat, and bone of 16-weeks old chickens "

ABDELHAMID MOHAMED ABDELHAMID

Department of Animal Production-Faculty of Agriculture - Mansoura - Egypt .

Summary: Different dietary protein levels (17.4-20.4-23.5-26.3%) were fed to egyptian (Dandarawi) and standard (Leghorn) chickens from day old till 16 weeks.

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Serum calcium and phosphorus, flesh acidity and tenderness and tibia ash, calcium and phosphorus were determined. It was appeared no effect of dietary protein levels on blood calcium and phosphorus or on meat acidity, but it was found a negative effect of dietary protein levels on meat tenderness with correlation of -0.93 and -0.98 for Dandarawi and Leghorn, respectively. A negative effect was shown too of dietary protein on the tibia ash, but no effect on tibia calcium and phosphorus.

1.04

Studies on some factors affecting pig meat quality

G. MALMFORS

Department of Animal Breeding and Genetics, Swedish University of Agricultural Sciences
S-750 07 Uppsala, Sweden

Some environmental factors affecting pig meat quality have been studied at the Meat Research Section. The most important results were:

- A holding period of 2-4 hours on the lairage before slaughter was found beneficial for meat quality. The PSE incidence was highest when pigs, transported a short distance, were slaughtered immediately after arrival at the abattoir. A lengthy transportation combined with a long lairage wait resulted in a high DFD incidence. The experimentally obtained incidences of PSE and DFD were compared with "normal" figures under the actual abattoir conditions. In a survey covering 12 months, and comprising nearly 3000 carcasses, the PSE and DFD frequencies were 12% and 3% respectively.
- By visual assessment of the degree of stress just before slaughter, it was possible to predict the ultimate meat quality. Separating severely stressed pigs from the others to give them an opportunity to recover in separate pens would be one practical implication of these findings.
- The stunning-order within a lairage pen affected meat quality. When the pigs in a pen (45-60 pigs) were divided into three subgroups immediately before slaughter, the meat quality of the group first slaughtered was superior to that of the last group.

1.05

The influence of transport on certain biochemical parameters in male beef-cattle

PRABUCKI, A.L. and MORGENTHALER, M.

Institute for Animal Production, Swiss Federal Institute of Technology, Zurich (Switzerland)

In two trials with 160 animals (bulls, short scrotum bulls, steers) held in tying and loose housing systems the influences of factors concerning the carry over of animals from farm to slaughterhouse on certain biochemical parameters were measured.

Caused by transport, but not by duration of transportation, the animals showed increased heart and ventilation rates. Rectal temperatures were slightly increased. In plasma the levels of glucose and lactate were increased, accompanied with a decrease in potassium concentration. The upper levels of glucose and lactate are limited by the renal threshold. If glucose and lactate levels in blood are increased significant amounts of this metabolites are excreted in the urine.

From the results it was deduced that increased lactate values are caused by the animal activity, while increased glucose levels are the consequence of emotional charge.

Containerized transportation of pigs aimed at the maximum preservation of product quantity and quality

Yu.V. TATULOV, I.P. NEMTOCHINOVA and N.G. MIRONOV

The All-Union Meat Research Institute, Moscow, USSR

V.A. LUBENETS

The All-Union Research, Design and Technological Institute of Animal Breeding Mechanization, Podolsk, USSR

L.D. KIRGETOVA

The Centre for the Scientific Organisation of Labour and Industry Management, Moscow, USSR

Improvements in pig transportation and in transport means, i.e. containerized delivery of large groups of pigs from big feedlots to meat packing plants, determine changes in some processing operations and in the traditional practices of pigs loading, transportation, unloading and pre-slaughter maintenance.

Pig transportation in containers, mechanized loading and unloading with lifting devices allow to cut carcass trimming extent due to fewer bruises and bites and thus to raise carcass yield by 0,03%; to upgrade wet-salted raw leathers due to a 10-11% decrease of defects on the hides of live pigs; to save manual labour at all the stages of pigs transportation and pre-slaughter maintenance due to the elimination of pig overlanding. A new technology of pigs delivery is suggested which eliminates mixing of animals from different lots, which is typical of the existing practice involving much low-efficient manual handling.

1.07

Influence of different transport times on the meat quality of pigs of known pedigree

PATRICIA ANNE BARTON, HANS BUSK and O.K. PEDERSEN

Danish Meat Research Institute, Roskilde, Denmark

All pigs to be tested for meat quality are subjected to a short considerate pre-slaughter treatment in Denmark. This treatment is essential if the pigs are to show their true genetic predisposition for meat quality. The aim of this experiment was to see if it was possible to transport progeny-/sib-testing pigs up to 80 minutes without affecting meat quality to any great extent. If this was the case then slaughter could be concentrated on fewer abattoirs and the increasing problems in maintaining the standardised treatment for all pigs could be minimised.

The experimental material consisted of 468 Danish Landrace pigs from one producer. The pigs, which were progeny after three boars, were transported for 30, 55 or 80 minutes, and all other details of the pre-slaughter treatment were as for the standardised procedure.

The results showed clearly that transport time affected meat quality. The incidence of PSE-meat was highest with 30 minutes transport and lowest with 80 minutes transport. Moreover, progeny from the three boars reacted differently, the progeny of one being more or less unaffected by transport, while progeny from the others were greatly affected by transport. All in all the results showed that in progeny testing the most reliable meat quality values were obtained with 30 minutes transport, so that increasing the transport up to 80 minutes could not be recommended.

1.08

Transportation and pre-slaughter stress in animals and the quality of meat

N. NESTOROV

Meat Technology Research Institute, Sofia, Bulgaria

The paper discusses the results obtained on the quality of meat, in experiments with cattle, pigs and poultry transported to slaughter-houses. It was found that, depending on transportation distances, the levels of blood ACTH, 17-OHCS, and free fatty acids are affected, as well as glycogen level in muscles and liver. Muscle tissue pH-value is higher (6,92-7,05), compared to control animals (6,42-6,48). The preliminary feeding of glucose (15 mg/kg of live weight) to poultry prevents the decrease of muscle glycogen level upon transportation.

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Studies on Slaughtering Procedures in Sheep

N.G. GREGORY and S.B. WOTTON

Animal Physiology Division, ARC Meat Research Institute, Langford, Bristol BS18 7DY, UK

The effectiveness of stunning at slaughter depends on two interdependent factors:-

- 1) The duration of anaesthesia induced by the stunning procedure;
- 2) The length of time anaesthesia has to last before the animal dies from loss of blood.

Preliminary results from a survey show that the interval between stunning and sticking for over 10,000 sheep at 33 abattoirs in England and Wales was 22 seconds (± 12 SD). In a separate study on eighteen sheep, the average interval between sticking and loss of brain responsiveness, determined from evoked electrocortical responses, was found to be 14 seconds (± 4 SD). On average, therefore, the required duration of anaesthesia following stunning is 36 seconds. The duration of anaesthesia achieved with electrical stunning is being assessed using averaged evoked electrical responses in the brain.

Combined Effects of Electrical Stunning and Stimulation on Post Mortem Glycolysis in Lambs.

G.V. PETERSEN and D.K. BLACKMORE

Department of Veterinary Pathology and Public Health, Massey University, New Zealand.

In New Zealand, sheep are stunned prior to slaughter by electrical methods whereas it is customary in many other countries to use stunning with a captive bolt. The present studies were undertaken to evaluate the effects of such methods of stunning on the muscular activity of lambs during slaughter and the subsequent effect on the extent and rate of post mortem decline on pH in *M. longissimus dorsi*.

All the studies were carried out at meat export works where groups of lambs originating from the same farm were subjected to different methods of stunning and slaughter. Muscular activity of animals was recorded by observers and pH was measured at various time intervals either by direct probe methods or using a plug sample technique.

Two methods of electrical stunning were studied and both caused tonic contraction of all skeletal muscles for about 25 seconds, whereas stunning with a captive bolt only caused tonic spasms for 15 seconds and lambs slaughtered without prior stunning only exhibited spasmodic clonic contractions. It was found that lambs stunned by an electrical "head-to-leg" method had significantly lower initial pH values as compared to animals stunned by an electrical "head-only" method, a captive bolt or slaughtered without any form of prior stunning. When electrical "head-to-leg" stunning was combined with low voltage electrical stimulation during the slaughter and bleeding process, the mean pH values declined to approximately 6.0 within two hours of slaughter. The relative merits of using such stunning and stimulation methods in the meat industry are discussed.

Rectal Electrical stimulation of bull carcasses.

B. BUTS, E. CLAEYS and D. DEMEYER

Laboratorium voor Voeding en Hygiëne, state University of Ghent, Ghent, Belgium.

Sixty three bulls were slaughtered in the slaughterhouse of our laboratory. Immediately after bleeding, thirty two of them were electrically stimulated with the rectal "Tender Pulse" stimulation apparatus (B.M. & B.D. Vidler, Australia). After dressing and splitting the carcass sides were chilled in a 4°C cooler and ribbed between 21 and 24 hours post mortem (P.M.). The Longissimus dorsi (8th thoracic rib) was removed, vacuum packed and stored at 4° C until 8 days P.M. and then evaluated for drip, cooking-loss, Warner-Bratzler peak shear force and Laser sarcomere length.

Electrical stimulation (E.S.) increased the temperature of the semitendinosus with 1°C, 45 minutes P.M. (p < 0.001) but did not significantly alter the temperature of the Longissimus dorsi and Triceps brachii. ES lowered the time to reach pH 6.00 with 2.43 hours (p < 0.001) in the semitendinosus and 0.8 hours (p < 0.05) in the longissimus dorsi but

did not accelerate the rate of pH decline in the Triceps brachii.

Rectal E.S. did not significantly change peak shear force, sarcomere length, drip or cooking loss of the Longissimus dorsi (8th thoracic rib). The effects observed on muscle temperature and pH indicate that the effect of rectal E.S. decreases as the distance of the muscle from the rectum increases.

1.12

Electrical stimulation of mature cow carcasses and its effect on myofibrillar fragmentation, protein degradation and tenderness.

E.B. SONAIYA

Department of Animal Science, University of Ife, Ile-Ife, Nigeria

The effect of electrical stimulation on myofibril fragmentation index (MFI) and the time of appearance of the 30,000 Dalton protein was studied in the semi membranous, longissimus dorsi and triceps brachii muscles of mature cow carcasses. Only one side of each carcass was stimulated (300 V. a.c, 60Hz for 120 sec). In each muscle, temperature, pH and MFI were measured and SDS - polyacrylamide gel electrophoresis on 7.5% acrylamide gels performed on samples taken at 0, 3, 6, 24, 72 and 168 hours post stimulation (PS). Steaks for shear test were taken at 24, 72 and 168 hours PS only. MFI was higher in stimulated muscles and further increased significantly ($P < 0.01$) with aging. Electrical stimulation also produced lower pH and higher temperature in muscles and lower shear force in cooked steaks, as compared with the control. In general, the time of appearance of the 30,000 protein on acrylamide gels was not affected by electrical stimulation. Differences between treatments and between muscles within the same treatment were studied. The implications of these results on the mechanism of the tenderizing effect of electrical stimulation is discussed.

1.13

The biochemical and quality characteristics of ovine muscle as affected by electrical stimulation and mode of chilling

N.H. RASHID, R.L. HENRICKSON, A. ASGHAR and P.L. CLAYPOOL
Oklahoma Agricultural Experiment Station
Oklahoma State University, Stillwater, OK 74078

The combined effect of electrical stimulation and carcass holding temperature was evaluated on some biochemical and quality characteristics of ovine muscles. Twelve Suffolk wether lambs were slaughtered, dressed split into sides. Twenty-four sides were randomly assigned to 4 treatments using a balanced incomplete block design, block size 2. Electrical stimulation was performed within 15 minutes post-mortem using a direct current with a square wave pulse (350) voltage, 10 pulse per second, and 20% duty cycle) for 4 minutes. The stimulated sides whether chilled rapidly (subjecting the carcass sides to 2°C soon after stimulation) or slow chilled (holding the carcass sides for 5 hr at 16°C) showed a significant ($P .05$) faster decline in pH of longissimus dorsi (LD) than the respective controls. The sides which were electrically stimulated and slowly chilled exhibited more rapid pH fall, less cold shortening and greater tenderness (reduced shear force value) than those which were electrically stimulated and rapidly chilled. On the other hand, post-mortem pH fall of the control sides was identical whether they were slow or rapidly chilled. However, the extent of shortening due to slow or rapid chilling of isolated semitendinosus (ST) strips from electrically stimulated sides was identical, whereas the ST strips from the control sides did significantly shorten more on rapid chilling than on slow chilling than on slow chilling ($P .05$). However, the shear force value of electrically stimulated ST was significantly less in the case of slow chilling than in rapid chilling whereas intact LD muscles did not show such differences in shear value with respect to mode of chilling. The differences in cooking loss among the four treatments was not significant for both ST and LD muscles. None of the treatments had any effect on lean color of the LD muscle as measured by Hunterlab L, a, b values and a/b color ratio during a 4-day retail display. Also, no significant effect was apparent for any treatment on the different protein fractions (sarcolemmal, myofibrillar, acid soluble collagen and acid insoluble collagen) as well as the swelling factor of the stroma protein of LD muscles.

1.14

The Electrical Stimulation of Lamb Carcasses.

S. GEORGAKIS, E. KALDRIMIDOU, K. VARELTZIS, E. AGAKIDOU and T. TSAGARIS.

Department of Technology of Food of Animal Origin and Department of Pathology, College of Veterinary Medicine, University of Thessaloniki, Greece.

In this study which constitutes continuation of other previous research, the morphological changes were studied which the electrical stimulation causes to the muscle of the sheep. The M. longissimus dorsi and M. semitendinosus were removed from the right sheep carcass half (30 min after slaughter) and they were electrically stimulated (ES) of 150 V for 55 sec ($I=23$ mA). The same muscles from the left sheep carcass half were served as a control sample.

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On all samples (treated samples and control samples) the following determinations were performed:

- a. Measurement of pH (10 min, 1st, 2nd and 5th day after the ES).
- b. GDF value, Water Holding Capacity (WHC), the lactic acid and the total creatinine determination (1st, 2nd and 5th day after the ES).
- c. The samples which were taken at 1st, 6th and 24th hour after slaughter were inspected under the light and the electron microscope.

From the results, one can provisionally conclude that there were differences between treated samples and control samples.

It was observed with a light microscope a lack of uniformity contraction in the myofibrils with alternating areas thickening and sparsing of muscle fiber. Furthermore, an oedema pyknotic nuclei and disruption of muscle fiber were observed.

It was observed with electron microscope that the lack of uniformity thickening and sparsing of muscle fiber, can be caused by intense contraction of the sarcomeres of the myofibrils in certain areas which are alternated with other areas in which contraction is less or absent.

The dilation of the sarcoplasmic reticulum and the abnormality of mitochondria, the rupture of the myofibrils and the changes in the nucleus appear to be more intense to the treated samples than the control samples and these seem to have a more rapid development.

1.15

The Effect of Electrical Stimulation and Hot Boning on Veal Quality

F.J.M. SMULDERS^v, G. EIKELENBOOM^Δ, and J.G. VAN LOGTESTIJN^v

^v Department of the Science of Food of Animal Origin, Faculty of Veterinary Medicine, the University of Utrecht, the Netherlands

^Δ Research Institute for Animal Husbandry "Schoonoord", Zeist, the Netherlands

In two experiments involving 2 x 20 calves, carcasses were either stimulated electrically (ES, 300 V, intermittent pulses during 1½ min., n=2x10) or served as non-stimulated controls (NS, n=2x10). Stimulation resulted in a significantly more rapid pH-fall during the first 8 hours p.m. both in longissimus and semimembranosus muscle. At 1 hour p.m. carcasses were conveyed through blastchillers for 1½ hour and subsequently stored at 2°C. At 8 hours p.m. mean temperatures of longissimus and semimembranosus muscle at 4 cm depth were 12°C and 14°C respectively. From the righthand carcassides longissimus samples with a temperature of approximately 25°C were excised 3-3½ hours p.m. (HB=hot boned), vacuum packed and immersed in icewater for 5 hours in order to provoke cold shortening. After 24 hours of storage at 2°C similar samples were taken from the lefthand carcassides (CB=cold boned) and vacuum packed.

At 6 days of storage at 2°C ES(HB+CB) samples showed longer sarcomeres, higher drip, and cooking losses, a brighter colour, lower maximum shear force values and better ranking and scoring in tastepanel preferencetests as compared with NS(HB+CB) samples. Comparing HB(ES+NS), and CB(ES+NS) samples, hot boned samples showed shorter sarcomeres, higher drip, and cooking losses, a less bright colour and higher maximum shear force values.

Our results indicate hot boning in combination with extremely fast chilling to have an adverse effect on waterbinding which may possibly be due to the state of muscular contraction.

1.16

The Effect of Electrical Stimulation and Hot Boning on Veal Quality

F.J.M. SMULDERS^v, G. EIKELENBOOM^Δ, and J.G. VAN LOGTESTIJN^v

^v Department of the Science of Food of Animal Origin, faculty of Veterinary Medicine, the University of Utrecht the Netherlands

^Δ Research Institute for Animal Husbandry "Schoonoord", Zeist, the Netherlands

In two experiments involving 2 x 20 calves, carcasses were either stimulated electrically (ES, 300V, intermittent pulses during 1½ min., n=2x10) or served as non stimulated controls (C, n=2x10). Stimulation resulted in a significantly more rapid pH-fall during the first 8 hours post mortem (p.m.) both in longissimus and semimembranosus muscle. At 1 hour p.m. carcasses were conveyed through blastchillers for 1½ hours and subsequently stored at 2°C. At 8 hours p.m. mean temperatures of longissimus and semimembranosus muscle at 4 cm depth were 12°C and 14°C respectively. From the righthand carcassides longissimus samples with a temperature of approximately 25°C were excised

3-3½ hours p.m. (HB+hot boned), vacuum packed and immersed in ice water for 5 hours in order to provoke cold shortening. After 24 hours of storage at 2°C similar samples were taken from the lefthand carcass sides (CB=cold boned) and vacuum packed.

At 6 days of storage at 2°C ES(HB+CB) samples showed longer sarcomeres, higher drip, and cooking losses, a brighter colour, lower maximum shear force values and better ranking and scoring in taste panel preference tests as compared with C(HB+CB) samples. Comparing HB(ES+C) and CB(ES+C) samples, hot boned samples showed shorter sarcomeres, lower cooking losses, a less bright colour and higher maximum shear force values.

Our results indicate that cold shortening may occur sooner than is generally anticipated and that this may partly mask potential advantageous effects of hot boning on drip loss.

1.17

The Effect of Electrical Stimulation on Veal Quality

G. EIKELENBOOM* and F.J.M. SMULDERS**

* Research Institute for Animal Husbandry "Schoonoord", Dribergseweg 10 D, Zeist, The Netherlands.

** Department of the Science of Food of Animal Origin, Section Hygiene, Faculty of Veterinary Medicine, The University of Utrecht, The Netherlands.

In three experiments, involving a total of 88 veal calves raised in groups and with access to straw, plasma haemoglobin (Hb)-levels were determined at one week ante mortem. In each experiment animals were paired for Hb-levels and within each pair randomly assigned to electrical stimulation (ES; 70 V, 14 Hz, 1 min) at 5-10 min post mortem or control (C) treatment.

ES resulted in a more rapid pH-fall in longissimus (rib) and semimembranosus (round) muscle. Carcass lean colour scores were improved at 24 hrs, but not at 40 min post mortem.

At 24 hrs post mortem samples of longissimus muscle were removed from each carcass at the 5th-8th rib. Samples from ES carcasses showed a brighter colour, lower sarcomere length and lower protein solubility. No significant differences were observed in total haem-pigment.

After vacuum storage at 2°C for 6 days, samples from ES carcasses had a brighter colour, higher drip and cooking loss, lower maximum shear force values and better ranking and scoring in taste panel preference tests as compared with C samples.

The data indicate that a certain degree of denaturation of the sarcoplasmic proteins may be responsible for the observed effects of ES on muscle colour and waterbinding, while the improvement of tenderness in the present experiment was due to the preventive action of the treatment on the occurrence of cold shortening.

It is suggested that ES may possibly contribute to the introduction in practice of alternative veal production methods, from the animal welfare point of view.

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2.

POST-MORTEN BIOCHEMISTRY

Studies of sarcoplasmic proteins by sodium dodecyl sulphate polyacrylamide gel electrophoresis.

MICHAEL G. HARRINGTON and MARGARET M. HENAHAN.

Department of Biochemistry, University College, Belfield, Dublin 4, Ireland.

Ground meat has been found to develop characteristic off-flavours during long term frozen storage. A possible source of these off-flavours is the products of the proteolytic degradation of muscle protein. Sarcoplasmic proteins undergo extensive proteolysis during normal conditioning and considerable proteolysis even during frozen storage, while the proteolysis of myofibrillar and connective tissue proteins is relatively minor. The changes in protein patterns obtained in sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE) of sarcoplasmic extracts have been investigated.

A high molecular weight component (>125,000 daltons) of sarcoplasmic protein extracts of pre-rigor bovine psoas muscle is not detectable in extracts of post-rigor meat nor from meat frozen pre-rigor.

At least four new bands appear in the gels of extracts of post-rigor meat. These were also detected in extracts from meat frozen pre-rigor.

Changes in intensity of specific bands suggest a complex progression of proteolytic events.

2.02

M. BOCCIGNONE, L. DAMASIO and C. SARRA

Centro di Studio per l'Alimentazione degli Animali in Produzione Zootecnica - C.N.R. - Torino - Italy.

Influence of age on total lipids and phospholipids in turkey meat.

Breast and leg muscles of 18 and 23 weeks old turkeys have been examined. Fatty acids of phospholipids and triglycerides and free fatty acids (FFA) have been determined by means of GLC.

A statistical analysis was developed to determine the significant differences.

The results allow to draw the following conclusions:

- in breast muscles total phospholipids decrease with age. A greater number of statistically significant variations was observed among the phospholipid fatty acids in comparison with those of triglycerides and FFA;
- in leg muscles total phospholipids show a more marked decrease with age. A greater number of statistically significant variations was observed among the triglycerides fatty acids in comparison with those of phospholipids and FFA.

2.03

Glycogen depletion and recovery in skeletal muscle fiber types of young bulls, after subcutaneous injection of adrenaline.

A. LACOURT and P.V. TARRANT*

Station de Recherches sur la Viande INRA THEIX 63110 BEAUMONT FRANCE
* Meat Research Department, An Foras Taluntais, Dunsinea Catleknok, Co Dublin Ireland

The response of three major fibre types in beef *M. Longissimus dorsi* during stress and recovery was examined with respect to cellular glycogen content. The cattle used was eight 12 month old Friesian bulls. Stress was induced by two successive subcutaneous injections of adrenaline, at a total dosage of 0.26 mg of adrenaline per kilogram liveweight. This treatment resulted in significant increases in heart rate and rectal temperature. The glycogen concentration of *M. Longissimus dorsi* fell to 37 % of the resting concentration during the stress period after the first injection of adrenaline. Muscle glycogen concentration returned to 73 % of resting value during a three day recovery period. Statistically significant differences were observed during stress between the SO fibre type (slow-oxidative) and the FG and FOG fibre types (fast-glycolytic) for percent glycogen intermediate fibers ($P < 0.001$) and percent glycogen negative fibers ($P < 0.01$). On the first day of recovery, only SO fibres continued to lose glycogen. On the third day of recovery all fiber types displayed glycogen contents partially similar to resting muscle.

Some observations on the giant fiber's distribution in bovine muscles.

RANTSIÖS, A.T., P.B. PAPAVALIIOU

Hellenic Army Biological Research Center.

In the Longissimus dorsi and Trapezius muscles of 17 Friesean steers, the number of giant fibers was counted, during meat preservation, for six days, in +1°C and +17°C.

The effect of muscle, preservation time and temperature as well as the combinations of factors, muscle X preservation time, muscle X preservation temperature, preservation temperature X preservation time, muscle X preservation temperature X preservation time, on the number of giant fibers by means of factorial analysis of variance was determined.

It appeared that only muscle influences significantly ($P > 0.01$) the number of giant fibers.

The number of giant fibers does not change significantly in Longissimus dorsi muscle during meat preservation for six days, while in Trapezius muscle a significant increase was evident between 5th and 28th hour after slaughtering.

