5. Meat Processing: Cooked Products

An Inhibition of TBA Formation in Cooked and Uncooked Lamb and Chicken Patties Using Alpha-Tocopherol

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The level of alpha-tocopherol (0, 100 and 200 ppm) were added to cooked and/or uncooked lamb and chicken patties as an antioxidant during storage at 4°C and -20°C, after packaging the products either under vacuum or atmosperic pressure in polyethylene bags. Lipid oxidation was measured using the thiobarbituric acid (TBA) as well as organoleptic tests. Data revealed that the level of 200 ppm of alpha-tocopherol was recommendable. However, positive relation was observed between the level of alpha-tocopherol and reducing rancidity in both cooked and uncooked patties of lamb and chicken. TBA numbers increased during storage of cooked products at 4°C with increasing time of storage. The highest level of alpha-tocopherol (200 ppm) resulted in the lowest TBA level of uncooked patties of both lamb and chicken which were packaged under vacuum and stored up to 270 days at -20°C. Organoleptic evaluation revealed that the level of alpha-tocopherol (200 ppm) slow rancidity in cooked lamb patties which were packaged under atmospheric pressure only comparing with the other treatments. While, panelists easily detected flavor difference due to 0 and 100 ppm alpha-tocopherol after 240 days of storage under -20°C either packaged under vacuum or atmospheric pressure.

Study Of Mechanical Treatment Possibilities Of The Meat Batter To Reduce Salt Content In Non-Structured Sausages

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The salt content is still high in the meat products in the modern production and do not respond to the nutrition hygiene norms, especially regarding hypertonia deseases. In non-structured sausages the sodium chloride has significant technological effect on stable meat emulsion formation and its minimum critical level is fixed in the formulations. There are some possibilities to compensate the reduce of this critical level as the added poly-phosphate preparates increased, but this method do not satisfy the hygiene requirements, especially in dietary nutrition.

In the present study we are oriented to investigate the possibilities for compensating to some extent the structure-forming functions of sodium chloride in stable meat emulsion preparation for non-structured sausages by increasing the extent of the batter mechanical treatment.

Experiments are carried out in production conditions of 60, 150 and 300 l cutters to achieve stable meat emulsion in non-structured perishable sausages with different salt levels. The micro and ultrastructure of "Teleshki kolbas" and wieners "Sofia" are investigated at different extent of cutter mechanical treatment as the added salt quantity reduces to 0.4%, in comparison with the control samples. In the experiments with the wieners "Sofia" frozen pork meat is used. Physicochemical and organoleptic investigations of the produced sausages are carried out. The results are demonstrated with microphotographs and tables.

It is established that the added salt quantity can be reduced to 0.4% as the knive revolutions increased by 58% for "Teleshki kolbas" and by 42% for the wieners. These cutter conditions do not change the structure of the tested sausages and have no negative effects on the organoleptic properties of the products.

5

BEEFRIMI, A SURIMI-LIKE PRODUCT FROM BUFFALO MEAT

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Beefrimi resembles a meat protein concentrate. By a process of grinding, washing and sieving, a high quality substrate was obtained. Beefrimi is suitable for use in the manufacture of value added meat products. Buffalo meat, in its raw form is tough and limited in its use for processed meat. The processing operations comminute the meat, remove substantial connective tissues, fats and water soluble components. Salt, phosphate and sugar were added, and blended for two minutes, shaped into blocks, wrapped in plastic bags and stored at -18°C. Yield data from topside and forequarter cuts were compared. Cooking methods (boil and oven heating) were used to evaluate tenderness and gelation properties. Proximate analyses were carried out to compare changes in protein, fat, moisture and ash components amongst buffalo meat, topside beefrimi and front quarter beefrimi. Result on yield showed a 57.3% and 38.7% beefrimi obtained from topside and front quarter, respectively. Gelling characteristic of beefrimi resulted in higher shear force compared to buffalo meat. Gelated samples from oven cooked was tougher when compared to samples that was boiled, due to formation of a thin hardened layer. Folding test showed beefrimi samples from both front quarter and topside had better grade (A) compared to bufalo meat samples with grade B. Proximate analyses indicated higher moisture, and protein content and lower fat content in beefrimi compared to buffalo meat. This study concludes that beefrimi obtained from buffalo meat is a functional raw material, high in protein, low in fat content, and has good gelation property, useful in the manufacture of value added meat products.