The Influence of Temperature on Shortening and Rigor Onset in Beef Muscle

P. RONCALES, K.O. HONIKEL and R. HAMM

Federal Centre for Meat Research, Kulmbach (German Federal Republic)

At sufficient ATP concentrations and temperatures below about 15°C prerigor beef muscles (neck muscles) contract; this phenomena is known as cold shortening. There is also a contraction at higher temperatures occurring just before rigor onset which is called rigor shortening. While rigor shortening starts in neck muscles at pH around 6.3 - 6.0 and at about 2 μ Mol ATP/g muscle, cold shortening can begin at pH around 7.0 and the full ATP concentration (4 μ Mol ATP/g) in the muscle. Shortening can take place as long as there is no irreversible formation of the actomyosin complex in the muscle i.e. before rigor onset occurs, which can be measured by putting a load on and off a muscle in intervals. The degree of extensibility followed thereby starts to decrease at the moment of rigor onset. This irreversible loss of extensibility at temperatures between the freezing point (-1°C) and physiological temperatures (38°C) starts at various pH values and ATP concentrations in the muscle. At 38°C the rigor onset occurs at pH 6.15 and about 2 μ Mol ATP/g muscle, dropping at 15°C to pH 5.75 and 1 μ Mol ATP/g muscle. At 0°C as at all temperatures below 10°C the loss of extensibility at medium loads (about 250 g/cm²) begins shortly after cold shortening. This loss of extensibility is reversible by higher loads or rising the temperature. The irreversible loss or rigor onset, however, occurs at 0°C with pH of 6.1 - 6.2 and 1.8 - 2.0 μ Mol ATP/g muscle. Thus the onset of rigor is influenced by more than one factor. Temperature, pH and ATP concentration play a role in this case.

Total loss of extensibility or completion of rigor is reached between 10°C and 38°C at pH 5.5 - 5.6 and less than 0.5 μ Mol ATP/g muscle. At 0°C the completion of rigor takes place at pH 6.0, but still at 0.5 μ Mol ATP/g muscle. The latter fact shows that the completion of rigor is solely dependent on the ATP concentration in the muscle, whereas the pH increases at least in the extreme cold shortening range. This is apparently due to a different pH/ATP relationship in muscles at low temperatures.

The results are important for the handling of hot boned meat for both the cooling of prerigor muscle and the use of hot boned meat for processing.

Appearance of PSE and DFD muscles in pigs fattened according to a "Tropik" system

B. DZIERZYŃSKA-CYBULKO*, E. POSPIECH*, H. GAJEWSKA-SZCZERBAL*, K. DOLATA*,
J. DOMAŃSKI**, A. SOSNICKI**.

* Institut of Animal Products Technology of Agriculture University,
Poznań, Poland

** Department of Meat Quality Evaluation of Agriculture University, Poznań, Poland.

Investigation was carried out on 2276 pigs, fleshy type, fattened in a "Tropic" system. Animals were fed with whey served "ad libitum" with the addition of protein fodder ranging from 0.5 to 1.5 kg per pig depending on the stage of fattening. Inside temperature of the pigsty was between 25 and 30°C and the relative humidity from 60 to 100%.

Animals were slaughtered at the preslaughter weight of 90 to 100 kg each. Duration of the fattening was ca 120 days.

Longissimus dorsi muscle was examined twice i.e. directly after- and 24 hours after slaughter. Changes in the pH level (i.e. pH₁ and pH₂), the level of glycogen, lactic acid, the ratio of IMP to ATP nucleotides as well as the colour and water-holding capacity of the muscle tissue were determined.

Percentages of pigs which displayed PSE and DFD muscles after slaughter were 31,33% and 2,20% respectively, which means that over half pigs produced meat of good quality.

On the basis of post slaughter changes and other physico-chemical properties meat quality of the examined pigs can be evaluated, from the point of view of its technological usefulness, between the quality of meat from individual farmers and that of big industrial producers.

2.07

The significance of the stress-susceptibility and quantity of pig muscles for PSE and DFD conditions in pork

J. SCHEPER

Federal Centre for Meat Research, Institute for Meat Production and Marketing, D-8650 Kulmbach,
Fed. Rep. of Germany

Examined were 1629 pigs of the Deutsche Landrasse (DL) (German Landrace) of which 60,0 % reacted positively (H⁺) at the halothane-test (4 % halothane, 96 % oxygen) and 112 halothane-positive pigs of the good muscling breed Pietrain (Pi), and Belgian Landrace (LB) concerning the influence of stress-susceptibility and lean mass on the meat quality.

The data of the fattening performance (Progeny Testing Station Conditions) have been considered at the evaluation. The carcass grading was based on the loin eye area, fat thickness and meat/fat ratio. Determined were the pH-value, the R-value, the rigor-value, the Göfo-value (color lightness), the liquid area (water-binding-capacity) and the meat area of the pressed sample (consistency) on the slaughter-warm half carcass (45 min p.m.) and/or on the chilled half carcass (ca. 22 hours p.m.) in order to evaluate the meat quality.

The data of the meat quality revealed no difference in the stress-susceptible pigs (H⁺) of the breeds DL and Pi/LB. All characteristics showed distinctively poorer values of the halothane-positive pigs, which is a hint to PSE-conditions, than in the stress-resistant DL-breed. The lower dispersion of the halothane-positive animals is caused by the poor meat quality in the whole musculature. This leads to the conclusion that hardly a good meat quality can be expected at halothane-positive pigs under normal conditions at transport and slaughter. Even at the stress-resistant pigs (H⁻) with extremely lean mass is the meat quality poor, i. e. maximum demands of the lean mass at selection for good muscling type pigs can not be combined with the high demands of meat quality.

After slaughter myofibrillar ATP-ase activity in PSE and DFD pig muscles

E. POSPIECH

Institut of Animal Products Technology, Agriculture University, Poznań, Poland.

The aim of this experiment was to compare myofibrillar ATP-ase activity of muscles with normal, watery (PSE) and dark (DFD) qualities.

Muscles were classified on the basis of pH_1 and pH_2 values measured 45 minutes and 24 hours after slaughter respectively. At those two moments levels of glycogen and lactic acid were determined in the muscle tissue. The colour of muscles was also estimated additionally, immediately after slaughter, and the level of free water content was determined next day, after carcasses had been cooled. The activity of the myofibrillar ATP-ase was determined directly after the slaughter.

From the total of 98 pigs 30 had the muscle of normal quality, 56 showed wateriness while 6 exhibited meat typical of DFD. In the latter type of meat ATP-ase was found to be most active, while in watery muscles its activity was the lowest.

Values of pH_1 and pH_2 followed the same pattern as well as scores given to them for the colour.

At the same time a new group of muscles with different characteristics was observed. There were muscles with the highest ATP-ase myofibrillar activity and other features close to the DFD type, while the content of glycogen in them was the highest among all groups of investigated muscles.

2.09

Significance of pH_1 and early rigor for prediction of pork meat quality

M. VADA-KOVÁCS, A. CSIBA, A. NAGY-NÉMETH and J. SÁSKA[‡]

Hungarian Meat Research Institute, Budapest, Hungary

[‡] Meat Packaging Plant, Budapest, Hungary

Analysis of discriminance has been performed with pH_1 , pH_{ult} , R_1 /p.m. 1 hr/ and rigidity observed in slaughter line within DFD semimembranosus samples / $pH_{ult} \geq 5.8$ /. It was found that pH_1 can predict DFD character of pork, provided that rigidity occurred, since pH_1 can be considered as ultimate pH in the case of early rigor. In the rigid DFD group /n= 40/ higher R_1 values and lower pH_1 as well as pH_{ult} values were found as compared to non-rigid DFD group where the pH slowly reduced. The group of rigid samples with low pH_1 / < 5.8/ showed both normal and PSE appearance at 24 hrs p.m. At that time the surface color /Lovibond Tintometer/, turbidity of sarcoplasmic protein extract and cooking loss /uncured samples/ were determined of both normal with high pH_1 and normal with low pH_1 samples. The major part of samples in the latter group tended to show poor quality.

2.10

DFD incidence in Swedish cattle

S. FABIANSOON¹⁾, I. ERICHSEN¹⁾, A. LASER REUTERSWÄRD¹⁾, G. MALMFORS²⁾

1) Swedish Meat Research Institute, P.O.B. 504, S-244 00 Kävlinge, Sweden

2) Dept Animal Breeding and Genetics, Swedish University of Agricultural Sciences, S-750 07 Uppsala, Sweden

The incidence of DFD in Swedish cattle was studied. The influence of some parameters of special interest for the development of DFD were evaluated. The pH was measured 24 hours after slaughter in *M. longissimus dorsi* and *M. semimembranosus* in totally 2,686 carcasses. Muscles with a $pH_{24} > 6.2$ were classified as being DFD.

DFD incidences of 3.4% and 13.2% were recorded in *M. longissimus dorsi* for electrically stimulated and nonstimulated carcasses, respectively. The corresponding values for *M. semimembranosus* were 2.3% and 5.4%. Only for electrically stimulated carcasses the pH_{24} values could be considered as being the ultimate pH values. This could explain the different figures in electrically stimulated and nonstimulated carcasses.

Significant pH differences were found between young bull carcasses and all other animal categories with the former having almost a twice as high incidence of DFD. Results also showed seasonal differences in the incidence of DFD with the highest numbers found in May. With overnight lairage times the DFD incidence increased substantially.

2.11

Effect of pre-slaughter handling of young bulls on dark cutting /DC/ character in various muscles

MÁRIA VADA, ENDRE SZÚCS* and ANDRÁS CSIBA

Hungarian Meat Research Institute, Budapest,

*Research Centre for Animal Production and Nutrition, Gödöllő, Hungary

13 young bulls held tied in the farm were transported on lorry from 100 km distance then slaughtered without resting. Slaughter of the whole group required appr. 2.5 hr. Ultimate pH was measured in 10 muscles /hind quarter and forequarter/. It was found that in muscles of animals which were waiting untied until slaughtered showed DC character. As the time advanced /after 1 hr of waiting/ the extent and intensity of DC character increased. *M. longissimus dorsi*, *m. adductor* and *m. semitendinosus* proved to be the most sensitive to DC. When young bulls /16 animals also held tied in farm/ were slaughtered after a rest of 2 days /tied/, fewer carcasses were found DC. However, not only the most sensitive muscles but majority of muscles tested were involved.

The topography of pH_{48} value in the carcasses of normal and DCB-beef cattle

2.12

MORGENTHALER, M., HARDER, M. and PRABUCKI, A.L.

Institute for Animal Production, Swiss Federal Institute of Technology, Zurich (Switzerland)

Dark-cutting in beef has economic consequences for both producers and consumer. For the butcher it is necessary to identify dark-cutting carcasses efficiently. At present the best method for identification is the measurement of pH_{48} value by direct insertion of a combined electrode into the meat. In addition it's of practical interest to know which cuts are most liable to be affected.

The aim of this investigation was to study the intra- and intermuscular differences of pH_{48} value in normal and dark-cutting carcasses with the intention to formulate recommendations for representative locations and necessary number of measurements.

The pH value was measured in more than 20 fore- and hindquarter muscles in the halves of more than 60 bull carcasses. According to the pH_{48} value in *M. long. dorsi* (10th/11th rib) carcasses could be assigned to different condition classes.

With one exception, the mean pH_{48} value of each muscle in class I (pH *M. long. dorsi* ≤ 5.60) was clearly less than pH 6.0. These results contrast with those found in pig carcasses. The muscles *M. semimembranosus*, *M. gluteus medius*, *M. long. dorsi*, *M. semitendinosus* and *M. biceps femoris* (portio cranialis) showed the lowest values (≤ 5.51) with the smallest standard deviations (≤ 0.054). There was a distinction in colour and pH_{48} value along the muscle in *M. rectus femoris*.

The data from this study further substantiates that a direct relationship between low pH_{48} value in *M. long. dorsi* and normal meat properties in the whole carcass does not exist. An insufficient acidification was found in some muscles (e.g. *M. psoas major*) or groups of muscles, not only in class I (≤ 5.60) but also in class II (5.61 - 5.90). On the other hand carcasses were found with dark-cutting properties only in *M. long. dorsi*.

It was demonstrated, that variations within a certain muscle of the same carcass become greater, if pH_{48} value is above its average. In this case additional measurements are recommended.

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Sensory properties of DFD beef and normal beef as related to thermal denaturation of meat proteins

EVA STABURSVIK and MAGNI MARTENS

Norwegian Food Research Institute, P.O.Box 50, N-1432 Ås-NLH, Norway

Texture changes in meat during heating are closely related to denaturation of myofibrillar proteins and connective tissue collagen.

Differential scanning calorimetry offers a method for studying denaturation of proteins in muscle tissue *in situ*. Denaturation of myosin, collagen and actin is known to occur in the region of 40-60°C, 55-63°C and 65-73°C, respectively. Denaturation of myosin is strongly dependent upon muscle pH, in contrast to collagen and actin denaturation. DFD muscle proteins were found to denature within the same temperature ranges as normal beef, but the denaturation thermogram was different for DFD myosin.

DFD beef became more tender than normal beef during heating, especially above 60°C. This difference seems mainly to be due to a less pronounced hardening effect caused by denaturation of myosin and actin in DFD beef, as compared to the effect observed for normal beef.

The juiciness of DFD beef was low and largely unaffected by temperature. In contrast, the relatively high initial juiciness of normal beef was reduced above 65°C, presumably due to actin denaturation. Thus, above 75°C DFD beef was found to be more juicy than normal beef.

The intensity of meat flavour, which is a property not directly related to denaturation of meat proteins, was judged considerably lower in DFD beef than in normal beef, but the intensity of meat flavour increased at higher temperatures in both types of beef. At 85°C the meat flavour of DFD beef had improved to such an extent that DFD beef had the same total preference among the judges as normal beef. The latter still had a stronger meat flavour, but was dryer and considerably tougher after being treated at this temperature.

A final temperature of 60-65°C for the heat treatment of normal beef and 85°C for DFD beef is recommended with respect to obtaining optimal sensory quality.

2.14

Variation of ultimate pH and residual glucose in aged beef.

J. BOUSSET

Laboratoire de Recherches sur la viande de l'I.N.R.A., C.N.R.Z., 78350 Jouy en Josas, France

pH and residual glucose have been measured after aging in 19 muscles of 7 beef carcasses. The lowest value for pH (5.58) was found in one Semimembranosus muscle and the highest value in one Tensor fasciae latae muscle. The lowest value for glucose (7 mg/100 g of fresh tissue) was found in the same Tensor fasciae latae and the highest value (367 mg/100 g fresh tissue) in one Semitendinosus muscle.

pH (y) was related to residual glucose (x, in mg/100 g fresh tissue) according the following equation :

$$y = 7.0 - 0.5 \log x, \text{ with } r^2 = 0.62, n = 133.$$

Intra-animal, despite large individual variations, the same general relation was found with similar coefficients. The amount of residual glucose was very depending on each individual animal but also on the type of muscle.

Estimation of residual glucose from pH measurements was not satisfactory, mainly below pH = 6.00. This limits the practical use of pH value as criteria of keeping quality of meat. The relationships between pH, glucose and metabolic types of muscle fibres are discussed.

2.15

A new basis for meat tenderness in terms of gap filaments

R. H. LOCKER

Meat Industry Research Institute of New Zealand, P.O. Box 617, Hamilton, New Zealand.

Work on gap filaments and tenderness has now progressed to the point where it is possible to propose a new and comprehensive theory of meat tenderness which accounts for all the known modifiers of tenderness.

Raw meat in rigor responds to tensile stress by I-filaments tearing out of the Z-line, while gap filaments (G-filaments) and the collagen net stretch readily. Ageing causes both I- and G-filaments to snap together.

Cooking totally changes the role of the various filaments. At 60°C, A-filaments have disintegrated, while denatured G-filaments remain strong and elastic. The myofibrils are cooked but not the connective tissue. By 70°C, I-filaments have disintegrated, while connective tissue has been pre-tensioned and elasticised by thermal shrinkage. The meat as a whole is now cooked and consists essentially of elastic G-filaments (the only survivors in the myofibril) in parallel with elastic collagen fibres. Each contributes significantly to tensile strength, the proportions varying with the cut and its history. G-filaments resist cooking but are vulnerable to aging. Collagen resists aging but succumbs to long cooking.

Tenderisation due to aging is due to proteolytic attack on G-filaments where exposed in the I-band. Toughening by cold shortening is due to elimination of the I-band, a weak link with only half as many G-filaments as in the A-band. In such meat aging is blocked, since G-filaments are totally protected as cores within A-filaments. High-pressure treatment (60 MPa) at 60°C, which tenderises both normal and cold shortened meat, weakens the G-filaments.

It is acknowledged that this theory, based on tensile properties, has ignored lateral cohesion, which is significant for tenderness, particularly as assessed by molars. It must be noted that desmin, which binds myofibrils together is particularly vulnerable to aging, and so is adhesion between fibres. Yet in spite of such over-simplification, this theory, based on G-filaments, represents a significant advance in understanding the most valued property of meat.

REPORT OF THE COMMISSIONER OF THE BUREAU OF FISHERIES
ON THE PROGRESS OF THE BUREAU OF FISHERIES
DURING THE YEAR 1900

The biological work of the Bureau of Fisheries during the year 1900 was devoted to the study of the life history of the various fishes of the United States and to the study of the diseases of these fishes. The work was carried on in the various divisions of the Bureau, and the results are reported in the following pages.

CHILLING, FREEZING, TRANSPORTATION AND THAWING

The effect of chilling and freezing on the life of fishes is a subject of great importance to the fisherman and to the biologist. It is well known that fishes can be kept alive for a long time by chilling, and that they can be kept alive for a still longer time by freezing. The purpose of this report is to give a summary of the results of the work done in this field during the year 1900.

REPORT OF THE COMMISSIONER OF THE BUREAU OF FISHERIES
ON THE PROGRESS OF THE BUREAU OF FISHERIES
DURING THE YEAR 1900

LIPID FRACTION CHANGE OF BEEF MUSCULAR TISSUE DURING STORAGE

E.N.LAZAREV, V.A.GERASIMOVA, L.D.PATRAKOVA, V.N.SIMONOVA, N.A.ANTONOV

The Leningrad Institute of Soviet Trade by the name of F.Engels, USSR

The biological activity of phospholipids and hydrocarbons in the life-time processes and in the after-slaughter changes in meat is well known, as well as their participation in the taste and odour forming. Chilled beef stored at 0°C temperature during 15 days was studied. 8 lipid fractions has been identified with the help of TLC method (thin-layer chromatography). Phospholipids are found to contain lysolecithins, phosphatidylserines, phosphatidylcholines, phosphatidylethanolamines, sphingomyelins. The following fractions of hydrocarbons are revealed: n-alkanes together with cycloalkanes, n-alkenes, isoprenoids (squalen and its derivatives), carotenoids and other pigments. The quantitative decrease of phosphatidylethanolamines and phosphatidylcholines and their lysoforms accumulation in beef muscular tissue during cold storage are ascertained. Apparently, lysophospholipids increase the cell membrane penetrability and thereby contribute to the intensive interaction of cell ferments with albumens of the inter-cellular substance.

Mono- and dinuclear arenes that unfavourably influence the human organism are discovered. It must be a result of biochemical changes in meat during cold storage. The quantitative decrease of squalen that is the predecessor in the cholesterol biosynthesis is noted. Squalen is likely to change by the oxydation of unsaturated double bonds. Hence, it is ascertained that during cold storage of beef the quantitative and qualitative composition of phospholipids and hydrocarbons in muscular tissue change.

3.02

The Effect of Poliphosphates on Moisture Absorption and Retention on Broiler Carcasses.

M. CAMIRUAGA, P. SCHULTZ y E. SANHUEZA.

Departamento de Zootecnia, Facultad de Agronomía, Pontificia Universidad Católica de Chile, Santiago, Chile.

The effect of two poliphosphates on carcass moisture absorption and retention was studied.

Carcasses were immersed in either one of the two poliphosphates solution (4% v/v) for 5, 10 and 15 min. Each immersion time was completed to 30 min. in pure water at room temperature. Carcasses were then chilled 25 min. in ice-water and stored at 0°-2°C for 48 hrs. Quantity and quality of dripping water at different time intervals were measured during this period.

Water absorption was significantly higher with the shortest immersion time with both salts. Only the 5 min. treatment produced a significant superior water absorption over the control (pure water).

No clear salt effect on carcass water retentions was observed, but a positive correlation between water absorption and water loss ($r=0.97$) was obtained during storage. The highest dripping water loss were produced during the first 5 storage hours (65% of the total at 48 hrs.).

Finally an increment of dry matter and protein concentrations in dripping water with storage time, was observed.

3.03

Effects of low-dose irradiation and subsequent storage on the technological properties of beef

A. GROZDANOV, N. DIMITROVA, N. NESTOROV, N. DILOVA, G. DIKOVA

Meat Technology Research Institute, Sofia, Bulgaria

Both hot-boned and chilled semimembranosus muscles were used. After their excising from the carcasses, they were cut into two equal parts and packaged under vacuum. The first halves were subjected to irradiation with a dose of 3 kGy, while the second, control, halves were stored under refrigeration. The ambient temperature was maintained at 2 ± 0.5 °C during the subsequent storage.

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Changes in pH and R-values were employed to follow post-mortem glycolysis rate in both irradiated and control hot-boned muscles. Before and after storage, beef samples were tested for water-binding capacity, protein extractability, emulsifying capacity and gelling ability. Neither acceleration of post-mortem metabolism, nor a faster ATP hydrolysis were observed as a result of irradiation of hot-boned muscles. Little or no differences in respect to all technological characteristics were established between the irradiated and control samples before storage. After a 20-day storage period, the differences between the samples, subjected to the different treatments, were more obvious, although not significant between the chilled irradiated, and the control muscles. The irradiated, hot-boned muscles, however, were inferior to the non-irradiated controls in respect to all characteristics tested.

3.04

Change of activity of multiple forms of lipase in meat during storage

N.A.GOLOVKIN, R.P.IVANOVA, V.I.SHAROBAlKO

Leningrad Technological Institute of Refrigerating Industry, Leningrad, Lomonosov st., 9, USSR

Data on the change of activity and iso-enzymic spectrum of multiple forms of lipase in meat during cold storage under varying temperature conditions are presented in the paper. The activity level and the set of isoforms of lipase apparently indicate the damaging effect of low temperatures, thus objectively testifying the intense catabolism in meat during storage.

3.05

Studies On Goat Meat As Influenced By Storage

I- Alterations During Cold-Storage At Two Different Temperatures.

EL-KADY, S.A.; AMMAR, K.A.* and FAHMY, A.A.*

Department of Food Sci., Faculty of Agriculture, Mansoura Univ., Egypt.

*Department of Food Technology, Faculty of Agriculture, Kafr El-Sheikh, Tanta Univ., Egypt.

Goat meat was examined for physical, chemical, organoleptic and microbiological alterations during cold storage at +4°C and at -1°C for 28 days. Moisture, total nitrogen, total volatile nitrogen, fat, thiobarbituric acid value, pH value, water holding capacity, free amino acids, total bacterial count and organoleptic evaluation were determined. Goat meat survived cold storage for 14 days at -1°C and 7 days at +4°C without pronounced effect on its physical and chemical properties. Storage of goat meat at -1°C was particularly effective in reducing lipids oxidation and proteolysis. After 28 days storage at +4°C and -1°C thiobarbituric acid value increased by 11.3 and 5.5 times while total free amino acids increased by 5.0 and 3.3 times, respectively. After 28 days total bacterial count was higher by 565 and 223 times, respectively. Roasted samples of goat meat gave higher score as estimated organoleptically than boiled samples cooked at any given time. The bacterial decomposition of protein to free amino acids was higher during storage at +4°C than at -1°C.

3.06

Studies On Goat Meat As Influenced By Storage

II. Effect Of Pre-and Post-Rigor Freezing and Some Storage Variables On the Quality Of Meat.

FAHMY, A.A.; AMMAR, K.A. and EL-KADY, S.A.*

Department of Food Technology, Faculty of Agriculture, Kafr El-Sheikh, Tanta Univ., Egypt.

*Department of Food Sci., Faculty of Agriculture, Mansoura Univ., Egypt.

Goat meat was analyzed for the changes in moisture, fat, thiobarbituric acid value, total nitrogen, total volatile nitrogen, pH value, water holding capacity, drip loss and organoleptic properties during frozen storage for 90 days of pre-and post rigor samples. The results showed that moisture, fat, total nitrogen and pH value of all samples slightly decreased with increasing the storage period. Samples pre-cooled at +4°C and frozen stored at -10°C showed highest increase

in thiobarbituric acid values, while values for samples directly frozen at -25°C were lowest. Drip loss was markedly higher for pre-rigor than post rigor freezing samples. Total nitrogen content of separated drip increased with increasing storage period. Roasted samples were of better organoleptic properties than the boiled ones. Post-rigor freezing samples, previously cooled at $+4^{\circ}\text{C}$ were better, in their organoleptic properties, than meat pre-cooled at -1°C or pre-rigor freezing samples.

3.07

EFFECT OF FREEZING, FROZEN STORAGE, AND COOKING ON THE CHEMICAL CHANGES AND QUALITY CHARACTERISTICS OF LAMB MEAT. I - AMINO ACIDS AND QUALITY CHARACTERISTICS.

F.A. EL-WAKEIL, H.M. EL-BANNA, N. ABDALLAH AND S.B. EL-MAGOLI
Dept. of Food Sci. and Technol., College of Agric. Cairo Univ., Egypt.

Two muscles (L.D.) and B.F) of lamb were frozen and stored at -20°C for three months. Each month samples were cooked using two conventional methods, i.e., roasting and boiling. The amino acid content (both essential and non essential) and palatability characteristics were periodically determined. L.D. muscle was found to contain higher concentrations of histidine, valine, methionine and phenyl alanine and attained higher scores for cooking quality characteristics. A clear relationship was observed between the amino acid content and the quality characteristics of cooked lamb. For both muscles tested, the roasted meat had lower acceptability and lower amino acid content than the boiled meat.

3.08

EFFECT OF FREEZING, FROZEN STORAGE AND COOKING ON THE CHEMICAL CHANGES AND QUALITY CHARACTERISTICS OF LAMB MEAT. II. FATTY ACIDS, PHOSPHOLIPIDS, CHOLESTEROL AND CHOLESTEROL ESTERS.

SALWA B. EL-MAGOLI, F.A. EL-WAKEIL AND H.M. EL-BANNA.

DEPARTMENT OF FOOD SCIENCES AND TECHNOLOGY, COLLEGE OF AGRICULTURE, CAIRO UNIV., EGYPT.

Fatty acids, phospholipids, cholesterol, and cholesterol esters were fractionated from the lipid fraction of lamb meat. Meat samples (L.D. and B.F. muscles) were frozen, stored at -20°C for three months and were periodically analyzed every month after roasting and boiling. Lamb meat was characterized by a high percentage of unsaturated fatty acids. Oleic, Linoleic and palmitic acids were the most predominant fatty acids. However, the two muscles revealed different proportions. Frozen storage prior to cooking as well as the method of cooking both clearly affected the proportions of the unsaturated fatty acids. Moist heat (boiling) induced more pronounced changes than dry heat (roasting) especially in the ratios between the unsaturated and saturated ones. The phospholipids changed considerably during frozen storage and the changes were dependent on the time of storage, cooking method and the type of muscle. Cholesterol and cholesterol esters increased during frozen storage, but decreased during cooking, regardless of the type of heat used.

3.09

The effect of meat freezing on the water-binding capacity of cooked sausage

EERO PUOLANNE and EEVA KUKKONEN

University of Helsinki, Institute of Meat Technology
Viikki, 00710 Helsinki 71, SF-Finland

The effect of the method of freezing and melting meat was studied using the laboratory sausage method.

When added phosphate was used the rate of freezing and melting meat had no significant effect on the water-binding capacity of cooked sausage. Without added phosphate, however, the best result was obtained with meat frozen quickly with CO_2 and melted slowly at 4°C . The mincing and curing of meat before freezing had no marked influence on the water-binding capacity. Adding the drip fluid back to meat improved significantly the water-binding capacity of cooked sausage.

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TTT - the influence of packaging

LEIF BØGH-SØRENSEN

Royal Veterinary and Agricultural University, Copenhagen, Denmark.

Two TTT-PPP experiments were carried out.

1. For hamburgers in retail packages it was found that using vacuum packaging in a rather impermeable laminate the stability time increased with 200% at -10°C and with 75% at -18°C and -24°C . The improvement in acceptability time was less pronounced.

For retail packaged pork tenderloin the vacuum packaging resulted in smaller improvements in storage life.

2. For catering packages (a paperboard carton and a polyethylene (PE) pouch) with 20 pork chops the acceptability time was 3 months at -12°C , 7 months at -18°C and 9 months at -30°C . Replacing the polyethylene (PE) with a laminate with much lower oxygen permeability did only result in a minor improvement, probably due to air trapped in the pouch. By vacuum packaging an acceptability time of 10 months at -18°C could be achieved.

These experiments show that with regard to storage life it does not suffice to use packaging materials with low permeability. The mechanical properties of the packaging material may be equally or more important, and it should also fit tightly around the product.

3.11

Electrostimulation Influence upon changes of slightly frozen meat qualities according to data of functional-morphological research

N.A.GOLOVKIN, N.N.VOROBIEVA

Leningrad Technological Institute of Refrigerating Industry, Lomonosov street, 9, Leningrad, USSR

T.B.ZHURAVLYOVA, F.B.ERMAKOVA, G.B.KOVALSKI

The First Leningrad Medical Institute, Leo Tolstoy street, 6/8, Leningrad, USSR

On the grounds of histological and quantitative histochemical research (citospectrophotometry) the analysis of structural-functional criterions characterizing meat quality is given. Reliable increase of lysosomal ferments and anaerobic glycolysis ferments and structural transformations are found as well. Ripening process acceleration depending on the technological regimes taken is known.

3.12

Effects of processing of fresh beef on microwave treatment

R. Enamorado, D. Yubero, D. Gutiérrez, and R. Rodríguez y Col

Dep. I + D, Carcesa, Madrid, Spain

The present paper presents a comparative study of two industrial methods of beef processing, mincing and slicing. Levels of microbial contamination were routinely checked for each method and the decrease in the number of microorganisms in the end product was analyzed after treatment by microwaves and/or conventional cooking.

The following methods were employed: a) meat, mincing, shaping, freezing (liquid N_2), storage, heat treatment; b) meat, slicing, packaging (plastic vacuum wrap), storage, heat treatment.

Microbe counts basically recorded the mesophilic and psychophilic flora. The analyses were also compared with conventional methods of dilution and bioluminescence.

A 2 450 MHz microwave oven was employed and organoleptic quality criteria were established taking into account shape, size, and the mincing and shaping process.

Release of Mitochondrial Enzymes by Freezing and Thawing of Meat: Structural and Analytical Aspects

R. HAMM and P. GOTTESMANN
Federal Centre for Meat Research, Kulmbach, German Federal Republic

The influence of temperature (between -5° and -196°C) and rate of freezing of beef on the damage of intracellular membranes was studied. For this purpose, the extent of the release of the mitochondrial enzymes lipoamide dehydrogenase, citrate synthase and β -hydroxyacyl-CoA dehydrogenase from the mitochondria into the sarcoplasm (muscle press juice) was determined. It was found that these enzymes are localized in the matrix compartment of the mitochondria and are more or less tightly associated with the inner side of the inner membrane.

As the results show, in the case of exclusively extracellular ice formation decreasing temperature down to -20°C causes an increasing membrane damage which is apparently due to the dehydration of the cellular system. A further lowering of temperature to -80°C does not result in an additional membrane damage. Intracellular ice formation causes a stronger damage than extracellular freezing; this effect increases with falling temperature (to -196°C) and increasing rate of freezing, i.e. with decreasing size of ice crystals. This fact can be explained by an increasing ice formation in the mitochondria causing a mechanical membrane damage.

Independent of the freezing rate, a deceleration of thawing results in a significantly higher membrane damage. This might be caused by the process of denaturation in the membrane system due to the longer period of exposure to the high ionic strength of the non-frozen water within the critical temperature range between -2° and -5°C .

The HADH activity does not change very much during refrigerated or frozen storage of meat; the enzyme is released by freezing and thawing only but not during storage of meat at above-freezing temperatures. Therefore, the determination of HADH activity in the muscle press juice by spectrophotometric methods or by a simple color test presents a reliable method for differentiation between fresh and frozen/thawed meat for the purpose of food inspection.

3.14

Micromorphological mutations in the semitendinosus muscle of the beef after variable freezing and thawing cycles

H.-G. LIEBICH and E. MEIER
Zoo-anatomical Institute, Professorship for Histology and Embryology, Munich University, FRG

Any freezing and thawing process of meat may be regarded as a multifactorial, physical or physico-chemical course of reaction whose implications entail diverse structural peculiarities and different biochemical alterations of the enzyme pattern within the individual cell systems. The object of these experiments was to acquire for this, with the aid of electron microscope imaging methods, morphologic parameters allowing in particular to tell thawed-off cold storage meat submitted to different preparatory treatments (variable freezing-up velocities, storage times and thawing-off temperatures) from fresh meat. Thereupon prefrozen muscle specimens were congealed at -22°C or -45°C and thawed off following a storage time of 1-4 weeks and 3-6-9-12 months at $+4^{\circ}\text{C}$ or $+20^{\circ}\text{C}$, respectively, fixed, and examined under electron microscope. Lower freezing-up (-45°C) and higher thawing-off ($+20^{\circ}\text{C}$) temperatures generally lead to more accentuated structural changes than in specimens which were congealed more slowly (-22°C) and at lower thawing-off temperatures ($+4^{\circ}\text{C}$). Shock-frozen (-45°C) muscular tissue, besides considerable deformations of the mitochondrial matrix, presents conspicuous dilatations of the Ca-activated L-systems in the terminal range of the triads. The T-system, too, appears markedly dilated. The actinic filament bundles within the I-zone of the sarcomers depart from the orderly basic structure in accordance with contractile elements in fresh meat; the Z-strip is thickened. The degree of such structural changes is influenced by the storage time of the test specimens at -22°C .

ICE CRYSTALLIZATION IN SOLUTION OF MUSCULAR PROTEINS

N.GURAVSKAYJ, E.KAUKHCHESHVILI, S.OSIPOV, A.VASILEV

Moscow Technological Institut of Meat and Milk Industry, Moscow. USSR

In that report you can see the problems of ice crystallization in albuminous systems containing milk-albumen protein
 For strengthening freeze effect was using method of repeated freeze-defrosting.
 It is determined that introducing to system milk-albumens proteins increases cryoprotective properties of meat systems.

Changes in the surface heat transfer coefficient during meat thawing

S J JAMES AND C BAILEY

Agricultural Research Council, Meat Research Institute, Langford, Bristol BS18 7DY. U.K.

Any method which mathematically models the pattern of heat flow from the thawing medium to the centre of a meat carcass or cut, is dependent on knowledge of the mechanism and magnitude of the heat transfer coefficient at the surface of the meat.

Few data are available on such heat transfer coefficients, and those that are assume the mechanism is principally convective and substantially constant throughout the process. Recent experiments at MRI have shown this assumption to be incorrect, as it has been found that the rate at which heat is absorbed from the air changes abruptly during the thawing process. Further investigations have shown that the change is related to the cessation of condensation on the surface of the meat and the subsequent evaporation of the condensed film. This, in turn, has been found to be a function of the orientation of the block.

The initial investigation has demonstrated the importance of the condensation component and the relationship between dew point and heat transfer coefficient in any method used for the accurate prediction of thawing time. Subsequent investigations will attempt to quantify this for a range of practical thawing conditions.

Meat Thawing under Reduced Pressure

N.P.YANUSHKIN, N.K.ZHURAVSKAYA, V.I.IVASHOV, V.P.TCHUMAKOV, I.M.TAMBOVTSEV and L.F.MITASEVA

The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR

Optimization of the meat thawing process is a multi-factorial task, and its solution should be directed towards restricted energy consumption, process intensification and provision of high-quality products.

As our analyses indicate, it is possible to meet these requirements due to complex regulation of the parameters of the processing environment: pressure, temperature, composition. As related to thawing, it is prospective to reduce total pressure, this allowing for heating with saturated steam in the environment with a lower oxygen content.

Meat thawing under reduced pressure does not considerably affect the condition of muscle proteins and minimizes possible oxidation of haem pigments, this having a positive influence upon finished product colour intensity and stability.

Comparison of histological and electron microscopic data on frozen, atmospheric pressure thawed and vacuum thawed meat indicated differences in the structure of the muscular tissue and myofibrillar pattern of muscle fibers.

The microbial load of meat thawed under vacuum is 40-50% lower as compared to meat blocks thawed under atmospheric pressure.

Quality of vacuum-thawed middles and hams

HANS OLE MIKKELSEN

Danish Meat Research Institute, Roskilde, Denmark

As part of the COST 91 study, experimental work on middles and hams has been carried out, using an APV-Torry thawing plant (pilot scale).

After thawing the middles have been cured and sliced as back and streaky bacon. The hams were used for rolls and a comminuted meat batter.

The following results have been obtained:

The thawing time is approx. eight hours for middles and 25 hours for hams using a thawing temperature of 10°C.

The combined freezing and thawing loss is approx. 2.3% for middles (protein loss 0.4%) and 3.3% for hams (protein loss 0.55%). The thawing loss of hams is considered to be the average of a weight gain on the outer parts of the ham (11-29%) and a loss of the pure ham-muscles of magnitude 10%.

Bacteriological quality studies of thawed middles have been satisfactory.

The capability of absorbing brine is higher for thawed meat than for normally cooled meat, when identical setting of the pumping machine is used.

The appearance of the sliced bacon from thawed middles is in general more attractive than the appearance of bacon from middles stored at 5°C. This is partly due to a better salt distribution giving a more uniform colour and partly to the observation that less needle marks can be seen in the final washers. The appearance of the ham products does not seem to be influenced by the use of thawed ham, except by being slightly darker in colour. This is also observed for middles.

Using thawed hams for roll-production gives a yield which is 4.5% lower than the yield when normally cooled hams are used. In the case of bacon production from middles, the curing process compensates in part for the drip loss.

3.19

Effect of thawing, cutting, and transportation on quality characteristics of frozen beef meat imported to Egypt.

R.M.A. EL SAADANY, F.M.H. ASHOUR AND S.S. ABBAS.

Food Sci. Dept., MOSHTOHOX Faculty of Agric. Sci., TOUKH, KALIOBEIA, Egypt.

Results obtained throughout this research indicated that frozen beef meat imported to EGYPT was declined in its quality properties, as, the sarcomer length was reduced with about 11.5% by thawing, cutting and packaging meat pieces, as well as, transportation when compared with the frozen beef which served as control.

5.25% weight loss of carcass was observed after thawing due to the separation of meat fluids which contained soluble proteins as four amino acids were revealed by paper chromatography. Morever chemical analysis of the imported meat was altered and fading in its spectral reflectance was noticed. Meat tenderness declined also due to the mentioned processes. Besides, bacterial load for meat surface was raised to a relative high limits during all stages of handling, although Coliform bacteria did not exist.

3.20

APPLICATION OF INTERNATIONAL SANITARY LAWS
FOR THE ELABORATION OF PROYECTS CONCERNING CONSTRUCTION AND
PERFORMANCE OF REFRIGERATED SLAUGHTERHOUSES IN CHILE

VET. DR. GUSTAVO AMTMANN BRIONES
SANTIAGO TOWNHALL, SANTIAGO, CHILE.

ARQUITECT MR. JUAN CARLOS MALDONADO MUSCIO
ARQUITECT MISS ANA MARIA HIDALGO MORALES
UNIVERSITY OF CHILE, SANTIAGO, CHILE.

The objective of this paper is to report our country the international sanitary laws that must be applied for elaborating proyects that concern cons - truction of refrigerated slaughterhouses and their adequate performance.

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The laws are numerated and standard rules are detailed so that the refrigerated slaughterhouses may fulfill these international standards.

The application of these sanitary laws in the construction of refrigerated slaughterhouses will enable the fulfillment of international agreements in these subjects and permit an adequate commercialization of meat products.

TECHNOLOGY, MICROBIOLOGY AND SANITARY ASPECTS OF THE DRY AND/OR COOKED MEAT PRODUCTS

Optimization of the process of continuous grinding combined with edible fat rendering

V.M. GORBATOV, I.V. GUBANOV and V.M. MOROZOV

The All-Union Meat Research Institute, Moscow, USSR

N.N. MIZERETSKY

The Moscow Technological Institute for Meat and Dairy Industries, Moscow, USSR

On the basis of a generalized transfer equation, a mathematical model is suggested for improved continuous edible fat rendering in a non-reducing centrifugal rotation-type installation. Grinding of soft fat-containing material and unfolding of hard-accessible fat cells occur successively in the working zone. Physico-chemical characteristics of the finished product are determined, and an equation for the efficiency of the installation is derived, it involving both quantitative and qualitative features of the process.

4.02

Optimization of mincing and mixing meats for sausage containing backfat pieces

V.M. GORBATOV

The All-Union Meat Research Institute, Moscow, USSR

A.V. GORBATOV, V.D. KOSOY and A.K. KAKIMOV

The Moscow Technological Institute for Meat and Dairy Industries, Moscow, USSR

Optimum regimes for mincing and mixing meats for sausages containing fat pieces, as well as a procedure for their determination on the basis of a complex study of changes in the mince structural and mechanical characteristics are suggested. At the final stage of sausage mince preparation (mixing) they provide the even distribution of backfat pieces throughout the mix and extreme structuro-mechanical characteristics of the latter, which should be controlled by the critical shear stress. The regimes suggested were tested in commercial production. The application of these regimes in sausage manufacture allows to stabilize product yields and quality.

4.03

Determination of the optimum compositions of meat products having pre set properties

N.N. MIZERETSKY, Yu.A. IVASHKIN and S.S. EZHOV

The Moscow Technological Institute for Meat and Dairy Industries, Moscow, USSR

I.V. GUBANOV

The All-Union Meat Research Institute, Moscow, USSR

To develop the formulations which ensure the production of finished sausages and ground meats with pre-set physico-chemical properties, a procedure is suggested to plot the relation $F_0 = f(B, \Delta)$, by which all the necessary calculations can be made using computers. The investigations carried out resulted in the development of an analytical model of the system "meat product", which allows to calculate the optimum compositions of raw material mixes.

4.04

Modelling of mechanical properties of its comminution

V.I. IVASHOV, B.N. DUIDENKO, C.G. JURKOV and ANDREENKOV V.A.

The Moscow, Technological Institute of Meat and Dairy Industries, Moscow, USSR

Optimization of the main performance factors of cutting devices and that of the process of cutting soft collagen-containing raw materials may be conducted by means of mathematical models: a mathematical model of mechanical properties of raw material and a mathematical model of the process of its comminution.

To construct a mathematical model of mechanical properties of raw materials the experiman-

tal study of its dynamic and visco-elastic properties is being carried out. The model is constructed on the basis of non-linear relations of the theory of visco-elasticity and is used for constructing models of the process of raw material comminution. Mathematical models describing the mechanics of cutting soft collagen-containing raw materials by circular and plate knives are constructed on the basis of cinematic parameters and dimensions of a cutting device. Optimum parameters of cutting devices and those of the process of cutting hide trimmings of cattle have been calculated on the basis of the given models.

4.05

General approach to the optimization of assortment and formulae in meat products production

Yu. IVASHKIN, A. BORODIN and K. SERDAKHEJI

The Moscow Technological Institute of Meat and Dairy Industries, Moscow, USSR

The optimal way of increasing the production efficiency at the wide assortment of products, different formulae for some meat products and changing the quality of raw material - is the effective solution of assortment-formulae task. For this purpose the general mathematic model of sausages and combined meat products is considered; the model consists of the equation of balance by standardized objective parameters of the finished product: water, fat, protein and protein of muscle origin content. Proceeding from the probable character of the parameters defining the quality of the finished products and from the deficiency of strict formulae in the standard the developed model determines the area of acceptable values that satisfies all chemical and organoleptical demands of the standard. The model allows to calculate the most profitable variant that at the selected assortment of the products satisfying consumers demand determines the optimal recipes which provide the minimum cost price of the products.

4.06

THE INFLUENCE OF SOME TECHNOLOGICAL FACTORS ON QUANTITATIVE AND QUALITATIVE PROPERTIES OF MEAT

CHLEBNIKOV V.I., V.MACHONINA, I.STEPHANOVA, N.KOVSEVNIKOVA

Scientific and Industrial Poultry and Glue and Gelatine Center "Complex"
Moscow, USSR

The study was conducted to determine the common patterns of qualitative and quantitative changes in minced meat depending on raw meat pH (musculus longissimus dorsi), and sample and warming medium temperature. Salt minced meat with pH=5,25-7,00 (0,25 intervals) was heated under 75, 100, 145°C to sample temperature 35-65°C, 35-90°C and 35-135°C respectively. As a result an empiric dependance was found for mass losses, product output, bound, weakly bound and free water content and pH changes on above mentioned factors. The dependance was also revealed of minced meat mass losses after superhigh frequency cooking (SHF-heating) on the rheological characteristics of raw material (protein content 21-12%, lipid content 3-30%, added water content 15-40% to raw material mass).

4.07

Mathematical fundamentals of standardization systems for meat industry.

Gert Lorenz

Institute for Economics and Market Research for the food processing industry of the Federal Dairy Research Centre, Kiel, Federal Republik of Germany

The aim of the following paper is to describe mathematical fundamentals of different standardization systems. Commonly applied methods use solution of linear equations to determine raw material input for sausage production. Generally the left hand side of such an equation system consists of a square matrix (A) of raw material coefficients.

If any solution exists, this one possible solution is found by inverting the matrix of raw material coefficients (A) and multiplying the inverse (A^{-1}) by the requirements of the final product(s) (vector b or matrix B).

The first part of this paper presents a standardization system, based on a square raw material coefficient matrix, which takes analysis data for fat, meat protein and connective tissue protein into account. Modern rapid analysis methods (Super Scan) can provide the needed data.

This and similar methods, which are based on square matrices, require only a small amount of input data, a short computing time and allow the use of standard software for matrix inversion and multiplication.

But there are two basic disadvantages of these methods: raw material prices as well as sophisticated food regulations cannot be taken into account.

Because of the lack of the above mentioned systems, the second part of the paper presents linear programming as a further developed method to select raw materials according to prices, additionally current food regulations can be met, provided they are defined in mathematical terms.

The determination of the least cost raw material composition of a mortadella (standard quality) according to German food law is given as an example for solving a complex standardization problem by linear programming

4.08

Influence of carbonyl and phenol compounds of smoke on pH and water holding capacity (WHC) of smoked beef

PETAR M. RADETIĆ, MILENKO D. ŠUVAKOV and JOVAN T. PANIN

Yugoslav Institut for Meat Technology, Belgrade, Yugoslavia

Smoking of M. longissimus dorsi beef samples was carried out by two methods by using conventional and automatic smoke chamber. Smoking conditions obtained by conventional meat smoking method were simulated to meat smoking in automatic smoke chamber. Main difference between these two smoking methods was intensive circulation and smoke transfer through water screen in automatic smoke chamber.

The obtained results have shown that the beef smoked in the automatic smoke chamber contained greater quantities of smoke components (carbonyl and phenol compounds) in regard to meat smoked by conventional method, as in surface layer so in central part of meat sample. Parts of the sample where the greatest quantity of smoke components had penetrated, showed the lowest water holding capacity (surface layers of the sample smoked in automatic smoke chamber). Central parts of the samples smoked by conventional method, where carbonyl and phenol compounds were found in traces only, showed nearly the same water holding capacity as the unsmoked meat.

Changes of pH caused by smoking were also observed. The significance of these changes to water holding capacity not defined.

4.09

Measurement and Control in Meat Cooking Processes

H.-J. RAEBER, H. NIKOLAUS, E. HÜBNER

Technische Universität Dresden, DDR

Cooking losses are of economical and qualitative importance in meat processing. They depend from process parameters and from structure, composition and ripeness of meat.

Under manufacturing conditions the cooking losses primarily are influenced by changing of process parameters (temperature, time, size of items, cooking liquid-meat-proportion). For comparative investigations an objective criterion of cooked state is necessary.

Cooking losses of lean pork (muscle long, dorsi) have been investigated experimentally as function of the parameters mentioned above including NaCl-content and statistically registered in a regressional equation. The statistical security is rather good.

A high fat content in other meat samples diminished the statistical security of predictions on cooking losses in a great manner.

Up to now it is not possible to make an analytical model. Control of cooking processes (boiling) can be done by means of the regressional equation.

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COOKING LOSSES IN 8 BOVINE MUSCLES

M. LAROCHE

Laboratoire des Aliments d'Origine Animale. Institut National de la Recherche Agronomique. Chemin de la Géraudière, 44072 Nantes Cedex. France.

Cooking losses kinetics have been investigated on different bovine muscles. Muscles Biceps fémoris, Longissimus dorsi, Psoas major, Pectoralis profundus, Rectus abdominis, Semi-membranosus, Semi-tendinosus et Triceps brachii caput longum were sampled on 3 bovine carcasses 24 hours post mortem, then aged for 8 days at 6°C.