1

Stabilization of Cooked Meat Flavor with Maillard Reaction Products

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Thiobarbituric acid (TBA) values, volatile lipid and sensory analyses were used to evaluate the effect of Maillard reaction products (MRP) on the flavor of cooked pork and beef during storage at 2°C. Ground pork was cooked in a 175°C oven to 70°C and beef chuck roasts were cooked in a smokehouse at 91°C to an internal temperature of 68°C. MRP were prepared by heating carbonyl compounds with amino acids. The optimal heating time, temperature and pH were determined for the MRP reaction mixtures as antioxidants and flavorants.

Among 58 compounds separated and identified by GLC-MS were saturated aldehydes, unsaturated 2-alkenals, 2,4-dialkenals alcohols and ketones. Hexanal, pentanal and 2,3-octanedione were the major volatile compounds present in meat with warmed over flavor (WOF). Correlations accounting for more than 95% of the variation were found between most individual volatiles analyzed and flavor of pork during storage at 2°C.

MRP prepared from amino acids and glucose were also used to preserve the flavor of cooked chuck roasts during storage 2°C for 21 days. MRP pumped into roasts at 0.27% reduced WOF and maintained meaty flavor during storage.

TBA values were highly correlated with warmed-over aroma and warmed-over flavor for both pork and beef.

Inhibition of Warmed Over Flavor in pre-cooked chilled meat.

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Development of Warmed Over Flavor (WOF) is often the parameter determining the quality and shelf-life of precooked chilled meat. This off-flavor has been the major drawback for marketing cooked ready-to-eat meat products, and it is recognized that there is a great need for further research in solving problems in relation to WOF.

In order to contribute with more fundamental knowledge about WOF, a research programme has been undertaken, including both basic research with model systems and more applied experimental work, embracing storage experiments with meat products, in order to determine the influence of different processing parameters (eg packaging method, cooking and chilling temperature, storage conditions) on the development of WOF in pre-cooked beef slices during chill storage for 10-14 days. The onset of WOF was followed by sensory analysis as well as by three analytical methods to follow the oxidation reactions responsible for the development of WOF: Determination of 1) Thiobarbituric acid reactive substances, 2) Volatiles (eg hexanal) by gas chromatography and 3) Fluorescent oxidation products.

These three analytical methods, of which the fluorescence method appears to be new in this respect, did all show a high correlation with each other as well as with the scores of the sensory evaluations during the onset of WOF and are each useful as indicators for WOF in future experiments.

As first step in the proces of developing cook-chill systems in which the WOF-phenomena can be minimized, vacuum packaging as well as modified atmosphere packaging (70%N_2/30%CO_2) was tested. Using O_2-barrier-material both of these packaging methods did retard the development of WOF effectively, in opposition to what was found for packaging in polyethylene bags.

Effects of Rosemary and Dodecilgalat on Fat Stability of Grill Sausages Kept in Cold Storage

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For a long time it has been known that oxidising changes of fat are very quick in minced meat products. In order to prevent oxidation of fats, various antioxidants (natural and synthetic ones) can be used. The synthetic antioxidants, however, can show a negative effect on the processes of metabolism in the organism; in view of this, there is an increasing use of natural antioxidants.

The aim of this paper was to examine the effects of rosemary and dodecilgalat on fat stability of grill sausages. The added quantities of rosemary and dodecilgalat were 0,2% and 0,01% respectevely. Sausages without antioxidants were used for control purposes. The sausage samples were stored at the temperature of +4°C during the period of 7 days. The changes of fat in the samples were observed by means of the analysis of TBK values, peroxide values, acid number and composition of fat acids. In addition, the sensory analysis was carried out and the total number of bacteries was determined.

Rosemery and dodecilgalat considerably slow the undesirable changes of fat in grill sausages kept in cold storage. Here, a greater effect is achieved with rosemary. In all cases, the sensory properties of the samples containing rosemary have been appreciated best.