Kinetics at 70°C were compared by mean of the equation :

$$P = P_{max} \left(1 - e^{-\left(\frac{F}{L_F} + \frac{1}{L_1} + \frac{1}{L_2} \right) vt} \right)$$

| | |
|---------------------------------|--|
| P | cooking loss (W/W) |
| P _{max} | maximal loss (W/W) |
| L _F | muscle fiber length (mm) |
| L ₁ , L ₂ | perpendicular length (mm) |
| F | anisotropic factor |
| V | losses speed (mm ³ /mm ² /h) |
| t | cooking time (h) |

It was established that the above equation fits samples weighing about 50 g heated up to 8 hours. The losses speed doesn't depend on both animal and muscle. The maximal loss and anisotropic factor are found basically the same except for muscle Psoas major which shows a slight deviation. This deviation may be due to the traditional way of hanging of the carcasses which yields longer sarcomeres in this muscle. As Tender and Tough muscles show the same rate of cooking losses, we can assume the myofibrillar protein govern these losses.

Water binding in meat related to heat processing

X MOTARJEMI and C SKJÖLDEBRAND

Division of Food Engineering, Lund University, P.O. Box 50, S-230 53 Alnarp, Sweden.

In an attempt to optimize the heat process of meat products a point which attracted our attention was the phenomenon of diffusion of water and its relation to water binding properties of meat. Another thing which raised our curiosity is how the heat denaturation of the meat proteins affects the state of water and thus the diffusion. It was with these questions in mind that we found it interesting to study the water binding properties of meat, its changes as function of heat treatment and ingredients (water, salt, starch, fat).

To be able to choose a relevant method for measuring bound and retained water, a literature review was made. This lead us to conclude that the concept of water binding is still very much unclear and confusing. We found many terms which tried to define the bound water in foodstuffs. Each definition suggested one method of measurement. We tried to systemize these definitions and these measurement methods and therefore we divided them into two groups.

One group is "relative methods". These are the methods which give results that are only valuable as long as the results are compared to the results of another measurement. In this group we classified centrifugation, pressing and cooking yield.

Another group is "absolute methods" and by that we mean those methods which measure a certain amount of water that is bound to macromolecules. In this group we have classified sorption isotherm, N.M.R, D.S.C and drying curve.

We chose three of the mentioned methods for studying the water binding properties of meat and meat products. Some of the results of this investigation will be presented.

Effect of different mechanical and heat procedures and storage conditions on the content of individual phospholipids in pork

VESELINKA DJORDJEVIĆ, FRANC BUČAR, IVANA DJUJIĆ, NADA RADOVIĆ

Yugoslav Institute of Meat Technology, Beograd, Yugoslavia
Biotechnical Faculty, Ljubljana, Yugoslavia

The effect of certain mechanical and heat procedures and storage conditions, being of interest for industrial and culinary practices, on the contents of nine identified and four unidentified phospholipids in the *M. longissimus dorsi* pork samples was investigated.

Content changes of both individual and total phospholipids were more pronounced in the meat homogenate than in meat pieces. Roasting of meat resulted in higher reduction of phospholipid content in the surface layer than mechanical treatment followed by pasteurization, namely sterilization. Regarding the average reduction of the contents of phosphatidylcholine and phosphatidylethanolamine, which presented the main quantity of total phospholipids, it was stated that in the surface layer of roasted meat, the reduction was approximately three and half times higher, immediately following the heat treatment than in the sterilised homogenates, four and half times higher than in sterilized meat pieces, five times higher than in pasteurized homogenates and approximately eight times higher than in pasteurized meat pieces.

On the basis of phospholipid changes it was concluded that changes of phosphatidylethanolamine and phosphatidylcholine were of significant importance for the development of rancidity whereby the effect of other phospholipids should not be neglected.

4.13

Diagram of rates and deformation at nonisothermic flow of comminuted meat through the pipes

V.M. GORBATOV

The All-Union Meat Research Institute, Moscow, USSR

A.V. GORBATOV and M.B. SMIRNOV

The Moscow Technological Institute of Meat and Dairy Industries, Moscow, USSR

The results of experimental investigation of diagrams of deformations, velocities and velocity gradients in a round tube with a uniformly heated wall at established flow of comminuted meat in it are given.

The tests are made on dismantlable tubes ($\varnothing = 0,05$ m; $l = 1,33$ and $2,62$ m; wall temperature = $20-45^{\circ}\text{C}$). The temperature of melting of fat mixture adhering to internal surface of the tube is approximately 34°C . A significant temperature gradient in the wall layer decreases viscosity, increases yield in a circular layer in comparison to volume yield and therefore changes the shape of rate diagram. The phenomenon of wall effect significantly influences the process of flow causing the increase of cost. Proceeding from the knowledge about two layer flow in the tube the relationship for cost determination was obtained analytically.

4.14

Studies into Physico-Chemical Characteristics of Combination Sausage Minces at Different Processing Stages

I.A. ROGOV, N.N. LIPATOV, A.V. EFIMOV, E.I. TITOVA, A.N. BOGATYRYOV, A.G. ZABASHTA and N.Sh. NADASHVILI

The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR

The paper presents the results of a study into the changes of some physico-chemical characteristics of combination sausage minces at different processing stages as related to the qualitative and quantitative composition of the components of structured proteins (ISBP) added.

Data are given which characterize regularities in the changes of pH, WHC, ultimate shear stress, moisture, fat, protein and ash of combination sausage minces before and after cooking.

From the studies carried out it was concluded that combination minces, in which a significant amount of muscle tissue is extended with structured protein components, before and after cooking can be considered as sausage mince analogues prepared from natural meat.

4.15

Survey study on the minced meat of local market in form of sausage or mixtures of minced meat and meat substitutes.

F.A.SALEM^{*}, M.M.ABD EL-BAKI^{***}, K.A.SEDKY^{**}, S.K.EL-SAMAHY^{***} and SH.A.A.EL-NEMR^{*}

Food Science Department, Faculty of Agriculture, Zagazig^{*}, Cairo^{**} and Suez Canal^{***} Universities, Egypt

Nine sausage samples and one soy meat sample were collected from local supermarkets. The samples were chemically, technologically, and histologically evaluated. The data proved that there was a wide difference in their chemical composition which might be due to unstandardised composition of such product. Water holding capacity, plasticity, and cooking loss were determined in all samples. Microscopic investigation indicated that some samples were prepared from previously frozen meat. A wide range of muscle fiber diameters and sarcomeres lengths were also observed. The data also revealed a wide range of connective tissues and that some samples contained intestine tissues in their formulation. In view of the present results it could be recommended that such findings might be considered when setting new standard specification for such a food commodity.

4.16

Substantiation of the optimum cooked sausage formulation, using a generalized criterion

M.P. VOYAKIN, V.M. GORBATOV, G.P. GOROSHKO and R.M. SALAVATULINA

The All-Union Meat Research Institute, Moscow, USSR

A change in cooked sausage formulations results in multiple alterations in finished product characteristics which constitute the notion of quality. This makes it necessary to establish such a criterion which would allow to choose the minute amounts of ingredients in the formulation, determining the efficient utilization of their functionality and the preparation of a high-quality product. To solve this problem, it is suggested that a generalized optimization criterion be used which characterizes the proximity of the total individual indices studied to their desirable values.

As individual indices were chosen those which characterize different classes of the properties of the finished product, the choice being made on the basis of our own 4-factor test, carried out according to the saturated simplex-scheme, and the literature available.

4.17

THE EFFECT OF PRESALTING OF MEAT ON PROPERTIES OF FINELY COMMINUTED MEAT PRODUCTS

A.-M. HERMANSSON

SIK - The Swedish Food Institute, Box 5401, S-402 29 Göteborg, Sweden

Standardization of meat to a uniform composition of protein, fat, and water involves unit operations such as coarse cutting and blending. If the meat is to be transported or cold stored, salt is often added during blending to inhibit bacterial growth. The effect of salt, added either dry or as a salt solution during blending of coarse cut meat, two days before production, was investigated with regard to functional and sensory properties of frankfurters as well as bacterial growth in the meat. A

comparison was also made between properties of frankfurters processed in a bowl chopper and in a continuous emulsifier. All unit operations were performed on a semi-large scale. For each experiment, 500 kg of meat were blended in a 1000 l single armed blender and 100 kg of meat batter was produced in a 150 l bowl chopper or in a continuous emulsifier.

As expected, presalting inhibited bacterial growth. The difference in the total number of bacteria between unsalted and presalted meat was one log cycle after 4 days of chilled storage and 4 log cycles after 11 days of chilled storage. There was no increase in viable counts in the presalted meat between the 4th and the 11th day of cold storage. When the functional properties of sausages were evaluated differences were found in the texture but not in the fat- and waterbinding properties. The sausage texture was less firm when the meat was presalted. Presalting also affected the colour of the frankfurters which turned less pink and more grey.

4.18

Effect of electrically stimulated meat on the processing properties of cooked sausages.

R. TUOMINEN and M. HONKAVAARA.

Finnish Meat Research Centre, Hämeenlinna, Finland.

Studies carried out into the electrical stimulation of carcasses and its effect on valuable muscles provide virtually conclusive evidence of the benefit to be derived from this procedure. The behaviour of meat obtained from electrically stimulated carcasses in the preparation of meat products, on the other hand, has been studied relatively little.

The present study examined the effect of low voltage stimulation on the binding properties of beef cuts for use in the preparation of cooked sausages and the effect on the quality of the final product.

The results show that stimulation causes a reduction of 12,5 - 15,2 percentage in the water-binding capacity of beef cuts and a reduction of c. 2,4 percentage in their fat-binding capacity. The addition of phosphate (1,5 g/kg) did not prevent the deterioration in water-binding capacity.

The effect of added water of cooked sausages prepared from stimulated and non-stimulated beef on consistency showed that the amount of added water corresponding to acceptable consistency (12 N Instron consistometer) was 1,9 percentage points higher for sausage made from non-stimulated meat than for sausage made from stimulated meat. The sausages prepared from stimulated meat were described in a sensory evaluation to be greyer in colour than sausages prepared from non-stimulated meat.

4.19

Investigations to analyse how various albumin additives of animal origin influence the colour characteristic and the nutrient value of non-durable & boiled) sausages

WOLFRAM SCHNACKEL and STEFAN DANCHEV

Higher Institute of Food and Flavour Industries, Plovdiv, Bulgaria

There has been checked the influence of an albumin mixture consisting of nonde-fibering blood of slaughtered animal and albumin concentrate of battermilk sour cream upon and nutrient value of non-durable sausages Without strukture. For comperison there has been used a colour-etalon that a group of consumers has confirmed as the sausage colour desirable.

Two, four, six hours after the sausage has been cat, the colour stability of the cut surface has been checked. Furtheron upon the control and the experimental sausages the balance of the amino acids has been determined.

There has been stated that axchanging 15% of meat against 15% albumin mixture consisting of animal blood and milalbumin impruve the characteristic and the stability of the colour not diminishing the nutrient value and the other organolep-tical parameter of the sausages.

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Effect of PSE meat on processing properties of cooked sausage and ham.

M. HONKAVAARA and R. TUOMINEN.

Finnish Meat Research Centre, Hämeenlinna, Finland.

The PSE Phenomenon in pork is most clearly noticeable in the valuable muscles, such as the semimembranosus and longissimus dorsi. It causes the pH value of the muscle to fall more rapidly than usual, resulting in a deterioration in water-binding capacity. The water-binding capacity in the ham prepared from severely affected PSE pork (pH₁ 5,3 - 5,4) was 33 % below normal, while that in the foreleg was 11 % below normal (pH₁ 5,9 - 6,0). The binding properties of pork with a high pH (pH₁ > 6,35) were better than normal. The use of phosphate did not improve the binding properties of PSE meat.

The water content of smoked ham prepared from severely affected PSE pork was about 2 percentage points below normal, while the protein content was about 2 percentage points higher than normal. The cooking losses were 4,7 percentage points larger than normal when ham was prepared from severely affected PSE meat. Because of the deterioration in water-binding capacity of cuts from severely affected PSE pork the normal amounts used in the preparation of sausage should be increased by 1,5 percentage points.

The smoked ham prepared from severely affected PSE pork was described in a sensory evaluation to be soft, crumbly and exudative in texture and to have a salty taste. There was no difference in chemical and sensorily evaluated quality between sausages prepared from PSE meat and those prepared from normal meat. Increasing the water content of PSE sausage caused it to lose its consistency more rapidly than normal.

4.21

The influence of tumbling techniques on quality and yield of cooked ham.

J. E. REICHERT

Laboratory for technology of preserves, Technical college Lippe, Lemgo, German Federal Republik.

The studies were carried out to determine the effects of different tumbling techniques, intermittent-, continuous-, and vacuum tumbling, intensity, times of rest before and after the treatment and rotating speed on sensory quality and yield.

In a drum with a stirrer fixed at an angle of 45° 25-30(hams pH 5,8 - 6,2, pumped with 14 % of a 23 % brine or 20 % of a 19 % brine) were processed continuously or intermittently (10 min. movement, 20 min. rest) for 90, 200 or 400 min. effective tumbling time. The influence of rotating speed was examined at speeds of 10, 20, 30 and 40 rpm continuously for 200, 267, 400 and 800 minutes.

With increasing intensity yield improved. Obvious differences were found between continuous and intermittent treatment up to ca. 200 minutes effective tumbling-time (= 4000 rotations total). Resting before and after tumbling as well as intermittent treatment led to higher yields. Effective tumbling times of 400 minutes (= 8800 rotations total) showed no significant differences concerning sensory quality and yield between continuous and intermittent tumbling. Rotation speeds of 10 to 20 rpm and 8000 rotations total produced the best results. Higher rotation speeds (30 to 40 rpm) led to increasing tumbling losses and smaller yields. Tumbling under vacuum obviously diminished tumbling losses, increased yield and improved cohesiveness of slices.

Concerning heat processing a Delta-T-method (25 to 30°C with a cooking temperature limited at 70°C) up to $F_{70^{\circ}\text{C}}^{10^{\circ}\text{C}} = 45$ to 55 led to obviously less cooking damages, higher yields and better cohesiveness of slices than heating up at a permanent temperature of 65, 70 or 75°C.

Determination of the effect of heat treatment, with the same F-value and different temperatures, on the quality of pasteurized canned ham

I. BAYCHEV

Meat Technology Research Institute, Sofia, Bulgaria

Pasteurized hams and shoulders were heat-treated according to two regimens with the same F-value (1.7 min), but at different temperatures: 75°C and 78°C. The finished cans were subjected to organoleptic and physico-chemical analyses. The hams and shoulders treated by the lower temperature regimen were found to have a better efficiency and quality.

4.23

Changes in the contents of total carbonyls and monocarbonyls and in the microorganisms of pasteurized canned ham upon storage for 12 months

D. GADZHEVA, V. VERGIEVA, N. NESTOROV

Meat Technology Research Institute, Sofia, Bulgaria

The contents of total carbonyls and monocarbonyls in pasteurized canned ham rise moderately for up to 6 months. After the 6th month, these substances cumulate progressively. After 11 months, the ketone fraction rises sharply which is accompanied by a reduced overall taste score and by a considerable rise in total contamination. After 12 months of product storage, a tendency towards a decrease in the contents of total carbonyls and monocarbonyls is observed, and changes in the microbial status are within the standard provisions. Enterococci predominate; no gram-negative rods, pathogenic bacilli and sulphite-reducing clostridia are found.

4.24

Changes in meat structure during curing under vibro-massaging

A.A. BELOUSOV, G.E. LIMONOV and V.I. ROSHTCHUPKIN

The All-Union Meat Research Institute, Moscow, USSR

V.E. STUPIN

The Tuapse meat processing plant, Tuapse, USSR

Histological, rheological and physico-chemical analyses, as well as scanning electron microphotograms demonstrated an advantage of a combined mechanical treatment - massaging and vibrating - during curing. It was found that a combination of massaging and vibrating allows to achieve greater loosening of the muscular tissue (providing its optimum alteration) and better protein swelling. This makes it possible to yield a product of a higher quality within a shorter mechanical treatment time.

4.25

MANUFACTURE AND ACCEPTABILITY OF AN ORIENTAL DRIED PORK PRODUCT.

H. W. Ockerman and J. C. Kuo, The Ohio State University, Columbus, OH 43210 and The Ohio Agricultural Research Development Center, Wooster, OH 44691.

Sixteen hams were processed with a dry high-sugar cure, tumbled and a mold shaping technique was used to produce a high quality, uniform and attractive oriental dried pork product. The effect of nitrate, packaging method and storage time were determined on residual nitrite, TBA values (oxidative rancidity), sensory properties and microbiological counts. Residual nitrite decreased with increased storage time at 3±1°C and the addition of nitrate plus vacuum packaging of the product caused it to retain a higher residual nitrite level and a lower TBA value than the groups without nitrate or vacuum packaging. Nitrite and/or nitrate acted as an antioxidant to retard oxidative rancidity, and combined nitrite and nitrate reduced the TBA values more effectively than nitrite

alone, especially during the latter stages of storage. Dried pork manufactured by the techniques described had no major rancidity or shelf life problems. Vacuum packaging maintained a more sensory acceptable product than non-vacuum packaging during storage. Tenderness and overall acceptability scores were significantly affected by vacuum-packaging. Total aerobic plate counts, lactic acid producing bacterial counts and total anaerobic bacterial counts were not affected by nitrate or packaging method but were significantly increased by storage time. However, the levels of the microbiological counts were acceptable during the 16 weeks of storage. Coliforms, and molds and yeasts were not observed in this dried pork. Color scores were inversely correlated with tenderness scores. Rancid odor and rancid flavor scores were positively correlated with TBA values and negatively correlated with residual nitrite. Overall acceptability scores were positively correlated with tenderness scores and negatively correlated with color scores.

4.26

Studies on the manufacture of Parma-type ham in Cuba. 1. Initial experiments for specifying the curing and ageing parameters

ZULEYCA VALDEZ¹, G. MANEV², MARLEN RAMOS¹

¹ Research Institute of Food Industries, Havana, Cuba

² Meat Technology Research Institute, Sofia, Bulgaria

The present work marks the beginning of a study on the manufacture of Parma-type ham under the conditions of Cuba, using available raw materials there. In the technological process of manufacturing that ham variety, the curing and ageing processes are of essential importance, since the organoleptic qualities of the finished product depend greatly on them. Several series of pilot plant experiments were made to specify the above parameters of the production cycle. For the purpose, hams from hybrid pigs weighing 90 to 100 kg and aged 9 to 12 months were used. The curing process lasted for 30-40 days, and afterwards, product ageing took place in 6 months, at controlled atmosphere. Organoleptic, physico-chemical and microbiological changes in the product were followed during curing and ageing. The data obtained indicated that NaCl content in the hams cured for 30 days varied from 2,41 to 4,57%, and in those cured for 40 days, from 2,59 to 4,74%. As for moisture, a decrease was observed during drying, constituting 10 to 14% in the different layers of the product. pH varied from 6,26 to 6,30. In the organoleptic preference test, 6 out of 9 taste-testers preferred the samples cured for 30 days.

4.27

Characteristics of dried ham of Jabugo type

F.LEON CRESPO, F.BELTRAN DE HEREDIA, J.FERNANDEZ-SALGUERO y M.ALCALA

Departamento de Tecnología y Bioquímica de los alimentos

Facultad de Veterinaria. Universidad de Córdoba, Spain

The analysis of 12 samples of Jabugo type raw dried ham showed its raw chemical composition to be as follow: 31.6 ± 5.0 % of moisture; 35.2 ± 11.7 % of fat; 28.7 ± 8.2 % protein ; 5.7 ± 0.7 % ash ; 4.8 ± 0.7 % NaCl ; 0.23 ± 0.05 % total phosphate. The pH value was between 5.30 and 5.95 ($\bar{x} = 5.62$), and the a_w was between 0.76 and 0.88 ($\bar{x} = 0.83$).

Injection of a salt suspension into bacon cuts

J.B. LENSSINCK, J. MEESTER, H. LABOTS AND E.J.C. PAARDEKOOPER

CIVO-Institutes TNO, Zeist, the Netherlands

The necessity of shorter curing times and better control over levels and distribution of curing salts in bacon, have increased interest in the optimal functioning of multi-needle apparatus and alternative curing and draining methods.

The distribution of curing salts in bacon cuts is more uniform using the newest multi-needle apparatus. Tank curing may be omitted or shortened, when in stead of a normal injection brine a salt suspension, that is a saturated salt solution in which extra salt is suspended, is injected.

Under these circumstances a desired salt level can be obtained and a sufficiently homogeneous distribution of the salt through all parts of the cuts, resulting in a sliced bacon with a good keeping quality.

4.29

Study of carbohydrate-breakdown in meat and meat products

K. INCZE, Á. JUHÁSZ and É. HORVÁTH

Hungarian Meat Research Institute, Budapest, Hungary

Carbohydrates in meat and meat products break down during storage as a consequence of chemical and/or microbiological processes. During this breakdown mainly organic acids are formed, which contribute to shelf-life and flavor as well.

Breakdown of carbohydrates, chiefly glucose has been studied in fresh meat and meat batter. Rate of carbohydrate-breakdown and increase of concentration of acids have been determined in "pre rigor" and "post rigor" meat and in batter made of them. Influence of chilling and freezing on breakdown has also been investigated.

It has been found that carbohydrates in "pre rigor" meat break down very rapidly. The rate of this breakdown depends on type of muscle and does not alter significantly after 24 h chilling or freezing either. Concentration of acids is not proportional with breakdown of glucose, suggesting of incomplete conversion to organic acids.

Rapid initial breakdown of glucose is caused likely by tissue enzymes. A better elucidation of this mechanism needs further studies.

4.30

Effects of freezing and freeze-drying on lactic acid production by starter cultures

B. DINEVA, TS. TSVETKOV, R. BRANKOVA, A. KRUSTEV

Meat Technology Research Institute, Sofia, Bulgaria

One of the most important attributes of starter cultures used in meat industry, is lactic acid production as a result of the disintegration of carbohydrates.

Studies were carried out on the changes occurring in the enzymatic activity of three strains of micrococci and one *Lactobacillus plantarum* strain in the production of frozen and freeze-dried preparations for the manufacture of ripening meat products. The capacities of lactic acid production in frozen and broth cultures were found to be similar. An enhanced enzymatic activity is observed in freeze-dried cultures.

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Studies on the nitrate reductase and catalase activities of micrococci in connection with their freezing and freeze-drying

B. DINEVA, N. NESTOROV, TS. TSVETKOV, A. KRUSTEV, R. BRANKOVA

Meat Technology Research Institute, Sofia, Bulgaria

Studies were conducted on the nitrate reductase and the catalase activities of two strains of *Micrococcus varians* and one *Staphylococcus saprophyticus* strain, used as starter cultures in the manufacture of ripening meat products. Changes occurring after freezing or freeze-drying were followed. The catalase activities of the three strains under investigation were found to be higher after freezing and freeze-drying. The nitrate reductase activities of the frozen cultures are similar to the ones of broth cultures or slightly higher, while freeze-dried cultures reveal a clearly expressed tendency towards an enhanced activity.

4.32

A Model System for Assessment of Starter Cultures for Fermented Sausages

Peter Zeuthen and Per Gotfredsen
Food Technology Laboratory, Technical University of Denmark

The report describes a model system for the assessment of starter cultures for fermented sausages to produce pH-decrease. The system comprises a meat slurry added 1 per cent glucose as well as sodium chloride and sodium nitrite in concentrations equivalent to those occurring in a sausage mix at the beginning of the fermentation. In the model system used it is therefore possible to take the buffer capacity of meat into consideration.

When testing a number of starter cultures variations were found both in the rate and the ultimate pH-decrease. The ability of *P.cerevisiae* to reduce pH was slighter than if *L.plantarum* was used, provided the commercial starter cultures were used in the recommended concentrations.

In preliminary tests where the composition of the commercial starter cultures were investigated, an indicative medium was developed which enabled to distinguish between *P.cerevisiae* and *L.plantarum*. The medium is described.

4.33

Examination of the influence of brine ingredients on water activity (a_w) and multiplication of selected microorganisms

LJILJANA PAUNOVIĆ, ŽIVKA TADIĆ

"Bek" Meat Packing Plant - Zrenjanin; Yugoslav Institute of Meat Technology - Beograd, Yugoslavia

In this work, the influence of various concentrations of NaCl, NaNO₃, NaNO₂+NaNO₃ combinations, polyphosphate and glucose, on a_w of bouillon and capability of multiplication of selected microorganisms: *Streptococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli* and *Bacillus licheniformis* was investigated.

The obtained results show that NaCl, in concentration of 10% and at a_w 0.9420, influences the growth of all the examined microorganisms, whereby *B. licheniformis* grows considerably slower and *E. coli* is sensitive already to 5% of NaCl at a_w 0.9701. Sodium nitrate reduces a_w of bouillon, but even in the concentration of 1% it does not influence essentially the reproduction of the examined microorganisms. Inhibitory activity of nitrite + nitrate combinations appears only at 0.1% of NaNO₂ + 1% of NaNO₃ combination, when a_w is 0.9922. Polyphosphate in concentrations of 0.3 and 0.5% does not influence more considerably the change of a_w of bouillon, and the inhibitory activity on selected microorganisms is slight as well. Glucose in concentrations of 0.5, 1, 2 and 3% does not change more essentially the a_w value of bouillon, and the majority of selected microorganisms grows well in its presence. Comparing the results obtained in control and nutritive bouillons, having the same a_w value (0.9969) but obtained by the addition of different concentrations of the examined ingredients, shows that the inhibitory effect of some substances originates from their specific activity.

Bacterial compound of frozen acidophillic bacillus for acceleration the process of semidried smoked sausages ageing

I.V. LAGODA

The All-Union Milk Research Institute, Moscow, USSR

M.M. MIKHAYLOVA and V.V. KRYLOVA

The All-Union Meat Research Institute, Moscow, USSR

In order to influence the process of ageing of semidried smoked sausages a bacterial compound of frozen acidophillic bacillus was used. The bacterial compound was obtained by growing the cells of acidophillic bacillus in a special nutrient medium, separation of the cells from the medium while centrifuging, mixing bi-omixture with a protection medium, packaging, freezing and storage in a frozen form. For increasing the amount of the cells and improvement of their storage life the biostimulators were added to the culture medium. The bacterial compound of frozen acidophillic bacillus were investigated during the technological process for microbiological, biochemical and physico-chemical parameters. The value of a_w was determined before and after freezing. Semidried smoked sausages prepared with a frozen bacterial compound of acidophillic bacillus were advantageous in comparison to the control by biochemical, organoleptical and microbiological parameters.

4.35

Effect of the ripening temperature on the pH fall and on some analytical characteristics of dry sausages.

J. FLORES y E. MARTINEZ

Instituto de Agroquímica y Tecnología de Alimentos. C.S.I.C. Jaime Roig 11, Valencia- 10, España

The effect of ripening temperatures of 15, 20 and 25°C, during two days before drying at 15°C, on the pH fall, on the residual levels of sugars, nitrates and final pH, is studied in three model systems of a typical Spanish dry sausage "Longaniza de Aragón", in 30/32 mm casings, with 3% different types of carbohydrates.

The results of this study showed that temperature of ripening directly influences the velocity of pH fall. The minimum pH values, around 5.2, are obtained after 6 days at 15°C fermentation temperature, 4 days at 20°C and 2 days at 25°C. After this time the pH showed a tendency to increase with the temperature. This values are lower in the model systems with higher dextrose rate. Final pH values of 5.2 are only obtained with 3% of dextrose and with 15°C fermentation temperature. The residual levels of sugars, between 1.0%-3.0% d.b., depends on the types of carbohydrates in the model systems. The residual levels of nitrates increases with the ripening temperature; 35 and 45 ppm are found at 20° and 25°C respectively while at 15°C there are only traces.

4.36

Microflora in raw sausages without casings

D. KALINOV, N. DIMITROVA, N. SPASOV, K. DIMITROV

Meat Technology Research Institute, Sofia, Bulgaria

The changes in microflora important for the ripening of raw sausages, lactobacteria, micrococci, enterococci and yeasts, were determined. Attention was paid also to the hygienic indices, coliforms and proteus. The predominant microflora are the lactobacteria. As a result of the low pH value of the sausages, the numbers of the micrococci and enterococci are low and those of the yeasts, high.

Quality of Cured Products Made from Horsemeat as Effected with Vacuum Mechanical Treatment

A.S.BOLSHAKOV, M.A.ANVAROV, N.N.LIPATOV, V.Kh.ADYLOV and I.B.MOSKVIN

The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR

This paper is a continuation of complex studies into vacuum application in cured meats technology. The effect of residual pressure, at which injection-cured meat was mechanically treated under vacuum, upon physico-chemical characteristics of raw and finished products and upon their organoleptical qualities and yields was studied.

It was found that during vacuum-mechanical treatment pH of the initial raw meat rises, increments averaging 0.17 - 0.29 with residual pressure decreasing from $1 \cdot 10^5$ Pa down to $0.5 \cdot 10^7$ Pa.

Since muscle pH increase results in higher water-holding capacity of meat, the suggestion previously made on the optimum residual pressure of vacuum-mechanical treatment being $0.5 \cdot 10^7$ Pa was again confirmed.

Results of physico-chemical analyses of raw cured meats and of the finished products, prepared under laboratory and pilot-plant conditions, together with organoleptical and yield data indicated that vacuum application in meat mechanical treatment improved considerably meat consumption per unit weight of the finished product, the optimum being reached at the residual pressure of $0.5 \cdot 10^7$ Pa.

4.38

The membrane clarification of used brains

B.V. SHERBINA, E.A. DENISIUK and S.V. KARPICHEV, L.V. KALMIKOVA

Moscow Technological Institute of Meat and Dairy Industry, Moscow, USSR

E.F. ORESHKIN

All-Union Meats Research Institute, Moscow, USSR

Productivity of the membrane apparatus is defined both by physical properties of separated product, and hydrodynamical conditions in the over-membrane area. At the other side, such operate properties of the membrane as specific permeability, selectivity, porosity, rigity of the membrane material and so on, effect the clarification process. As a result of the experimental investigations carried out on the distilled water (with the aim to avoid the concentration polarization phenomena and plugging the membrane pores) data were obtained, which permit to establish the following relationship for the membrane specific permeability determining with the account of the elasticity of the membrane material after appropriate mathematical treatment: $Q = \frac{R \cdot f}{8 \mu L} k_1 \Delta p e^{-\frac{\Delta p}{k_2}}$;

where k_1 and k_2 - are the empirical constants.

4.39

RATIONAL TECHNOLOGY AND QUALITY OF POULTRY MEAT BABY FOODSTUFFS

SHUMKOV E.G., M.KOROTAYEVA, V.KRAJNJAJA, G.CHERNOVA, V.CHLEVOVAJA, M.BRENTZ

Scientific and Industrial Poultry and Glue and Gelatine Center "Complex"
Moscow, USSR

The formulation and rational sterilization methods for "Bogatyr" canned paste and canned "Chicken Puree Scoop" for Schoolchildren were developed. The soft heat treatment regimes were used. After quick boiling chicken meat (20%) was mixed with blanched giblets (37%) and with some other components. Canned mixture was deaerated and preliminary heated in order to cut the time of high-temperature sterilization but with the same bacterium-lethal effect secured. Meat with valuable additions combined with rational technology permit to create high biological value products: valuable protein and easy-digestible fat ratio is 1:1 in paste and 1:0,7 in canned "Chicken Puree Scoop", amino acid content is near the optimal level. The biological value was determined by net protein ratio (NPR) and by net protein utilization (NPU). Canned "Chicken Puree Scoop" NPR is 5,52, paste NPR is 5,66, NPU is 59,5 and 61,1% respectively. It demonstrates these products' ability to ensure extensive growth of organism.

Microbiological quality of meat products and raw materials used. VII - Microbiological criteria proposed.

M. CATSARAS and D. GREBOT

Institut Pasteur de Lille, 20 Bd Louis XIV - 59000 Lille (France)
and Laboratoires de Recherche des Ets J. Morey et Fils - 71480 Cuiseaux (France)

The microbiological quality of raw materials used related to the quality of meat products fabricated was studied previously, for the five classical groups, on 2 000 samples of raw materials and 250 makings all in. Full results were published in previous congress: the XXV th, in Budapest (Hungry), in 1979, for crude unripened products and for products treated by ripening and desiccation; the XXVI th, in Colorado Springs (United States of America), in 1980, for cooked products and semi-preserved products, and the XXVII th, in Vienne (Austria), in 1981, for preserved products.

From all these results, it was demonstrated that three raw materials classes could be distinguished (CATSARAS and GREBOT, Bull. Acad. Vét. de France, 1981, 54, 503 - 511):

- a first class permitting obtention of a produce of good microbiological quality, but exceptions;
- a second class going to obtention of a produce of microbiological quality which is regularly insufficient;
- and a third class, of which use would guarantee fabrication of bad microbiological quality produces.

For each of products studied belonging to one of five great groups of meat products and for each category of microorganisms, the three classes of raw materials precedently enounced are defined by mean of inferior and superior numbers of bacteria by 1 g limits. These limits are propositions for eventual microbiological criteria for meat raw materials, and criteria so defined are examined. Discussion on this subject is open; it should be profitable for all the people.

4.41

Microbiological Characteristics of Artificially Structured Proteins (ISEP) Based on Blood Plasma

V.M.MATVEJTOHUK, N.N.LIPATOV, E.I.TITOV, N.Sh.NADASHVILI, A.S.MYAGKOV and I.A.ROGOV

The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR

This investigation is an independent fragment of a complex study into the problem of the development and application of structured protein meat replacers based on slaughter animals' blood plasma in combination meat products.

As test objects served four varieties of ISEP: plasma, soy/plasma, caseinate/plasma and soy/caseinate/plasma ones. It was found experimentally that the total microbial load of ISEP based on beef blood plasma is as follows: mesophils - 10^7 /g, thermophils and psychrophils - 10^2 ; the highest mesophilic load of $(0.69 \pm 0.04) \cdot 10^7$ and $(0.82 \pm 0.05) \cdot 10^7$ per gram being observed in caseinate/plasma and soy/caseinate/plasma ones, respectively. The major part of the microflora in the above products constitute spore-forming and sporeless aerobes and lactic acid bacteria - from 70.83 to 100% cases. In single cases, 4.17 to 16.67%, coli-type bacteria, staphylo-streptococci, proteus, spore-forming anaerobes and some others are also found.

The results obtained indicate a necessity of sanitary-&-hygienic evaluation of the components of structured protein replacers of meat due to their importance in ISEP exogenic microbial contamination with microflora including pathogenic organisms capable of causing food-borne intoxications and toxicoses.

It is allowed to store ISEP at 2-4°C for 24 to 48 hrs, longer storage at higher temperatures (20-22°C) resulting in their quick spoilage and making them unfit for use in combination meat products.

The use as food of the meat from pigs suspected of being contaminated by african swinne fever virus

MELO, R.S.

Departamento de Tecnologia das Indústrias Alimentares - LNETI - Rua Vale Formoso, 1 1900 LISBOA

It has been shown that the pigs suspected of being contaminated by african swine fever virus (SAFV) can be used as food, without the danger of being a way of spreading the virus. Meat should be processed into sausage products submitted to a thermic treatment with a lethal effect, for 60°C, greather, then 14 units.

SURVIVAL OF AFRICAN SWINE FEVER VIRUS IN PORK PRODUCTS

* A. Ordás Alvarez and ** M.A. Díaz Yubero

* Servicio Virología I.N.I.A., c/ Embajadores, 68, Madrid, Spain
** Subdirector General de Sanidad Animal, c/ Embajadores, 68, Madrid, Spain

Experiments performed on cooked and raw products made from pigs previously inoculated with African swine fever virus demonstrate that industrial heat treatment (pasteurization temperature) inactivates the African swine fever virus in cooked ham, and consequently these products do not constitute a possible source of transmission of this disease. In products which have not been heat treated (cured ham, "lomo": Spanish loin, "salchichón": Spanish salami, etc.), the virus remains active for three to five months, after which time it is rendered innocuous.

The use of electrical stimulation as an alternative method in the aging of meat in countries affected with foot and mouth disease virus (FMDV).

W. GARCIA VIDAL, C. CORREA, H. LAZANEO, S. HUERTAS y V. URRESTARAZU.

Meat Institute, Veterinary Faculty, Montevideo, Uruguay.

Aging of meat stored in a chilling room with a temperature not below + 2°Celsius during 24 hours is one of the requirements of the European Economic Community (EEC) for meat exporting countries affected with FMDV.

The objective of this regulation is to ensure that a pH below 6.0 has been reached before deboning, to guarantee the inactivation of the FMDV that might be present. This could eventually determine a delay in the traditional meat deboning production system for exportation.

The inactivation of FMDV in meat from artifitially infected animals has been studied in relation to the post mortem decrease of the pH in the muscle tissue.

Studies have been performed at two slaughter-houses that use electrical stimulation at industrial level with low and high voltage. The post mortem evolution of muscle pH was controlled in treated beef.

It was conclude that electrical stimulation reduces the time needed to obtain the pH values that guarantee the FMDV inactivation in muscle, resulting the possibility of using it as an alternative method in the aging of meat.

The Inspection of Pig Mesenteric Lymph Nodes: a Possible Source of Salmonella Diffusion.

M.L. CORTESI e G. CATELLANI

Istituto di Ispezione degli Alimenti di Origine Animale, Facoltà di Medicina Veterinaria, Napoli, Italia.

The frequent localization of salmonellae in the mesenteric lymph nodes of normally slaughtered pigs is a well established fact.

Three hundred samples of pig mesenteric lymph nodes were analyzed and, in a significant number of the positive samples, salmonellae were recovered from the sterile blades of the knives used for the incision of the lymph nodes.

The routine incision of pig mesenteric lymph nodes, which is statutory in many countries during meat inspection, represents a possible source of cross contamination and therefore requires proper hygienic cautionary measures.

4.46

Daily and annual microbial variation in a delicatessen plant

R.E. SIMARD and G. AUCLAIR

Département de sciences et technologie des aliments, Université Laval, Ste-Foy (Québec) G1K 7P4

The level of microbial contamination was measured on working surfaces in a delicatessen plant. Samples (swabs) were collected at 10 different sites on the production line during 10 different working days during a 12-month period. The level of contamination was established by numbering total bacteria at 35 and 22°C, total coliforms, fecal coliforms and streptococci as well as molds and yeasts.

Total bacteria counts at 35 and 22°C varied from 3.051 to 4.966 and 3.486 to 4.999 (log 10/77 cm²); total coliforms and fecal streptococci varied from 0.620 to 1.228 and 0.467 to 1.144 respectively. Sausage meat grinders, sausages stuffers and working tables were the heaviest contaminated areas. The total number of all microbial groups found on the working surfaces increased with the production period. Finally, the total number of any microbial group evaluated was higher during the hot summer months and lower in February and March.

Residual Viruses in Processed Meat Products: A Review

P.D. MCKERCHER, J.H. BLACKWELL AND J.J. CALLIS

Plum Island Animal Disease Center, USDA, ARS, S&E, P.O. Box 848, Greenport, New York 11944

There are a variety of meat products and by-products on the international market. Many of them when they originate in a country having an animal disease that does not exist in the importing country could serve as a means of introducing the disease. The disease agent may be carried in a product from a diseased carcass (primary contamination) or in products contaminated after processing (secondary contamination).

Animals can become infected with a variety of viruses and many of these viruses may be found in food products prepared from these animals. Viruses such as those of foot-and-mouth disease (FMD), swine vesicular disease (SVD), hog cholera (HC), and African swine fever (ASF) are a few of the viruses that pose a threat to the live-stock industry. Survival of viruses such as these in various food products prepared under commercial conditions are of economic importance and may lead to restrictions on importation of many products produced in countries where these diseases exist.

Countries that are beef exporters must deal with the eradication of foot-and-mouth disease (FMD). The presence of FMD in a country is a serious, if not complete obstacle to its exportation of animals and animal by-products to many importing countries. Certain of these products, because of the industrial processing they receive, are rendered free of infective virus. Other products that in the past may have been accepted by countries free of the disease, may subsequently be banned because of the acquisition of new knowledge which indicates risks in their importation.

SVDV can survive in dried salami and pepperoni sausages for at least 400 days and in processed intestinal casings for at least 780 days. ASF and HC viruses were recovered from dried salami and pepperoni sausages after processing but not after the required curing period. When partially cooked canned hams were heated to 69°C, none of these four viruses could be recovered. ASFV has been detected in processed hams from 3 to 5 months and in the bone marrow of these hams for as long as 6 months. FMDV has been recovered from salted bacon for 190 days and in ham fat up to 183 days.

FMDV has survived in lymph tissues after heating for 2 hr at 69°C, for 1 hr at 82°C and for 15 min at 90°C. However, FMDV was inactivated in meatballs and ground beef cooked respectively to internal temperatures of 93.3°C and 98.8°C in commercial flexible nylon tubes.

The marketing of various products after current curing periods does not apparently eliminate all risk of spreading virus diseases.

Non-Meat Products
LITHUANIA S.S.R.
Lithuanian Academy of Sciences
Grad, USSR
Lithuanian Academy of Sciences
Grad, USSR

Production of non-meat products
from proteins extracted from fish
and fish bones. The products are
in terms of their nutritive value
and processing. The authors
believe that the products are
of special interest for the
study of nutrition and health.

Use of Casein

S. DALY, N. ...

Dairy Research
Norwegian Food ...

Further studies on the ...
purpose of ...

Application of ...
the ...

Application

J. E. ...

X. VASSILOV ...

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NON-MEAT INGREDIENTS

Application of ...
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Non-Meat Proteins in Composition of Meat Sausages

BIDENKO M.S., BAIDALINOVA L.S., VERKHOTUROVA F.I

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography, Kalinin-grad, USSR

REKHINA N.I

All-Union Scientific Research Institute of Marine Fisheries and Oceanography, Kalinin-grad, USSR

Production of meat products can be increased using non-meat ingredients of animal origin: protein isolate and special mince produced from the fish of low food value, and non-fish sea organisms.

In terms of total chemical composition the contents of dissolved nitrous fractions and their spectroscopic characteristics, the number of adenite nucleotides, inosine acid and products of dissociation there is no difference between the studied non-meat ingredients and the beef. Besides, the protein isolate and special mince lose specific fish taste and smell during the process of preparation. Testing of protein isolate, special fish mince and non-fish sea organisms showed that they can be used in the recipes of cooked meat sausages without decreasing organoleptic indices at the ratio of 2%, 40% and 20% respectively of the weight of the sausage mixture.

5.02

Use of casein as a meat extenderS. DALE¹, K. STEINHOLT¹, S. Aa. GUMPEN² and T. HØYEM²¹Dairy Research Institute, Agricultural University of Norway, 1432 Aas-NLH, Norway²Norwegian Food Research Institute, 1432 Aas-NLH, Norway

Rennet casein is a by-product in the production of certain cheese types in Norway, and used for technical purposes or in feeds. A better utilization of this casein in human food is desired.

The effect of addition of dried and frozen rennet casein from cow's and goat's milk in meat sausages has been studied. Levels of 3, 6 and 9% dried casein, and 6, 12 and 18% frozen raw casein were used. Tested against meat sausage without casein addition, sensoric analyses by a trained panel revealed that several important characteristics were changed in a negative direction by adding increasing amounts of casein. Goat casein gave the largest negative effect. Release of fat by heating in a microwave oven decreased when the amount of dry casein was increased, and was considerably less for this type of casein than for the frozen casein.

Addition of goat casein to fermented sausage (Salami type) improved the rheological properties without interfering with taste. A reduced weight loss during production and storage was also noted, while pH was at a higher level.

5.03

Application of the lactic protein concentrate to the production of cooked sausagesIII. Effect of the protein concentrate on the stability of the meat emulsion and the stuffing for cooked sausages

K. VASSILEV and K. KOSTOV

Higher Institute of Food and Flavour Industries, 4000 Plovdiv (Bulgaria)

The effect of the lactic protein concentrate on the stability of the emulsion obtained in the stuffing for cooked sausages was studied in view of the fact that the stability of the meat emulsion was of great importance for the possibilities of obtaining high quality products.

It was found that the addition of protein concentrate in amounts of up to 10%, compared to the quantities of the meat raw materials, has increased the stability

of the meat emulsion. This stability has decreased as these amounts exceeded 10%. Therefore, it is advisable that the amount of the lactic protein concentrate introduced in the cooked sausages should not exceed 10% compared to the quantities of the meat raw materials.

5.04

Effect of the degree of meat replacement by soy protein isolate and sodium caseinate on quality of sausages

A.F. SAVICHENKO, R.M. SALAVATULINA and L.K. ZYRINA

The All-Union Meat Research Institute, Moscow, USSR

V.G. VYSOTSKY and A.M. SAFRONOVA

Institute of Nutrition of AMS USSR, Moscow, USSR

Comparative investigations were made of cooked sausage containing 40% of beef of the first grade and 60% of semilean pork (control) and also of test samples of sausages with meat replacement 12,5; 25,0; 50 and 100% by the equivalent amount of soy protein isolate or sodium caseinate.

In the experiments on white rats digestibility and biological value of the finished product were determined; the values of chemical score were calculated according to the scale of FAO/WHO.

Physico-chemical and organoleptical parameters of the finished product were determined. For each protein composition the comparison of the obtained values for physico-chemical and organoleptical parameters, of chemical score and biological value were made.

On the basis of the comparison the optimum of meat replacement by soy protein or sodium caseinate was chosen.

5.05

The Functionality of Soy Protein Concentrate in Canned Luncheon Meat

G. R. SCHMIDT¹, W. J. MEANS¹, D. F. HERRIOT² AND B. F. MILLER¹

¹Department of Animal Sciences, Colorado State University, Fort Collins, Colorado 80523 U.S.A.

²A. E. Staley Manufacturing Company, P. O. Box 151, Decatur, Illinois 62525 U.S.A.

The objective of this work was to determine the functional properties of STA-PRO 3200 soy protein concentrate in a water and fat emulsion that is blended into minced pork.

Batches of luncheon meat were formulated with either 4, 2 or 0% of STA-PRO 3200 soy protein concentrate; 2 or 1% NaCl; 0.5% sodium tripolyphosphate; 20% water; 30% pork backfat; 15% pork (50% lean) and 30% pork (90% lean).

The material was prepared by chopping the STA-PRO 3200 soy protein concentrate, water and pork backfat to 12°C. The lean pork and fat pork were minced and premixed with the salt and phosphate for three minutes in a vacuum mixer. The chopped material was then added to the mixer and vacuum mixed for an additional three minutes. The product was canned and either pasteurized or sterilized. The addition of 4% STA-PRO 3200 soy protein concentrate significantly reduced the release of moisture during pasteurization and sterilization. The addition of 4% STA-PRO 3200 soy protein concentrate reduced the cookout of fat and moisture in the pasteurized product by 31% and in the sterilized product by 33%. There was no effect of salt level. The pasteurized product had significantly less cookout than the sterilized product.

5.06

Influence of the addition of texturized soybean proteins to canned pork leans. Effects on the texture.

W. CANET (1), J. ESPINOSA (1) and R. ENAMORADO (2)

Instituto del Frío (1), Ciudad Universitaria, Madrid-3, (Spain)
Carcesa (2), José Ortega y Gasset, 40, Madrid-6 (Spain)

Objective texture measurements by means of an Instron Testing Instrument have been performed in order to determine the effects of four different types of texturized soybean proteins on the texture of canned pork - leans with two different grades of chopping.

In some cases a clear difference has been found between the control sample and the samples with added texturized soybean proteins, and it has been possible to determine which of the tested proteins changes least the textural characteristics of the product.

It has been found that there were correlations between the results of measurements made in mechanical tests and the ones obtained by a taste panel in preference-acceptance tests.

5.07

Use of textured Soy protein for the dry sausage production

I. AMBROSIADIS*, F. WIRTH* und H.J. SINELL**

*Bundesanstalt für Fleischforschung, Institut für Technologie, Kulmbach und
** Institut für Lebensmittelhygiene, Fleischhygiene und -technologie des Fachbereiches
Veterinärmedizin der Freien Universität Berlin

Inadequate supply for a great part of the world population with meat, demands new protein sources which are able to replace a part of the meat in some meat products, without changes of their characteristic properties. The sensorical and technological limits of the addition of these new meat substitutes are hence of great interest. In this study we investigated the replacement of a part of the lean meat in dry sausages, by textured soy protein (TSP), by physical, chemical and microbiological examinations. By the dry sausage production with TSP an hydration of this meat substitute with 75 % water was technological necessary. The best integration of the TSP was achieved through the mixing and cutting of this product together with the lean beef. By addition of 6 % dry TSP, which replaces 11 % of lean meat, there were not noticeable sensoric deviations from the standards. None of the panel noted a strange or unusual taste. From a technological standpoint additions up to 12 % of dry TSP were possible. That means 25 % lean meat can be replaced. These products had however an unusual cutting surface and a strange taste and flavor. Characteristic for the TSP batches was a rapid and larger pH-depression and a sour flavor and taste. This is due to the great carbohydrate content of the TSP. A reduction of the usual amount of the added carbohydrate was hence necessary and had a favorable influence upon the sensoric quality of the products. Also an 1 % addition of a special milkprotein preparation for the dry sausage production with TSP, proved to be favorable. The addition of TSP was more suitable for the production of long, naturally ripened dry sausages. The marked meat aroma development covered almost completely the specific soy odor and taste. Obvious deviations of the taste were observed however in the dry sausages with TSP, which were ripened for only a short period of time. The TSP addition has caused some microbiological changes which however were not untypical. The higher pseudomonas and enterobacteriaceae counts of the fresh sausage mixtures with TSP as well as the higher counts of lactobacilli and yeasts during the ripening did not change the typical ripening-process of these products.