5

Action of Emulsifiers in Finely Comminuted Cooked Sausage

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The aim of the presented study was to clarify the mechanism of action of certain emulsifiers in finely comminuted cooked sausage (bologna type) and to determine the criteria for the selection of suitable emulsifiers. The cooked sausages were prepared with 42 % lean meat, 30 % back fat and 28 % ice. Not only the effect of emulsifiers on the stability of cooked sausages, but also synergism of emulsifiers with phosphate or citrate was examined. All cooked sausages released a very low amount of fat (< 0,4 %). The instability mainly appeared in a high jelly separation which was not reduced by either of the used emulsifiers. By using some lipophilic emulsifiers the fat separation disappeared completely, nevertheless it did not play an important role for the stability of prepared sausages. A synergism of emulsifiers with phosphate or citrate could not be observed. The influence of monoglyceride esters with various chain lengths of fatty acid on the stability of sausages was also examined. Monoglyceride esters with C_{16} or C_{18} showed a lower fat and jelly separation than monoglyceride esters with C_{12}, C_{14} or C_{22}, but the decrease was not significantly different to the control. In order to provoke the fat separation, the previous recipe was changed to 30 % lean meat, 40 % back fat and 30 % ice. The meat batters were longer and more intensively comminuted, the temperature was controlled by using liquid nitrogen. In the experiment of that kind, all cooked sausages released a very low amount of fat (0,2 - 0,3 %), because, in the presence of phosphate, myofibrillar proteins had been activated sufficiently for the fat- and water-binding. Therefore, the used emulsifiers showed no positive influence on fat stabilization. For that reason, it is not necessary to add emulsifiers to produce cooked sausages with current recipes, because fat separation is of subordinate importance for the stabilization of the systems. In the production of cooked sausages with reduced salt concentrations or without the aid of phosphate or citrate, effective emulsifiers can probably support the emulsifying and stabilization of fat.

Protein additives effect on textural properties of comminuted meat products

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Effects of protein additives on textural properties of comminuted meat products /CMP/ were studied. At 80 °C pasteurized sausages and at 121 °C sterilized comminuted canned meats /CCM/ were produced by using protein additives such as soy protein isolate, soy protein concentrate, sodium caseinate, milk protein concentrate and dry egg white with an exchange level of 2 % of the meat proteins.

Textural properties /hardness, strain energy of compression, elasticity/ were determined by Instron 1140 Universal testing machine using textural profile analysis.

Results of textural measurment has showed that use of protein additives significantly determines textural properties of CMP. However, the effect of protein additives in different types of meat products is different. By using all protein additives the hardness of CMP has decreased with exception of dry egg white in CCM. Strain energy of compression has also decreased by using investigated protein additives. The elasticity of sausages has decreased by using investigated protein additives with exception of soy concentrate. The elasticity of CCM has decreased only by using soy protein concentrate.

According to results all investigated protein additives with exception of soy protein in sausages and dry egg white in CCM had negative effect on texture.

Hygienic quality and shelf-life of a Moroccan cooked sausage (Kasher)

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For a better assessment of changes in cooked sausages (Kasher type), the development of the hygienic status of 16 samples from two meat factories was studied with special regard to the organoleptic and physico-chemical (pH-value, a_w-value, total volatile bases) as well as microbiological aspects (total mesophilic aerobic counts, yeasts, molds, total coliforms, enterococci, staphylococci and sulphite-reducing clostridia).

Moroccan kasher sausages are very prone to changes in the microbial status as a result of the high pH-value (6,6), the high a_w-value (0,98) and the exceptional microbial level even after the cooking procedure.

The results can be outlined as follows: After the 3rd day of storage at ambient temperature (+25 °C) the microbial flora increased beyond the standard values for this kind of product. Organoleptic changes were only distinctive after the 7th day.

Under cooling conditions these sausages kept their organoleptic characteristics. Their microbial flora increased above normal values only at the end of the first week of storage.

Meat Processing: Cooked Products

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The review is confined to meat products, which are traded after they are heat processed. Meat products are heated, to make them easily digestible, to inactivate enzymes (e.g. lipases) and microorganisms. Examples for cooked meat products are cooked hams, other salted and cooked meats, certain types of fermented sausages, cooked sausages, liver sausages, blood sausages and products in jelly. All these products may be smoked or not. Traditionally to most of them nitrite is added and they exhibit therefore a cured color and a cured flavor. In Germany some cooked sausages and some liver sausages are manufactured traditionally without nitrite. But all of the cooked products contain NaCl to enhance their meat flavor.

It is of some importance not only technologically, but even more for reasons of public health that liver sausages, blood sausages and products in jelly may be produced without salts or "chemistry" and the products do not separate on heating.

The technological background for the successful production of cooked products, which meet the consumer claims, that they must be healthy and palatable, is presented.

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Processing of cooked sausages containing unsaturated vegetable oils.

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The reasons to supply the consumer with cooked sausages containing unsaturated vegetable oils are to increase the amount of unsaturated fatty acids in the diet and to lower the plasma-cholesterol content relative to "normal" cooked sausages. Diets with unsaturated fatty acids may decrease the risk for CHD. In this connection the consumption of oils high in linoleic acid was favored for about 30 years. A daily uptake of linoleic acid, exceeding 10 % of the total daily uptake of calories is however not recommended any longer. By monounsaturated fatty acids (e.g. oleic acid) a similar reduction of plasma-LDL cholesterol, and by this a reduction of the risk to suffer CHD, is achieved as by polyunsaturated fatty acids. A vegetable oil rich in linoleic acid is sunflower oil, and olive oil contains high amounts of oleic acid.