5.08

The Free Short-Chain Fatty Acids in the fermented sausages produced with soybean protein supplement

A. JAKUBOWSKI, M. PANASIK, W. MAŁECKA, K. ŻAWADZKA

Institut for Meat and Fat Industry, Warsaw, Poland

The fermented sausages were produced on the basis of beef / 35% / pork meat / 35% / and pork fat / 30% /. The hydrated soybean grits or textured soybean protein was used to replace 10% or 20% of meat mass. After filling the sausages were immersed for 48 hours in the 8% brine and then placed in fume chamber in temperature below 22°C and relative humidity of 75-90%. The cold fuming was applied three times, 4-5 hours each. The processing was finished in 35 days, while pH of the sausages lowered below 5.2. No starters were used for fermentation. The fermentation was stopped by freezing the sausages below -35°C. The sausages were extracted by distilled water, ethylic and petroleum ether. The acidity of the extracts was estimated and the composition of free short-chain fatty acids was studied by GLC.

Some substitutes of animal proteins. Assessment of the nutritive value of the meat products manufactured using them

N. TYUTYUNDZHIEV, Z. TSANEVA, M. CHERNEV
Meat Technology Research Institute, Sofia, Bulgaria

Nine variants of combined protein preparations based on soya bean, wheat and maize protein were developed, with the purpose of obtaining a maximum nutritive and biological value. An interpretation is given of the different components and per cent ratios of the combined protein preparations in view of their amino acid composition and functional properties. Experiments were conducted with 2 types of perishable cooked and smoked sausages, frankfurters and a sausage, with the introduction of the different variants of the combined protein preparations in the form of substitutes. Results indicate that variants III, IV and VI are the most successful, since they have the most pronounced correlation dependence between the characteristics of fat content, water content, and total and digestible protein. On substituting 15% in the basic formulation, a lower per cent fat content is obtained, and a corresponding increase in water content and protein content. This is expressed best in variant IV, followed by variants III and VI. Higher values are obtained for all amino acids in both experimental sausage products. The substitution of meat proteins with the combined protein preparations in the frankfurters and the sausage, excepting variant VI, results in an increase in nutritive value and a balancing of biological value in the model specimens.

Investigation of the influence of porous lyotropic gels on the quality of combined communit-ed meat for sausage and finished products

V.T. DIANOVA, N.G. KROKHA and V.B. TOLSTOGUZOV
The Nesmiyanov Institute of Hetero-Organic Compounds of AS USSR, Moscow, USSR

During the last years there appeared a new trend in the world food production - manufacture of new kinds of foods. It includes the development of combined meat products, i.e. products obtained by joint processing of communit-ed meat and protein texturates. Protein texturates-porous lyotropic gels are obtained on the basis of two types of protein raw material by cryoconcentration that allows to get porous lyotropic gels with the given macro- and microstructure and with the complex of functional characteristics that are necessary for their use in cooked sausage production. It is shown that it is possible to add 40-50% of porous lyotropic gels without causing changes of rheological characteristics of communit-ed meat for sausage and of cooked sausage. Physico-chemical, organoleptical characteristics and nutrient and biological value of combination sausages were investigated. The allowed level of meat replacement by 30% of porous lyotropic gels is preconditioned by organoleptical parameters.

Examination of the influence of additive mixtures from the group of weak organic acids with common salt on the prolongation of shelf life of ground young beef

PETAR MODIĆ, LJUBICA BASTIĆ, RADMILA ŽIVANOVIĆ, VLADIMIR MILOŠEVSKI
Yugoslav institute of meat technology, Beograd, Yugosla

The authors examined the influence of the addition of additive mixtures (based on weak organic acids and their salts) and common salt on the prolongation of shelf life of ground young beef.

Cooled, namely thawed young beef with-different (higher or lower) initial bacterial contamination was used as raw material for this examination. The ratio of common salt and additives in the-mixture was determined on the basis of the previous examination results. Total quantity of the mixture was maximum 0.4% on the meat weight. All experimental and control groups were

kept in the refrigerator at 5°C (+1°) till the appearance of deterioration (odour change), namely 10 days maximum.

The obtained results have shown very favourable-activity of the mentioned mixtures both on the prolongation of shelf life of ground young beef and on its sensory properties. Shelf life of experimental groups in relation to controls was prolonged more than twice regardless of the initial bacterial contamination. Since the additives used for the preparation of mixtures belong to completely harmless components, the authors are of opinion that their application in the preparation of ground meat and ground meat products is justifiable.

5.12

Reducing of the cell count of spices by irradiation

István KISS

Central Food Research Institute, Budapest, Hungary

The microbiological contamination of the spices is considerable and therefore it often gives much trouble in the meat- and canning industry. The method for the reducing of cell count applied to-day most of all is the treatment with ethylene-oxide. On purpose to solve some problems in connection with the treatment we investigated the effect of the ionizing radiation. As a function of the radiation dose we established that the ionizing radiation results already in case of 3-10 kGy dose sufficient degree of reduction of the cell count.

At the different spices such as paprika /red pepper/, black pepper etc. further at mixtures of spices the number of mesophilic aerobic microbes decreases minimum by 2-3 orders of magnitude. We investigated also the shaping up of the count of mesophilic-, thermophilic aerobic spores, the enterobacteriums and moulds. We established that the heat sensitivity of bacterium-spores surviving the irradiation increased and as a consequence still further cell count decreasing is to be expected at the heat-treatment of the product. We made a comparison between the cell count decreasing effects both of the treatment with ethylene-oxide and of the treatment with irradiation. The irradiation is already at 5 kGy of the same effect like the treatment with ethylene-oxide applied in the practice. Her effect is in some respect more effective. On the basis of the chemical and organoleptic tests no significant change is to be observed practically in the spices. No change of taste can be detected in the products. The multi-generationfeeding-tests didn't show any injurious alteration. Mutagenic and potentially carcinogenic compounds were not detected by the different methods.

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When a substance is subjected to a process, it may be transformed into a product which may contain one or more by-products. The nature of these by-products depends upon the nature of the substance and the process. In some cases, the by-products are of great value and are sold or used in other industries. In other cases, they are of little value and are discarded. The study of by-products is important in order to determine their value and to find ways to utilize them.

PLANT

U. S. MARSHAL

Patent

When the process of a substance is completed, the product is usually a solid, liquid, or gas. The by-products are usually of a different nature than the product. For example, when a solid is melted, the by-products are usually gases or liquids. When a liquid is evaporated, the by-products are usually solids or gases.

BY-PRODUCTS. PROCESSING, UTILIZATION AND STABILITY

The use of by-products in industry is increasing. This is due to the fact that many by-products are of great value and can be used in other industries. For example, the by-products of the paper industry are used in the production of other products. The study of by-products is important in order to determine their value and to find ways to utilize them.

The over production of by-products is a serious problem in many industries. This is due to the fact that many by-products are of great value and can be used in other industries. For example, the by-products of the paper industry are used in the production of other products. The study of by-products is important in order to determine their value and to find ways to utilize them.

PRODUCTION

X. S. VOLLE

Scientific

The production of by-products is a complex process. It involves the use of many different techniques and methods. The study of by-products is important in order to determine their value and to find ways to utilize them. The production of by-products is a complex process. It involves the use of many different techniques and methods. The study of by-products is important in order to determine their value and to find ways to utilize them.

Use of mechanically deboned meat for manufacture of meat products

I. JUHÁSZ¹, R. SÁNTA², G. SELMECI³

1/ Salami and Meat Factory, Szeged

2/ National Technical Development Committee, Budapest

3/ County Inst. for Food Inspection and Chemical Analysis, Szeged, Hungary

When slaughtered animals are dismembered and deboned, as much as 5-10% of the total meat may remain on the bones. To eliminate the drawbacks /e.g. large work force requirement/ of the traditional deboning procedures /manual, mechanical, cyclic deboning/, continuous and intermittent operating mechanical equipment is finding increasing use in the meat industry.

Experimental production has been performed with PROTECON SELO and INJECT STAR deboning machines. The mechanically deboned meat has been used to prepare Bologna sausage, sliced meats, smoked sausage and black and white puddings. On the basis of the experimental results, a proposal is made concerning the ratio of this mechanically deboned meat that may be used, and the critical technological and dietetic-physiological parameters are defined: these are the meat protein content, the relative connective tissue protein content, the calcium content, the size distribution of the bone and gristle fragments, the FEDER index, the fat - protein index, and the sensoric properties.

6.02

Poultry Meat as an Ingredient in Beef and Pork Processed Meats

B. J. McAULEY, S. D. MOTT and F. JOHNSON

Purina Protein Application Laboratory, North Orbital Trading Estate, St. Albans, Herts. AL1 1XB, England

Within the overall patterns of meat consumption there is a general and significant increase in the utilisation of poultry meat. This applies equally to those established meat eating communities, such as the U.S.A. and Australia, and to those countries where meat eating habits are developing, for example Japan.

The use of poultry meat as an ingredient in traditional pork and beef processed meats is becoming increasingly widespread, together with the development of poultry products in their own right. It is tempting for the meat technologist to assume that the behaviour of poultry meat, and therefore its application, will be the same as for the red meats, beef and pork. Whereas this can often be so, there are a number of significant differences of great potential importance.

This paper presents results which highlight these basic physical/chemical differences, discussing both skeletal and mechanically deboned meats. Water binding capacity, texture and colour data, both sensory and instrumental, are shown together with the corrective measures which should be employed to optimise the economic use of poultry in red meat products. The use of complementary ingredients to assist in this, and also to even out the inherent variations in the behaviour and chemistry of poultry meat, is also discussed.

6.03

Production of hydrolyzates from lowvaluable products of poultry processing

Y.G. VOLIK, K.I. LOBZOV and V.P. TARAKANOVA

Scientific and Industrial Poultry and Glue-&-Gelatine Centre "Complex", Moscow, USSR

The possibility of rational utilization of lowvaluable products of poultry processing for feed hydrolyzates production is investigated.

The technology of obtaining feed hydrolyzates using native enzyme and enzymes of animal and microbial origin is developed.

The meal obtained by enzyme methods is analysed by physico-chemical and microbiological methods. Its biological value is determined.

The results of investigations showed that the parameters of the content of soluble nitrogen, the degree of hydrolyzate, solubility, digestibility, relative biological value and ratio of protein efficiency contained in the meal obtained by the new technology more than twice higher in comparison to the control samples.

INCORPORATION OF BONE PROTEIN EXTRACTS INTO COOKED SAUSAGES

H. W. Ockerman and H. A. Caldironi

The Ohio State University, Columbus, and The Ohio Agricultural Research and Development Center, Wooster, Ohio, U.S.A. and Instituto de Investigaciones Bioquímicas, UNS-CONICET, Bahía Blanca, ARGENTINA.

The possibility of including bone proteins into human food was explored. Bone protein extracts (BPE) were obtained from ground beef bones by an alkaline treatment with an NaOH solution (final pH approximately 10.0), tumbling (1 h) and storage at 4°C for 24 hours. After filtration through cheese-cloth, proteins were precipitated from the slurry by adding an HCl (0.5 N) solution to obtain a pH of 5.6. A pink, meaty paste was separated when the product was centrifuged at 3,000 x g for 10 minutes at 4°C. Emulsifying capacity (EC) values (ml oil/g total protein) were determined and compared to beef muscle protein (BMP) and bovine blood plasma protein (PP) values. The EC values for BPE were lower than the other 2 products but they were considered acceptable. Replacement of BPE with percentages of BMP resulted in improved EC values. When EC values were expressed as a function of salt soluble protein content, bone protein extracts showed similar values to beef muscle proteins. Water holding capacity (WHC) of BPE, BMP and PP showed a close correlation (0.99) with fat/protein ratio when the moisture was similar in all samples (79.9 ± 2.9%). EC and WHC values of bone protein extracts were improved by adding Na-pyrophosphate. An experienced taste panel evaluated cooked sausages (bologna) including combinations of BPE, BMP and PP with and without Na-pyrophosphate. Phosphate addition was undesirable in these sausage emulsions because it produced a soft texture probably due to increased WHC. Texture was also very sensitive to changes in the BPE proportions. Twenty percent BPE appeared to be the critical value. Incorporation of 0.4% Na-pyrophosphate to these samples resulted in a product whose texture was significantly softer (P<0.01) than the control. Flavor was objectionable when more than 20% bone protein extract was incorporated into the emulsions. Phosphate improved the flavor at these levels. Products including up to 10% BPE, up to 10% BPE plus 5% PP, and these combinations plus phosphate, were rated as being acceptable.

6.05

Utilization of animal blood for human consumption.
Sensory evaluation and measurement of surface colour of meat products, and determination of hemoglobin and myoglobin in raw materials.

ERIK SLINDE, JAN MIELNIK, MAGNI MARTENS AND ARNE TENNINGEN

Norwegian Food Research Institute, P.O.Box 50, N-1432 Aas-NLH, Norway.

Iron deficiency is a common nutritional disorder. Blood is particularly rich in heme iron, which is the biologically most available form of iron. Traditional blood products have a black colour. Generally, the colour of meat products reflects the total amount of pigment present, i.e. the concentration of heme, hemoglobin, myoglobin, and the amount of nitrosoheme, nitrosohemoglobin and nitrosomyoglobin formed from added nitrite.

By addition of blood (0-5%) to a meat emulsion, only minor texture and flavour changes in the products were measured by analytical sensory methods. Further, the products became darker, but addition of a smaller amount of blood (~2%) was assumed to give acceptable products, as far as colour is concerned. If a higher amount of blood was added (~5%), off-flavour and colour problems arised.

The colour of surfaces has been determined using integrating sphere reflectance spectrophotometry. By measuring the colour properties of the processed meat products and calculate the visual colour parameters (i.e. CIE 1932 or CIE 1976 L*,a*,b*), it is possible to achieve an objective measurement of the colour. These results show that it is possible to utilize blood as a colour ingredient in meat products.

It is also necessary to determine the amount of hemoglobin and myoglobin present in the raw materials. This has been done by high performance liquid chromatography using a molecular sieve column.

Ideas for the use of animal blood plasma.

OLE SIGMUND BRAATHEN, JACK AAGE NILSEN, RICHARD McCORMICK^{x)}
 Norwegian Farmers Meat Marketing Organization, Department of Technical Development,
 P.O.Box 96, Refstad, Oslo 5, Norway. Telephone: 47-2-15 05 10. Telex 71302.

1. "Braathen's omelet". An "eglike" product.
2. "Long-eg" made from pork plasma (white) and bovine plasma (yellow).
3. Fresh or frozen fresh animal plasma for feeding piglets and calves in order to obtain "immuno-effects".
4. Blood plasma used for dilution of semen from boars and bulls.

Blood plasma is obtained by centrifuging blood and approximately 60% plasma is obtained.

It is known that blood plasma may be used for making sausages and in the bakery industry as a substitute for eggs in products for people being allergic to eggs. Blood plasma may be used for making pancakes, wafers, etc.

The author got the idea to fry blood plasma and it was found that bovine plasma changed its partly red colour originating from the hemolyzed blood cells into an egg-yolk-yellow, attractive appetizing colour. Bovine plasma gave after frying a yellow omelet which might be served with chives. The salt content is increased during the frying process giving a suitable "salted" omelet.

Blood plasma from pigs is not turning into yellow, but turns white like heated egg-white during heating and might be used after being concentrated together with bovine plasma for making "long-eg".

The above mentioned idea is published in order to let as many as possible know about this nutritional and appetizing product. Practical tests based upon the four above mentioned ideas are carried out.

x) Kansas State University,
 Animal Science Department, Weber Hall- Meat Section,
 Manhattan, Kansas 66506, USA.

Investigation of quality of proteins obtained from nontraditional animal raw materials

L.I. STEKOLNIKOV, V.I. PIULSKAYA, V.Z. KRAKOVA, G.I. EDELMAN and V.P. KARPOVA

The All-Union Meat Research Institute, Moscow, USSR

A simple and effective method of getting edible protein from wastes of endocrine preparates production process (insulin, heparin, ATF) is developed. It is shown that cake from the production of these preparates contains 12-30% of proteins with a full complex of aminoacids, about 3% of ash and 4.5-14.5% of fat. The protein products obtained from cake contain more than 70% of protein, low toxic in acute tests on laboratory animals and wholesome from the sanitary-&-hygienic point of view. The preliminary tests showed the possibility of partial meat replacement by extracted proteins in cooked sausages production.

A complex enzymic preparate for meat tenderization

L.V. ALEKHINA and L.I. STEKOLNIKOV

The All-Union Meat Research Institute, Moscow, USSR

Experimental investigations for obtaining an original preparate from wastes of endocrine-enzyme production process were made. The obtained preparate with the conventional name "Testippan" contains the full complex of aminoacids of proteins and has a wide spectrum of enzymic activity: proteolytic, hyaluronidase, elastolytic. The range of optimum activity of the preparate is determined in relation to pH and temperature; it is shown that it is possible to retain catalytic activity of the preparate during storage for more than one year. Testippan is low toxic in acute and chronic tests on laboratory animals and wholesome from the sanitary-&-hygienic point of view. Investigations on fermentation of meat (semitendinosus, infraspinatus, supraspinatus) with Testippan in concentration of 0.025-0.1% of raw mate-

rial weight showed that tenderness of roasted ready-to-cook meats in pieces in comparison to control samples increased.
The Ministry of Health of the USSR gave a permission for utilization of Testipan for meat tenderization.

The contribution of pig fat and soluble proteins of various parts of the pig carcass to the Emulsifying (CE) and Emulsion Stability (ES) of meat emulsions obtained according to a Model System.

J. BELLO y Ma. C. ANCIN

Departamento de Bromatología, Toxicología y Análisis Químico Aplicado.
Facultad de Farmacia, Universidad de Navarra. Pamplona, España.

We have studied the contribution of soluble proteins from the shoulder-blade of pigs, along with some other parts of the pig's carcass (liver, kidney, heart and tongue), to CE and ES, when they are used in emulsions in which the internal phase is made up of oils composed of the oleins of pig fat.

We have determined the CE's using a variation of the SWIFT method and those of the ES using a modified version of the TWONSEND system.

From the values obtained it is deduced that the relation between the CE's and the proteic concentration of meat emulsions can be represented on a graph in the form of a linear function, within two consecutive periods, reaching a constant value in the system.

Moreover, all the other parts of the pig which were studied, offer CE values 117-136 % higher than those of the pig's shoulder-blade. However, the ES of these emulsions are reduced by 10 - 20 %.

Also, the initial proteolysis of pig meat proteins, obtained through the enzymatic activity of the papaine, increases the CE's and ES's of the emulsions, even though the breaking-down of the proteins nullifies completely the possible formation of emulsion.

The effect of alkali treatments upon thermodynamic values of the "order-disorder" conversion in collagen

O.O. BABLOYAN

The All-Union Meat Research Institute, Moscow, USSR

Collagen alterations, intensively alkali-treated by the regimens used in the manufacture of gelatine, belcosine and non-denaturated collagen solutions, were studied thermographically. An express differential thermal analysis of collagen was developed for varying pressures. It was shown that, by the area of endothermal effects on differential curves for collagen at 10-25 m Hg, it is possible to estimate the basic thermodynamic parameters of dehydration, melting, yield and destruction. Studies carried out allowed to obtain some new data elucidating the periods of collagen cooking and quantifying the limits and energy values of the thermal stability of the initial and modified hide derma; this is important for practical considerations concerning collagen-based material technology and application.

The Effects of some Chemical Compounds on the Removing of the Slime in Small Intestines

of Pigs.

E. COROMINAS, M. HORTOS y M. GARRIGA.

Institut Català de la Carn. Granja Camps i Armet. Monells (Girona), España.

This study is about the effect of some chemical compounds (highly diluted in soaking water) on the removing of the slime in small intestines of pigs.

The procedure is to remove the residual ingesta and to cut the intestine in similar pieces in order to be subjected to different treatments, using the following compound groups: Bases (Na OH, K OH, NH₄ OH, Ca (OH)₂); acids (HCl, CH₃-COOH, citri acid, lactic acid); salts (sodium citrate, sodium pyrophosphate, calcium carbonate, magnesium carbonate,

calcium chloride, magnesium chloride); detergents (S.D.S.) y chelate compounds (tetrasodium and disodium EDTA).
A simple device capable of obtaining by scraping the amount of slime detached in constant conditions (pressure, scraping angle, surface, etcetera) has been used.
Having obtained some results we try to improve the traditional methods of intestine cleaning by the use of chemical compounds in order to reduce the time employed, the cooking water temperature and to increase the quality of natural sausage casings.

6.12 .

Influence of preservation with sorbic acid on the quality of intestins stored at increased temperatures

M.M. KREKHOV, A.F. SAVTCHENKO, E.P. KONSTANTINOVA, M.M. ALIMOV, and N.A. ZHIZHOKINA
The All-Union Meat Research Institute, Moscow, USSR

Investigations on selection of antiseptic preservative for intestins were made. It was found that test batches of beef and pork rounds preserved with the mixture of salt and sorbic acid added in the amount of 1% to raw materials weight and stored at 20 C for three months corresponded to the established requirements by all parameters. The bacterial load of intestins, preserved with sorbic acid in test batches was two orders lower in comparison to the control; pathogenic microflora was not found.

6.13

Primary cure of hides of slaughtered animals by jets of liquids

I.A. ROGOV, E.E. APHANASOV, A.I. ROMANOV and G.J. KNEILLER
Moscow Technological Institute of Meat and Milk Industry, Moscow, USSR

Under examination there was the feasibility of using jets of fluids in the primary cure of hides of slaughtered animals. The use of such jets makes it possible to considerably intensify the sanitary treatment, the removal of flesh remnants and preliminary preservation due to the high speeds of processing, concurrent introduction of solutions of salt substances and to the combination of processing operations of cure and preliminary preservation. Research has been made in the influence of the following factors (working fluid pressure, angle of "attack", nozzle bore and overall intensity) on the efficiency of separate processes of treatment of hides. The efficiency of flesh remnants removal amounts to 90%. The final content of salt in the hides cured was within 6 to 8 per cent, that of moisture within 65 to 70 per cent. The histological analysis has shown that the jet cure does not impair the quality of hides.

SCIENTIFIC AND TECHNICAL

UNITED STATES DEPARTMENT OF AGRICULTURE

WASHINGTON, D. C.

1934

Technical Bulletin

Number 100

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PACKING, PACKING AND STORAGE OF MEAT AND MEAT PRODUCTS

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CARBOXYMETHYLCELLULOSE INFLUENCE UPON THE PROPERTIES OF COLLAGEN DISPERSIONS AND PROTEIN SAUSAGE CASINGS

PANKOV N.F., S.KOBYAKOVA, G.DUMA, V.G.BELORUSSKIY

Scientific and Industrial Poultry and Glue and Gelatine Center "Complex"
Moscow, USSR

Carboxymethylcellulose sodium salt (Na-CMC) 70/450 influence upon the basic properties of collagen dispersions and casings (films) is studied. Na-CMC addition to the collagen mass for protein sausage casings production is based on its good film and stable dispersions developing ability in solutions with pH=2,0 - 3,0, water solubility, and it is harmless for human consumption. The procedure for mixing of mass components for sausage casing production with 11-12 per cent of dry matter content is developed. Na-CMC is injected as a 3-6 per cent dispersion. The dependance of collagen dispersions viscosity and mechanical firmness and model films welding temperature upon Na-CMC content is studied. It is determined that more than 10% addition of Na-CMC to dry matter, lowers the dispersions viscosity and films' mechanical firmness. The casing with Na-CMC was successfully tested in sausage production.

7.02

A new gelling collagen additive for the manufacture of meat products

E.F. ORESHKIN, M.M. MIKHAILOVA, O.O. BABLOYAN, E.G. BOBRIKOVA and S.K. KHARYBINA

The All-Union Meat Research Institute, Moscow, USSR
V.V. SUKHOTSKAYA

The Tcherkassy meat packing plant, Tcherkassy, USSR

When producing some meats (jellied meat, head cheeses, etc.), as a gelling component food-grade gelatin is used, its preparation being time and labour consuming. Gelling additive technology is based on chemical pre-treatment of collagen-containing material. The thus produced additive is practically sterile. The quality of pasteurized canned ham with different amounts of the gelling additive incorporated was evaluated physico-chemically, biochemically, microbiologically and organoleptically. The amount of the additive was found to influence the level of volatile fatty acids, carbonyls, lactic acid and the organoleptical scores of the finished product. Gelatine replacement with the above additive allows to yield canned ham which is similar to the one with gelatine added.

7.03

The study of free formaldehyde migration into sausage mixture

L.A. ABRAMOVA

Scientific and Industrial Poultry and Glue and Gelatine Center "Complex", Moscow, USSR

One of the ways of food contamination is migration of some harmful substances from the package. Free formaldehyde residue quantities in sausage mixture in natural, cellophane and protein casings with the different free formaldehyde content (by the index of migration to water) were studied. Three-layer film (cellophane-aluminium foil-polyethylene) was used as a test, excluding smoke effect on sausage mixtures due to diffusion processes. The effect of some processing stages on free formaldehyde migration changes was also investigated. It is shown that free formaldehyde migration level from protein sausage casings doesn't result in its accumulation in cooked, cooked and smoked and half-smoked sausages. Free formaldehyde content level depends on sausage mixture type and its formulation, particularly on the salt content, and doesn't depend on the casing type. Free formaldehyde accumulation is possible in the surface layer of half-smoked sausages due to smoke diffusion through the casing.

Bacterial Growth in Exudate of Vacuum Packed Beef

L. DE ZUTTER and J. VAN HOOF

Institute of Meat Hygiene and Meat Technology, Faculty of Veterinary Medicine, State University of Ghent, Belgium

During storage of vacuum packed meat, meat juice exudes and accumulates mainly in folds of the film beside the meat. The objective of this study was to determine the growth of bacteria present in the exudate of vacuum packed beef stored for extended periods of time.

In the course of storage exudate was always obviously higher contaminated than the meat surface. Initial (at 1 week of storage) exudate contained a high number of bacteria (log N/ml: 6.59). At 3 weeks total bacterial counts reached 8 log per ml exudate. Further storage led no more to an increase of the number of microorganisms. During the first weeks of storage the bacterial population consisted mainly of *Pseudomonas* spp. and *Brochothrix thermosphacta*. After 5 weeks *Lactobacillus* spp. reached a number which was equal to that of *Brochothrix thermosphacta*.

Lactobacillus spp. were the most common organisms on meat surfaces. Both other types of bacteria showed only a limited growth. From a storage time of 3 weeks a sour/acid odour was observed on opening the packs. With exception of the pieces stored for 10 weeks, this odour dissipated in aerobic circumstances at 2°C. The source of this odour was probably due to biochemical changes caused by the high number of bacteria in the meat juice.

7.05

Extended frankfurter shelf-life under nitrogen

R.E. SIMARD, L. LALEYE, B.L. LEE and R. HOLLEY

Département de sciences et technologie des aliments, Université Laval, Ste-Foy (Québec) G1K 7P4

Frankfurter shelf-life was studied by packaging under nitrogen and using vacuumized frankfurters as control. The effect of light and dark storage for periods of 49 days at -4, 0, 4 and 7°C was also compared. The frankfurter quality was assessed by monitoring changes in microbial counts (lactobacilli, psychrotrophics, molds and yeasts as well as coliform bacteria) and physico-chemical characteristics (extract release volume, gas composition, pH, colour and odour).

Nitrogen-packaged frankfurters had slightly higher psychrotrophic and lactobacilli counts than vacuum ones and counts were lower under light than under dark. After 14 days, vacuum-packaged frankfurters stored at 3°C under light were considered unfit to eat while nitrogen packaged frankfurters under identical conditions were still suitable for consumption after 28 days. Frankfurter greening and discolouration seldom develop under nitrogen.

7.06

Growth of bacteria at 1°C on beef stored in controlled atmospheres of mixtures of O₂, CO₂ and N₂ and its relevance to vacuum packaging

B. G. SHAW and J. RONCAROLI*

Agricultural Research Council, Meat Research Institute, Langford, Bristol, BS18 7DY, UK.
*Present address: Yatay 237, Morun, Buenos Aires, Argentina

The growth of different groups of bacteria has been monitored on naturally contaminated beef muscle stored at 1°C in controlled gas atmospheres containing 0, 1 or 3% O₂ each in combination with 10, 20 and 40% CO₂ plus the residue of N₂.

Brochothrix thermosphacta was the predominant organism on almost all samples stored in gas mixtures containing 1 or 3% O₂ whereas lactic acid bacteria became dominant on samples stored without O₂. At each O₂ concentration numbers of *B. thermosphacta* were lowest in the mixture containing 40% CO₂, but CO₂ had little effect on the growth of lactic acid bacteria. Numbers of Gram-negative bacteria were highest in the 3% O₂ + 10% CO₂ gas mixture.

These results demonstrate the importance of both low O₂ and high CO₂ concentrations to the preservation of meat in vacuum packs in which *B. thermosphacta* and Gram-negative bacteria are widely regarded as more potent spoilage organisms than lactic acid bacteria.

Qualification of packed back-bacon

FERENC HAVAS
Ministry for Agriculture and Food Industry Service of Hygienic Control, Budapest.

Chemical and microbiological properties of pickled, smoked, sliced into PE foil vacuum-packed back-bacon were investigated when storing them at temperatures of 0°C , $+6^{\circ}\text{C}$ and $+17^{\circ}\text{C}$.

From among parameters determining biological quality, the ratio of the water- and protein-contents did not reach values higher than 3,38. The protein-content of the fat-free part is $x: 24,75$, $s: - 1,71$. The correlation between these parameters is high, and in a graphic representation they depend on each other nearly linearly. The determination of any foreign water or other foreign material content failed in all cases. A nitrite content of 14 mg/kg has not been surpassed.

Water content, a factor strongly influencing conservability, is between 43,57 and 62,25 %, sodium chlorid content between 2,15 and 4,30 %, maximum fat quantity is 35 %, minimum 14 %. The value of the water activity has an average of 0,910, within the limits of 0,848 and 0,960. The brine concentration is between 4,2 and 8,0.

In the microflora, a value of $10^6/\text{g}$ was reached by the psychrotolerant bacteria in the 7th - 9th weeks. The psychrophiles, the halophile and halotolerant germs reached this order of magnitude in one and in two cases, respectively, at $+6^{\circ}\text{C}$. The number of the lipolytic bacteria did not surpass an order of magnitude of $10^4/\text{g}$. Gemmating fungi reached the value of $10^5/\text{g}$ only in the 9th - 10th weeks. Coliform germs, *Staphylococcus aureus*, enterococci, enterobacteria, lactobacteria and mesophile saprophyte germs as well as *Clostridium* never reached the lowest demonstrable limit /i.e. $<10/\text{g}$ and $<100/\text{g}$ / at temperatures 0°C - $+6^{\circ}\text{C}$. *Salmonellae* could not be demonstrated from a sample of 25 g.

The back-bacon conserved its properties at 0°C - $+6^{\circ}\text{C}$ for the organs of senses for about 8 weeks. From that time on colour defects occurred, and from the 10th-11th week, the kreiss-test has shown a low level of rancidity.

Microbiological, chemical defects or those observed by the senses of organs at $+17^{\circ}\text{C}$, prevent a storing of the foil-packed back-bacon without cooling. In our opinion sliced and PE foil-packed back-bacon can be preserved at temperatures below $+6^{\circ}\text{C}$ without any quality and food hygienic risk for 4 - 6 weeks.

RESIDUES IN MEAT AND MEAT PRODUCTS

Cadmium, lead and copper content in meat products.

N. YEÑEZ, R. MONTORO, R. CATALA y J. FLORES

Instituto de Agroquímica y Tecnología de Alimentos. C.S.I.C. Jaime Roig 11, Valencia- 10, España

The cadmium, lead and copper levels of different cooked meat products of wide consumption and industrial interest (cooked ham, luncheon meat -"fiambre"- frankfurters, mortadella and liver paste) are studied, in order to contribute to the establishment of limits of tolerance for trace metals. Several representative samples from each kind of product, purchased at the market, are analyzed by atomic absorption spectroscopy. The average concentrations of cadmium detected in the different products are lower than 0.05 mg/kg, with some values slightly higher in cooked ham.

For lead the average levels are around 0.2-0.3 mg/kg, although in some isolated sample of canned liver paste values higher than 2.0 mg/kg are detected.

With reference to copper the concentrations are similar for the different products -0.75 to 1.0 mg/kg- with the exception of liver paste. In this product an appreciable metallic accumulation is detected, with an average level near 10.0 mg/kg.

8.02

Evaluation of some metals in canned meat: variations in relation to storage time.

B. PARSISI, R.M. TURI, L. PALINI

Instituto di Scienze degli Allevamenti e Controllo dei Prodotti di Origine Animale. Università di Torino - ITALY.

Canned meat stored for different periods of time (1, 2, 3, 4, 5, years) have been examined in order to evaluate the possible transfer to the meat of the components of the alloy of the containers (Tin, Lead, Copper, Zinc and Iron). Analysis have been performed on samples taken in different layers and different points of the can in order to put in evidence the modalities of the migration of the above-mentioned metals.

8.03

Residual Levels of Nitrite in Spanish Sausages and Cold Meats.

F. RINCON LEON, G. ZURERA COSANO, L.M. POLO VILLAR y R. POZO LORA

Departamento de Higiene, Inspección y Microbiología de los Alimentos, Facultad de Veterinaria, Universidad de Córdoba, España.

A study of the residual levels of nitrite in a total amount of 339 samples of meat products produced in Spain and acquired in commercial establishments in Western Andalucía has been carried out. The result has been determined following the International Norm ISO/DIS 2.918. The results are grouped in a table. These results show three groups: a) sausages with a low content of residual nitrite (loin in a skin), b) sausages with a medium content of residual nitrite (salami and spanish sausage), and c) sausages with a high content of residual nitrite (sausages, in a plastic container and tinned). Due to the slight differences found, we find (it impossible to make a similar classification) for the cold meats under research. Two samples of mortadella have shown residual levels of nitrite superior to the limit fixed by the legislation, the rest of the samples contain nitrites within the allowed levels.

8.04

Research on the Fungicide Hexa-chlorocene and other organochlorine pesticides in tinned pork products.

R. POZO LORA, L.M. POLO VILLAR, M. JODRAL VILLAREJO y A. HERRERA MARTEACHE

Departamento de Higiene, Inspección y Microbiología de los Alimentos, Facultad de Veterinaria, Universidad de Córdoba, España

Organochlorine pesticides have been under research, working on 47 samples of tinned pork products of Spanish fabrication. They have been chosen including nine brands three different types of products: "lean pork", "baked ham" and "cold ham". The following pesticides have not been detected: chlordane, dieldrin, aldrin, heptachlore

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epoxide, TDE (DDD), op'DDE and endrin. The following have: synthetic fungicide HCB, and alpha and beta HCH, - heptachlore, pp'DDE, pp'DDT. HCB has been detected in a 76'6 per 100 of the samples, HCH total in a 31'9 per 100, and DDT total in a 4'25 per 100. Five samples showed levels of heptachlore superior to the limits recommended by FAO/OMS, one of the samples showed a dangerous level of DDT total, and another (HCB) went over the a limit allowed by FAO/OMS.

8.05

INVESTIGATION OF CURED MEAT PRODUCTS FOR THE PRESENCE OF N-NITROSTHAZOLIDINE

W. Fiddler, J. W. Pensabene and W. I. Kimoto

Eastern Regional Research Center, Philadelphia, Pennsylvania 19118, U. S. A

N-nitrosothiazolidine (NTHZ) has been isolated and detected in extracts from fried belly bacon initially analyzed by the U.S.A. official mineral oil distillation - Thermal Energy Analyzer procedure and confirmed by low resolution gas chromatography - mass spectrometry. However, the addition of NTHZ precursors or the use of inhibitors known to prevent the nitrosation reaction indicated that most of the NTHZ was artifactually formed as a result of the analytical procedure. Therefore, a non-thermal dual-column chromatographic procedure, free from artifactual nitrosamine formation, was developed that had a standard deviation for repeatability and reproducibility of 1.20 and 1.55 ppb, respectively. Using this procedure, NTHZ was also confirmed by low resolution mass spectrometry. A limited preliminary survey of cured meat products indicates that NTHZ is present only in bacon, both dry cured and pump-cured, but very infrequently even in this product. There was no apparent change in NTHZ concentration in bacon subjected to different cooking conditions. When present, considerably more NTHZ was present in the lean tissue rather than in the adipose tissue. The effect on NTHZ concentration after addition of potential amine precursors, thiazolidine, cysteamine, cystine and methionine or nitrite to nitrite-free and nitrite containing bacon prior to frying will be discussed.

8.06

"In vitro" Action of DES in Cell Cultures.

A. BORREGON, F. SANZ, A. SANTA MARIA, J. SALAS, M. MARTIN, C. BECERRIL, M. BAREA, C. CABALLO, M. FERNANDEZ, A. GARCIA, and M.T. POLLASTRINI

Centro Nacional de Alimentación y Nutrición, Majadahonda (Madrid), Spain.

A study of DES in cultures of human cells with fusiform fibroblastic morphology was made.

The cells used in the study came from primary cell lines (Fc and FH) from skin and muscle and liver, respectively.

Varying concentrations of DES were employed, ranging from 0,2 ppb to 15 ppm, and in each case cell viability, morphological alterations, and chromosomal abnormalities were examined.

Significant alterations in the cells were observed at DES concentrations higher than 2 ppb.

The most frequently observed abnormalities in the chromosomes were ring formation and polyploidy.

Alterations in the cells and chromosomal abnormalities were found in more than 50 % of the cells at concentrations of over 10 ppm, which was considered highly significant.

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QUALITY CONTROL AND NUTRITIVE VALUE
OF MEAT AND MEAT PRODUCTS

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Effects of Technical-Technological Alterations on Quality

Dr. István SÁNTA

Central Enterprise for the Organisation of Agricultural- and Food-Industries

Budapest, Hungary

We inform you about a research work which was accomplished in the field of meat industry. We examined such activities which are most important from the point of view of export. At all technological lines the production process was examined from the point of view of quality. General conclusions:

- 1/ There are results in the field of complex quality-regulating systems, but still there is not suitable practice in evaluation the technical authenticity of producing equipments. Firstly it refers to investigation from point of view of quality sensitiveness.
- 2/ Production-technological cross-sections are not necessarily equal to quality-sensitive cross-sections.
- 3/ We have to take all important production phases into account independently of their mechanical or manual characters.
- 4/ According to our experiences all basic production phases have significant effect on shaping quality.
- 5/ Nearly half of analysed production phases is manual operation.
- 6/ We have to pay greater attention to those cross-sections /Q+C/ which correspond with each other from both points .
- 7/ It is necessary to improve the degree of mechanization of technological processes in order to establish a greater production sensity and a complex quality controll system.

9.02

Effect of genotype and age on the quality of beef

ENDRE SZÚCS*, ANNA NAGY and ANDRÁS CSIBA

*Research Centre for Animal Production and Nutrition, Gödöllő,
Hungarian Meat Research Institute, Budapest, Hungary

In muscle samples taken from m. longissimus dorsi, m. semitendinosus and m. psoas major chemical composition /moisture, protein, fat, connective tissue, total pigment/ has been determined and tested by two and/or three way classification analysis of variance. Hungarian Spotted and Holstein Friesian bull calves and/or growing-finishing bulls were slaughtered at the age of 200, 350, 500 days and Herefords at the age of 500 days. Considering several parameters of chemical composition significant differences have been established between genotypes, age groups and muscles. Fat content, total connective tissue, and total pigment increased as affected by age. In case of Holstein Friesian percentage of fat, total connective tissue and total pigment were higher as compared to Hungarian Spotted breed.

CARCASS AND MEAT QUALITY OF CHAROLAIS AND ZEBU STEERS

L. MÜLLER, L. F. P. BORGES and L. A. PFAU

Universidade Federal de Santa Maria - Departamento de Zootecnia, Santa Maria,RS,BRASIL

Twenty Charolais and fifteen Zebu type steers were raised during growing and finishing period on grass with some hay and corn supplementation during the winter time. At slaughter with 2.5 years of age, they presented similar carcass weight, 221 and 229 kg for Charolais and Zebu respectively. No significant differences were found for conformation, area of the muscle Logissimus, carcass length and thickness of cushion. Zebu steers presented a better finish and more length in the leg. The Charolais presented a better proportion of the pistol cut (8 ribs), 50.8% against 49% in the Zebu, with latter being heavier in the forequarter. Marbling, colour and texture of the lean were similar for both groups. Charolais steers however produced more tender steaks either by Warner-Bratzler Shear or taste panel evaluation that were also more juicy and ranked higher in overall palatability.

Possibility for determination of the commercial storage time of pork and beef on the basis of the work of Wenzel, Srerod and Gissel

G. SELMECI¹, G. GALAMBOS²

1/ County Food and Chemical Quality Control Institute, Szeged, Hungary
2/ József Attila University, Szeged, Hungary

A knowledge of the post mortem "age" of packaged and unpackaged fresh meats is important for both consumer and trader. Post mortem biochemical changes in meat initially affect its quality favourably, but later unfavourably. To protect the customer, official quality control institutes should be able to guarantee the period during which commercially available meat retains its quality. Of the post mortem biochemical changes, several parameters /e.g. glycogen, lactic acid, nucleic bases, pH, etc./ appear suitable for determination of the post mortem "age" of meats. Following the very noteworthy results of Wenzel at the University of veterinary Sciences in Hannover, we studied the post mortem changes in hypoxanthine and inosine as a function of time in meats stored at 0-2, 5, 7 and 10°C. Linear /y=a+bx/ and exponential /y=ae^{bx}/ regression curves can be fitted to the increase in hypoxanthine during 24 h /Hx/24/, to its reciprocal, and to the inosine decrease per unit hypoxanthine increase /in/Hx/. For instance: for mixed pork stored at 5°C the linear regression lines calculated from the average values of Hs/24, 1/Hx/24 and In/Hx are y = 18.19x + 23.9 /r²=0.91/, y = -1.3432294151 . 10⁻³x + 0.02 /r²=0.82/, and y = -1.29 x + 11.51 /r²=0.91/. The equation of the exponential curve calculated for Hx/24 is y = 49.8 e^{0.15x} /r²=0.91/. We recommend introduction of the indices Hx/24 and In/Hx for control of the post mortem "age" of pork and beef stored at 0-10°C.

Variation of the collagen content of beef muscles and consequences on the quality of the resulting meat products.

B.L. DUMONT

Laboratoire de Recherches sur la viande de l'I.N.R.A, C.N.R.Z., 78350 Jouy en Josas, France

The C index defined by the value of the ratio :

$$\frac{\text{N from hydroxyproline}}{\text{N total}} \times 10^3$$

was used to study the effect of the variation of the relative amount of collagen in the whole muscle proteins of beef samples from different muscles more or less trimmed (epimysium and tendons) off. The extent of muscle trimming significantly affects the C index value of trimmed products as the C index is about 15 to 20 times higher in tendons than in the internal part of muscles. C has been measured in 8 muscles (adductor (Ad), longissimus dorsi (Ld), psoas major (Pm), rhomboideus (Rh), semitendinosus (St), splenius (Sp), teres major (Tm) et triceps brachii caput laterale (Tb)) from 34 carcasses.

The observed range of C was 0,9 to 8,07. Analysis of the variation showed an effect of the type of muscle (Pa < Im < Ad < Ld < St < Sp < Rh < Tb), a large intra-type of muscle variation (variation coefficients were 12 to 28 % according muscles) and an influence of conformation. The interest of knowing C to assess meat quality is discussed. With minced meat, C gives information on the type of muscle used and (or) on the extent of trimming. If, on the whole, the shear forces are related to C it is not possible to use the actual values of C for grading meat on tenderness unless the anatomical type of muscle is very well known. C values could be proposed to set the limit between meat cuts for quick cooking (i.e grilling or roasting) and for braising, stewing and processing.

9.06

Techniques for the Accurate Measurement of Ultimate pH of Meat

G.V. PETERSEN.

Department of Veterinary Pathology and Public Health, Massey University, New Zealand.

The ultimate pH of muscle is regarded as one of the more important parameters affecting the quality of meat and it has become customary to use the *M. longissimus dorsi* (LD) as an indicator muscle. The present studies were undertaken to develop more precise methods for measuring the ultimate pH values in the LD of meat animals during commercial slaughter and dressing operations.

Meat samples were obtained from either condemned sheep carcasses or from wholesale export cuts from beef. All pH measurements were obtained with a combination glass electrode after homogenisation of samples in an approximately 1:10 dilution of 5mM iodoacetate.

Comparisons between 24 hour and 48 hour post mortem pH values of beef cuts indicated that the mean values obtained at the latter time were significantly lower than those obtained at the time of cutting and packaging (24 hours post mortem). A modified surgical biopsy instrument was developed for taking plug samples of approximately 2g from the LD without mutilating the carcass. When such samples were incubated under liquid paraffin for 24 hours at approximately 20°C, the pH values obtained were found to be an accurate measure of ultimate pH of the muscle at the site from which the plug samples were taken. Comparisons between two different solutions for homogenisation (iodoacetate/water and iodoacetate/0.15M potassium chloride) indicated that these two methods had the same degree of precision and that it is possible to predict very accurately the slightly lower iodoacetate/KCL values from the iodoacetate/H₂O values. Although differences were observed in pH values between different sites within the LD of both sheep and cattle, it was shown that such differences appear to occur at random and therefore the site of sampling of this muscle is of little importance in relation to precision of the test.

9.07

ACTIVITY OF WATER IN PROCESSES OF DRYING & FREEZING OF MEAT PRODUCT

Knemovnikov B.P., Brazhnikov A.M., Antipov A.V., Groudzinsky V.V.

Moscow technological Institute of Meat & Dairy Industry of the Labour Red Banner Order, Moscow, USSR

It is necessary to know the activity of water in the product. An and the energy of nonextracted & nonfrozen moisture E. for the scientifically substantiated choice of art and regime of process conservation, creating of the quality model of the preserved product.

The existing methods of experimental definition an and E don't meet modern requirements. The suggested method is based on the quasistative representation of the process of preservation and allows to define a \bar{w} and E in the process of preservation.

9.08

A Rapid Determination of Composition and Commercial Value of Meat Products by Infrared Reflexion Analysis.

E. HAUSER, U.WEBER, and B.ZESIGER

Swiss Federal Veterinary Office, Bern (Switzerland)

rd Information: Refined Regression Curves for scalded sausage products and fermented meat products. The analysis consisted of a 150 samples each, in which the contents of moisture, raw protein, collagen, ash and collagen-free meat protein were determined (moisture: air drying method, 105°C, 2h; fat: modified Soxhlet method; raw protein: modified Kjeldahl method; collagen: Hydroxyproline method according to Stegemann; ash:

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Heraeus oven, 550°C). The Infrared Reflexion Analysis of the mentioned meat products using the "Technicon 400 Infra Alyzer" shows very satisfying results in regard to accuracy and rapidity.

9.09

Automated analysis of starch in cooked sausage.

M. HONKAVAARA and R. TUOMINEN.

Finnish Meat Research Centre, Hämeenlinna, Finland.

The weakness of quality control methods for determining the starch content of cooked sausage has been the fact that they are slow and have to be carried out manually. The present study has led to the development of a routine method, suitable for use with a Technicon Auto-Analyzer II, which permits the native potato starch content of sausage to be determined within the hour. Once the sample has been prepared (about 35 minutes), sampling, hydrolysis of starch to glucose, and determination of glucose all take place automatically. The sample is analysed in two stages: the first stage is to determine the content of reducing sugars in the sample prior to hydrolysis (sample blank) and the second is to determine the quantity of reducing sugars formed by enzymatic hydrolysis. The starch content of the sausage is obtained by subtracting the blank value from the value obtained after hydrolysis and comparing the result with the starch standards.

The method is linear and gives good reproducibility for samples of 1,5 - 2,0 g containing 0-10 % starch. The lactose present in powdered milk has not been found to interfere with the determination. The results obtained with the reference (gravimetric) method and the new method did not differ statistically significantly ($p < 0,05$), and their correlation was highly significant ($p < 0,001$). The Technicon method gave a recovery of 85 % compared with 71 % for the reference method. This is because the latter method gave excessively high results for low starch contents (0-3 %).

9.10

Quantitative Analysis of Vitamin A in Meat Products by High Yield Liquid Chromatography.

T. REUVERS.

Centro Nacional de Alimentación y Nutrición, Majadahonda (Madrid), Spain.

A method for determining the Vitamin A content of liver pâté has been developed. The technique was carried out in a radial compression C18 column, using a methanol-water mixture as the carrier phase and a U.V. detector locked on a wavelength setting of 313 nm.

The results of high yield liquid chromatography are compared with those obtained using the Carr-Price colourimetric method.

In the conditions employed, the method is applicable over a wide range of concentrations of Vitamin A in a sample (100 - 20 000 I.U. %).

9.11

Control of colouring value of seasoning paprika with an automatic analyzer.

É. TAKÓ¹, G. SELMECI², A. ACZÉL², J. JUHÁSZ³

1/ Agricultural and Food Min., Budapest, Hungary 2/ County Inst. for Food Inspection, Szeged, Hungary 3/ LABOR MIM Sc. Instruments L. E., Budapest, Hungary

For meat-processing plants, not only the seasoning effect of paprika is of importance /this may be measured well with sensoric methods/, but also its colouring value, which is proportional to the colouring content of the paprika. Paprika of excellent quality must be a "fiery" red. The quality and price depend sensitively on the colouring content. It is therefore important for meat plants that the colouring value of paprika, i.e. its dye content, be checked with serial measurements immediately before use. In our work we have studied the spectra of the two most important coloured constituents of

paprika /capsanthin and beta-carotene/ in solution in acetone, benzene, benzine, n-hexane, cyclohexane and petroleum ether. The red capsanthin gives an absorption maximum at 470 nm in acetone, at 485 nm in benzene, at 472 nm in n-hexane, and at 473 nm in petroleum ether solution. The yellow beta-carotene gives an absorption maximum at 451 nm in petroleum ether, at 455 nm in cyclohexane, and at 465 nm in benzene solution.

The ASTA procedure and the BENEDEK method are used to determine the colouring value of paprika. These involve photometry on acetone and benzene extracts, respectively, of the paprika. We have constructed an automatic analyzer suitable for serial analysis of the colouring value of paprika with the use of acetone, benzine, n-hexane, benzene, cyclohexane and petroleum ether solutions. Measurements are made at the points of intersection of the capsanthin and beta-carotene spectra recorded on solutions in the different solvents, e.g., at 477 nm for benzene, at 461 nm for benzine, and at 462 nm for petroleum ether solution. The main parts of the automatic analyzer: a sampling module, a pump module, an analytical module, a photometer, a recorder, a printer /and a microcomputer/.

With this automatic analyzer, 300 measurements may be made in 8 hours. Agreement with the manual procedures /ASTA and BENEDEK methods/ is very good. Results for comparative measurement series on paprika millings belonging in different quality categories were as follows: $n_1 = 10$, $s_1 = 0,029$ and $0,028$; $n_2 = 5$, $s_2 = 0,018$ and $0,026$; $n_3 = 5$, $s_3 = 0,031$ and $0,038$; $n_4 = 5$, $s_4 = 0,037$ and $0,024$; and $n_5 = 5$, $s_5 = 0,019$ and $0,025$. On the basis of the F test, at a confidence level of 95 % the difference between the manual and automatic measurement series results is not significant. The automatic analysis procedure has the advantages of allowing large numbers of measurements in plants, a large variety of solvents may be used, energy and labour are saved, and much reliable information is obtained on the colouring value of paprika, which is indispensable in the manufacturing of meat products.

9.12

Rapid instrumental control of ash content of spices /paprika, pepper/ for use in the meat industry

G. SELMECI, F. CSEH, A. ACZÉL

County Institut for Food Inspection and Chemical Analysis, Szeged, Hungary

Ash content determination procedures based on measurement of electrical conductivity are increasingly used in the foodstuffs industry as rapid factory control methods. No data are to be found in the literature on the rapid instrumental determination of the ash contents of spices used in the meat industry, e.g. paprika and pepper. A study has been made of whether there is a correlation between the ash content of paprika or pepper and the electrical conductivity of an aqueous extract of the sample. Statistical evaluation of the analytical data reveals that there is a definite linear correlation between the ash content and the conductivity. For milled paprika samples belonging in different quality categories the regression equation is $y = -2.949 + 8,728 x$, while the correlation coefficient is $r = 0.953$, i.e. the correlation between the ash content of milled red pepper and the electrical conductivity of its aqueous extract is strong. This correlation has been used for analytical purposes, and a procedure is reported for the instrumental measurement of aqueous extracts of milled red pepper. The procedure is also suitable for measurements on aqueous extracts of pepper, but the relative measurement error for pepper is twice as high as for paprika. The reported instrumental technique is convenient for serial measurements and for automatic performance.

9.13

Determination of proteins in meat products by means of Dodecyl sulphate Polyacrylamide

Gel-Electrophoresis

D. CALSINA, G. CASADEMONT, J.M. MONFORT

Institut Català de la carn, Granja Camp i Armet, Monells (Girona), España

In this study electrophoresis patterns of meat (pig, cattle and horse), soya and milk proteins, and its mixtures were obtained in different conditions.

It is interesting to emphasize the different thermolability of proteins in relation to its origin.

Also, electropherograms from cured and cooked meat products obtained with proteins extracts are presented.

Usefulness of the method in the determination of non meat proteins and different animals proteins in the manufacturing of meat products is discussed.

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Characterization of the immunoelectrophoretical fractions resulting from soluble extracts of meat from different species.

C. CASAS, J. TORMO y B. SANZ.

Departamento de Higiene y Microbiología de los Alimentos. Facultad de Veterinaria. Universidad Complutense, Madrid-3, España.

Several soluble antigenic extracts have been prepared from meat homogenates of different species. The corresponding immunosera were obtained after parenteral inoculation of those extracts, together with complete Freund Adjuvant, into New Zealand strain rabbits. Among the electrophoretical bands obtained following a modification of Scheidegger's method, it was possible to immunochemical identify glycoprotein components in the horse, pork, dog and chicken meat extracts and lipoprotein components only in that of chicken. Confrontation between heterologous systems has made possible to identify the following major specific components.

| <u>Soluble protein in meat from:</u> | <u>Porcentual mobility of components (referred to bovine albumin).</u> |
|--------------------------------------|--|
| BEEF (PSB) | 31 y 40 |
| HORSE (PSCA) | 24 |
| PORK (PSC) | 75 |
| DOG (PSP) | 97 |
| CHICKEN (PSPO) | 17, 44 and 85 |

We consider that preparation of antigenic extracts from these fractions will make much more easy, the immunological differentiation of meats, based in precipitation reactions.

Quantitative Analysis of Casein in some heat-treated Meat Products.

J. HUESCAR FERNANDEZ and I. SANTILLANA LOPEZ.

Centro Nacional de Alimentación y Nutrición, Majadahonda (Madrid), Spain.

The casein content of liver pâté and cooked sausages marketed in Spain was studied.

Immunoelectrophoresis as described by Laurell was used for the analysis, employing anticasein serum followed by quantification.

The results showed that 60 % of the liver pâté samples and 75 % of the cooked sausages contained casein.

The method detects levels as low as 0,1 % in this type of samples.

Quantitative Determination of Soya Protein in Meat Products Heated at High Temperatures

CH. RING and F. SACHER

Institut für Hygiene und Technologie der Lebensmittel tierischen Ursprungs, Tierärztliche Fakultät, Universität München, Deutschland

Soya protein is permitted in many countries as an additive to meat products. But until now we have no practicable means for the quantitative determination of soya protein in meat products heated at high temperatures. By the modification of the previously known extraction process and the indirect haemagglutination technique, which has been developed by the Institute, a method with an accuracy of 1 % can be recommended which allows the determination of soya isolates in meat products heated at high temperatures with reasonable costs.

Functional properties of comminuted and salted hot-boned pork and beef

N.NESTOROV, A.GROZDANOV, N.DIMITROVA, N.DILOVA, M.TANTIKOV, P.PETROVA

Meat Technology Research Institute, Sofia, Bulgaria

Bovine and porcine semimembranosus muscles were excised from the hind quarter within one hour after slaughter. One third of the muscles was ground and tested while it was still hot. The second third was ground and salted with sodium chloride (final concentration, 2.4%) while it was hot, and then kept at +4 °C for 24 hours before being tested. The remaining third of the muscles was cooled for 24 hours, then ground and tested. Comminuted and salted muscles were extracted with the Hasselbach-Schneider solution for 30 min, and the extracts tested for emulsifying capacity and heat-induced gelation. Meat samples were also tested for their water-binding capacity and colour-forming ability. It was established that the water-binding capacities of both comminuted-hot and comminuted and salted-hot meats were better than the ones of cooled meats. The superiority of hot meat was better pronounced with beef than with pork. The heat-induced gelation, emulsifying capacity and colour-forming ability of hot meat proved to be inferior to the ones of cooled meat.

9.18

Effects of the oxidation of fat on the emulsion capacity of meat proteins (MRM = CRM)

JIMENEZ COLMENERO, F. and GARCIA MATAMOROS, E.

Instituto del Frío, Ciudad Universitaria, Madrid - 3, Spain

Emulsion capacity (EC = CE), the most commonly used method of determining the emulsion properties of proteins, depends on a number of factors (type of protein, pH, temperature, the rate at which oil is blended in, etc.). One of these factors is the type of fat used as the discontinuous phase of the emulsion, as its composition will affect the amount of fat emulsified. Oxidation of the fat produces alterations in its composition and causes changes in the number of unsaturations, the length of the hydrocarbonated chain, and the appearance of new compounds, all of which affect the emulsifiability of the fat.

The object of the present experiment was to determine the effect of the degree of oxidation of a fat on the emulsion capacity of a protein extract. Olive oil in varying stages of oxidation was employed as the discontinuous phase, oxidation being rapidly produced by heating and aeration. A protein homogenate (in 5 % NaCl solution) of mechanically recovered pork (MRP = CRM) was used as the continuous phase.

The results obtained indicate that the EC (= CE) decreases as the level of oxidation of the oil increases, the maximum percentage variation between the limit values for rancidity being 6,3, with emulsion capacity expressed in grammes of oil per gramme of MRP (= CRM). Thus, this effect, which can be brought about by a variety of factors, seems to be important only at high levels of rancidity.

9.19

Application of the GOSUC consistometer to meat extract viscosity measurement

F. LEON CRESPO, F.BELTRAN DE HEREDIA y J.C. PENEDO

Departamento de Tecnología y Bioquímica de los alimentos

Facultad de Veterinaria. Universidad de Córdoba. Spain

The application of the GOSUC consistometer to the measurement of the viscosity of meat extracts prepared with 3% salt (4:1) is reported. A description of the apparatus is provided and its high reproducibility is included ($\overline{C.V.} = .64\%$).

Also included are the results of its application to evaluate the changes in viscosity produced by extract storage, temperature, protein concentration and pH, as well as the effect of sodium pyrophosphate .

Influence of pH and Salt concentration on ^{the} stability of emulsions made with different protein fractions
C. DENOYER, J.P. GIRARD, Station de Recherches sur la Viande - I.N.R.A. THEIX 63110 BEAUMONT

To further investigate some aspects that the work of VAN EERD (1971-1972) did not completely clarify, the following work were carried out.

- 1 - We quantified the effect of pH on the hydrophil-lipophil balance of meat proteins considered as a whole. The HLB in the pH range studied (from 4.5-8) was noted to shift from between 11 and 13 inclusively ;
- 2 - We studied the influence of pH and sodium chloride, taking into account the different protein fractions, actine, myosine, actomyosine and sarcoplasmic, on the stability of emulsions made with one fat only (HLB required 13).

Results showed the superiority of myosine over all other meat protein fractions. Thus, a practical aspect has been cleared up, meat in the pre rigor stage is particularly suited to processing. Our study also showed the role of sarcoplasmic proteins as emulsifying agents, and emphasized the beneficial effects of increasing sodium chloride concentrations in the range studied (0-4 %) for all protein fractions except actine.

THE USE OF THE DSC ON THE THERMAL CHARACTERISATION OF MEAT. PART II.

F. FERNANDEZ-MARTIN and P.D. SANZ
Instituto del Frío (C.S.I.C.). Ciudad Universitaria. Madrid - 3 (Spain)

The usefulness of DSC for the characterisation of the thermal behaviour of meat has been already reported in an earlier paper. Heat capacities of minced meat were really determined through this microtechnique with results comparable to those obtained by adiabatic calorimetry using large samples. However, the determination of the unfreezable water showed values by about 10% lower than those commonly accepted. Inadequate thermal treatments and moisture losses of the sample while being conditioned for DSC analysis could be responsible for this abnormally low figure. The study of these points by differential scanning calorimetry and thermogravimetric analysis is the aim of the present paper.

An estimation method for the determination of thermo-physical characteristics of meat products

V.M. GORBATOV

The All-Union Meat Research Institute, Moscow, USSR

N.N. MIZERETSKY

The Moscow Technological Institute for Meat and Dairy Industries, Moscow, USSR

On the basis of a new classification of structures, an estimation method was developed to determine thermo-physical characteristics of raw meats and finished meat products; their numerical values are given for a broad temperature range.

ESTIMATION OF HEAT-PHYSIC CHARACTERISTICS MEAT-PRODUCTS HOW THE FUNCTION OF THEIR INTERNAL HUMIDITY

A.BRAJNIKOV, N.KAUKHCHESHVILI

Moscow Technological Institut of Meat and Milk Industry SIKTI coldindustry. Moscow. USSR.

It is shown possibility to often Heat-Physic Characteristics (HPC) of food products have line function of their internal humidity for engineering-estimating calculations. That conclusion is conditioned by the presence of greater variations in HPC of food products.
The application of the offer method of definition HPC of food products get more simplify engineering-estimating calculations.

Electrophysical diagnosis of meat quality and portable means for its realization

H.A. GOLOVKIN, S.A. YEVELEEV

Leningrad Technological Institute of Refrigerating Industry, Leningrad, USSR

In this paper appearance of portable conductivity apparatuses designed for estimating meat quality is presented. Their application in the analysis of variable conditions of meat refrigeration is shown.

9.25

Method for property-analysis of meat products

E. ZUKÁL, V. MIHÁLYI and ZS. GYÖRGY

Hungarian Meat Research Institute, Budapest, Hungary

As the basis of the new descriptive sensory analysis the "property-list" can be considered. This consists of typical properties - desired and undesired - of meat products, intensity scale included. The proposed new system works well only if

- panelists are able to recognize the given property with its intensity uniformly
- contains all the characteristics important for consumers.

A method for elaboration of "property-list" is presented. For mathematical-statistical evaluation performing of contingency test /G-test/ has been suggested.

9.26

A Note of Boar Taint in the Carcasses of Non Castrated Pigs in Catalunya.

A. DIESTRE; D. CALSINA; G. CASADEMONT and J. M. MONFORT.

Institut Català de la Carn. Granja Camps i Armet. Monells (Girona), Spain.

Partial results of the evaluation of boar taint using soldering iron method and length and weight of accessory glands in non castrated pigs in Catalunya are presented. In this area as in all the country, from few years to now all male pigs reared to meat production are not castrated. This problem was begun to be studied as an answer to some claims of the meat industry.

In this note the first partial results are presented in order to direct a possible solution of this problem that put face to face different sectors of the meat chain.

9.27

Fat composition and organoleptic estimation of meat from pigs of various sexual types

B. DESMOULIN, J. DONNART, M. BONNEAU

I.N.R.A. Recherche sur l'Élevage des porcs - St GILLES - 35590 L'HERMITAGE - France

A total of 72 entire male pigs, castrated males and females were fed according to a liberal and restricted feeding system: the fatty acid composition and androstenone content were determined. Cooked meats were judged in the laboratory according to the main criteria: cooking odour, aroma, flavour, toughness, juiciness and general impression. Fats of entire male pigs were more unsaturated than those of the castrates, especially after restricted feeding ($P < 0.01$). Reduction of fatness after feed restriction was accompanied by an increase in the unsaturation of the fats ($r = 0.69$) characterized by a high linoleic acid content ($r = -0.77$).

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The androstenone content of entire male pig fats was little affected by the feeding conditions, but played a large part in the unfavourable estimations concerning cooking odour, aroma and taste formulated by the panel about male meats.

Estimations of the meats of castrates and females were more favourable when the level of polyunsaturated fatty acids was higher ($r = + 0.57$).

Toughness and juiciness traits were little affected by the sexual type of the animals and the production conditions.

9.28

Influence of liquid smoke on digestibility (in vitro) of connective tissue proteins of pork loin

N.N. KRYLOVA, L.F. KARMYSHOVA and V.T. KOLESNIKOVA

The All-Union Meat Research Institute, Moscow, USSR

Use of liquid smoke in sausage production promotes getting the finished products not containing cancerogenic compounds that get into products while processing with smoke. It was determined that pork products treated with traditional or liquid smoke have the ability to digest in vitro better. It is shown that the main technological factor increasing the degree of muscle proteins digestibility in vitro is the processing with traditional or liquid smoke. It was found that addition of liquid smoke into substrate (hemoglobin) increased the activity of pepsin and trypsin. Introduction of these preperates into meat at different stages of technological process of pork products production also increases the degree of digestibility of muscle tissue proteins. It allows to think that smoke components of preperates and smoke products - are the reagents of enzymes (pepsin and trypsin).

9.29

A nomographic method of optimizing the nutritive value of meat with different regimens of heat treatment

I. ZAKHARIEV, E. TSVETKOVA

Institute of Nutrition, Medical Academy, Sofia, Bulgaria
Meat Technology Research Institute, Sofia, Bulgaria

Nowadays, the problem of whether the technological regimens selected in industry guarantee the preservation of the finished product nutritive and biological qualities, is of great interest. The results of the studies enabled the creation of a nomograph for optimizing the sterilization processes of 400 g cans with dimensions of 99 x 73, in the rotary sterilization of veal. Optimization is done using more than one index: determination of B_1 , SH-groups, organoleptic score, and shear force. It was found that, on optimizing sterilization regimens with an 'excellent' sensory score, chemical characteristics change in the following ranges: for vitamin B_1 , at a temperature of 121°C , from 32 to 40%; for SH-groups, from 6,00 to 6,44 $\cdot 10^{-5}$ mol/mg of protein. Shear force varies from 4,09 to 5,11 kg/cm². Using the nomograph, one can develop new technological regimens which represent an optimum in respect to product nutritional and biological value.

9.30

On the nutritive value of poultry meat, with different regimens of treatment

E. TSVETKOVA, K. BEEV, N. ALEXIEV

Meat Technology Research Institute, Sofia, Bulgaria

Poultry meat, with its nutritive qualities, is the object of many-sided studies. In this work, such regimens of poultry meat treatment were tested, as would guarantee a long storage life and a maximum preservation of nutritive value to the finished product: heat treatment and freeze-drying. Also, a study was made of some of the basic indices for poultry meat nutritive value with the different regimens of treatment: digestibility of protein substances and vitamin

B. The results of the study indicate, that the digestibility of protein substances is not reduced by heat treatment (96,2%), and in heat treated freeze-dried meat it constitutes 96,9%, which points to a high digestibility of protein substances. Upon the heat treatment of poultry meat, the average vitamin B₁ loss is 25 mg%. The freeze-drying of heat treated poultry meat does not affect vitamin B₁ content. The products prepared in this way can be used successfully in dietetic and curative nutrition.

9.31

The nutritive value of mechanically deboned meat /PER, basic composition and aminoacids composition/

E. PROST

Institute of Food-Hygiene of Animal Origin, Agricultural Academy, Lublin, Poland

The purpose of the studies was to determine the basic composition and biological value of proteins, expressed by PER and the composition of aminoacids of mechanically deboned pork in comparison with normal meat. The variation factors were: a/ mechanically deboned meat and normal meat, b/ three kinds of bones mechanically demated: shoulder, arm bone, vertebral column. Significant differences in the features studied were shown between mechanically deboned and normal pork. However, no significant differences were found in relation to the kind of demated bone.

9.32

BIOLOGICAL VALUE OF MECHANICALLY DEBONED POULTRY MEAT AND OF SAUSAGES WITH THIS MEAT ADDED

O.N.KRASULYA, V.V.KHLEVOVAYA, V.A.GONOTSKY and L.S.KUZNETSOVA

The Scientific & Production Corporation "Complex", Moscow, USSR

A.S.BOLSHAKOV

The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR

A comparative biological value of mechanically deboned chicken and duck meat, as well as of sausages with this meat added was studied microbiologically on the *Tetrachymena pyriformis* infusorian and in a "carcass" experiment on white rats.

A higher relative biological value (RBV) of MDM was determined microbiologically as compared to manual deboning - by 25% for chicken meat and by 34% for duck meat.

The effect of various levels of MDM in the sausage mix (from 10 to 60% with 10% increments) on RBV was studied. It was established that from 30% on the infusorian growth reached a certain maximum which is maintained in the sausages with 50% of chicken MDM and with 40% of duck MDM.

The "carcass" experiment on test animals indicated a higher biological value of sausages (NPU, NPR) containing 30% of poultry MDM as compared to the sausages ("Molotchnaya", "Stolovaya") produced using the conventional formulations.

One of the basic factors improving the biological value of MDM and of sausages with this meat incorporated (as compared to manually deboned meat) is a lower level of connective tissue proteins as determined by hydroxyproline (Neuman & Logan's method).

The utilization of mechanically deboned poultry meat ensures a high biological value of cooked sausages.

9.33

The moisture/protein ratio of canned sausage - an equation to estimate its value.

PASQUAL MUCCILO* and MESSIAS C. GALVÃO GOMES**

* Conselho Federal de Medicina Veterinária - P.O.BOX 07/0645 - Brasília - DF - Brazil - 70303

** UNESP - Botucatu - SP - Brazil - 18600

According to the Brazilian Official Regulation, the moisture/protein (m/p) ratio of Vienna and Frankfurter sausage links prior to canning must be 3.50 to 1. As the control is very often performed on cans collected at the retail market, when osmotic currents between sausage and liquid have been established, the m/p ratio becomes useless in informing about the amount of water or ice added at the time of sausage preparation.

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Our objective was to find out a mathematical equation that, applied to the chemical analysis results of a canned sausage could enable to closely estimate if the sausage m/p ratio before canning implied with the Brazilian legal requirement (3.50:1). Analysis were performed determining the moisture as recommended by AOAC and the total protein was determined by the so-called macro-Kjeldahl method (Society Analytical Chemistry and Instituto Adolfo Lutz - São Paulo).

Two sausage batches were prepared using special meat formulae aiming to obtain a m/p ratio according to Brazilian Regulation (3.50:1 at the end of the fabrication). Of each batch sausages before canning were analyzed and 30 (thirty) cans were kept to be opened and sausage analyzed in different lapse of canning time. The m/p ratios obtained were submitted to a mathematical study which derived the equation:

$$m/p = a + b \log^t \quad (t = \text{canning time})$$

where the 99% confidence intervals of their coefficients a and b have the following lower and upper limits:

$$5.31 \leq a \leq 5.51 \quad \text{and} \quad 0.452 \leq b \leq 0.620$$

which the average points respectively are:

$$5.41 \quad \text{and} \quad 0.536$$

The application of this equation to the chemical analysis results of the canned sausage will closely estimate if the sausage m/p ratio, before canning, was in compliance with the legal Brazilian requirement and so restraining the fraud of using exaggerated amount of water or ice during the sausage manufacture.

Our research work indicates that the Brazilian m/p ratio must be corrected to 4 (four) computing also the 10% water that the law allows at the cooked sausage preparation (moisture = $4P + 10$).

9.34

" MOTIVATION AND OTHER DETERMINANTS OF WORKERS' HYGIENIC PRACTICES - AN EMPIRICAL INVESTIGATION "

G.E. GERATS[∇], F. TAZELAAR^Δ, R. WIPPLER^Δ and J.G. van LOGTESTIJN[∇]

[∇] Department of the Science of Food of Animal Origin, Section Hygiene, - Faculty of Veterinary Medicine

^Δ Department of Sociology, Section of Theoretical Sociology and Methodology - Faculty of Social Sciences
The University of Utrecht - Biltstraat 172 - 3572 BP Utrecht - the Netherlands

SUMMARY

Cross contamination of carcasses with spoilage and pathogenic micro organisms mainly originates from equipment, hands, knives, axes, aprons and other slaughter tools. Therefore, a regular and careful cleaning and -where required also- disinfection of utensils and hands are imperative. Observations at many slaughterlines however generally show a low degree of adherence to these hygienic practices. Additionally to the elimination of actual sources of bacterial contamination, more attention should be paid to methods to achieve an improved hygienic job performance in slaughterlines. However, no investigations on this specific subject have been found in the literature.

To obtain an insight into the determinants of workers' hygienic practices, an investigation was carried out at six pig slaughterlines, including over 200 workers. During working hours, 106 of these workers were observed on the workspot and moreover interviewed by trained interviewers.

An analysis of the results showed, that differences in hygienic practices between workers are closely related to 1) differences in specific motivations to practice hygiene at the slaughterline; 2) differences in specific knowledge of bacteriology in general and, particularly, of the mechanisms of bacterial contamination of carcasses during slaughter; 3) presence and accessibility of technical hygiene provisions on the workspot, including means of disinfection (i.e. 'hot water'), manual showers and handwashing facilities; 4) differences between working groups regarding age, experience and knowledge; 5) differences in the extent of social control among colleagues, particularly, regarding hygienic practices; 6) differences in 'hygienic-practice' stimulating skills of foremen and meat inspectors.

The results of this investigation are reviewed and recommendations for improvement of the situation advanced.