The question arises if cooked sausages can be produced routinely which contain vegetable oils instead of fat pork. To meet the concerns of the consumers, phosphates, emulsifiers or non-meat proteins were not be used in this project.

Cooked sausage batters with vegetable oils (50 % lean beef or pork, 1.6 % salt, between 10 und 25 % sunflower oil or olive oil, the rest up 100 % water) became more heatstable, if their oil content was increased between 10 and 25 %. Special technological actions were not necessary, if the lean meats, salt and water were chopped in a silent chopper to about ± 0 °C, and if the comminution was continued to about 12 °C after the addition of the oils. In comparison to cooked sausages with fat pork those with vegetable oils were lighter in color. The eating quality of cooked sausages with fat pork or vegetable oils was similar. An unimportant specific flavor of oils is acceptable. With 25 % of olive oil the oleic acid content of the sausages rose from about 41 % (25 % fat pork) to about 66 %, with 25 % of sunflower oil the linoleic acid content rose from about 8 % (25 % fat pork) to about 55 %.

Influence of Conditioning and Fat on the Odour of Pressure-cooked Beef

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The flavour of meat is derived from the complex interactions of amino acids, sugars and fats during cooking. These components change dur glycolysis and post-mortem conditioning but are accompanied with changes in texture and colour of meat which would confound any sens assessment of flavour. The effect of fat removal and the prevention of post-mortem glycolysis were studied by odour assessment. *M. Semimembranosus* was excised at 1 hour post-mortem and stored at 2°C. Iodoacetate (5mM) prevented glycolysis and proteolysis and was extracted repeatedly with chloroform-methanol solutions. The mince was pressure-cooked and odour assessed by a trained panel. Meat of pH 6.70 (iodoacetate) was compared with meat (pH 5.48) aged for 21 days; both with and without fat. From the four treatments, six paired comparisons showed significant differences which averaged about 20 on a 100 point (difference) scale. The effect of the two fac (fat and proteolysis) were additive but the effect of defatting appeared less in aged meat than in meat processed at 1 hour post-mortem. Changes in conditioning time and fat content in meat at pH 5.5 were investigated using fixed category scaling of the most common descript Significant differences were found between all four samples but conditioning normal meat for 21 days had much less effect than defatting - w defatted meat scoring lower odour overall. Individual assessors differed in their descriptions of the odour and, where significant differen were found, defatted meat scores for "fatty" and "musty" were reduced, whilst scores for " beefy and "meaty" were increased. Free-choice profiling, in which the assessors may use their own choice of descriptors, was also used to establish different usage of the gi descriptors. Panellists generally used between 6 and 11 descriptors but score for most of them did not differ between the treatme Multivariate analysis, however, suggested a similar patterns of odours resulting from defatting.

Studies on New Canned Food Containing Plants and Meat

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Processing a kind of canned meat product with the local plant and meat resources according to the physicochemical and biological properties of the plant and minced meat is the objective of this study. The studied product is a multiplex canned food. It is the first generation of a high grade, natural nutritious canned food in China. It is rich in the nutritive composition and the eatable fiber. Protein, fat, moisture, vitamin C, vitamin A, vitamin E, ß-carotene and glucomannan were 12-15%, 15-20%, 50-55%, 1-5mg/100g, 8-10μg/g, 0.1-0.15mg/100g and 0.2-0.4g/100g, respectively. And there were many kinds of trace elements and eighteen kinds of amino acid, but preservatives and a artificial synthetic pigments in the canned food. It shows specially the advantages of both animal and plant.

Ultrastructural Examination of Fresh Pigskin and after Frozen and Cooked

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Pigskin was viewed with a scanning electron microscope (SEM) when in native state, after being frozen at -18°C for half a year, and heated at 40, 50, 60, 70, 80, 90 and 100°C in distilled water for 30 minutes. All samples were prepared with conventional method. Native pigskin exhibited four layers under the SEM: the stratum corneum, the subjacent layer which was composed of irregularly shaped cells, the dermis and the hypodermis. The stratum corneum consisted of many layers of flat cornified cells whose membrane was very thick. Those cells composing the subjacent layer showed various appearance in shape and were rich in filaments which arranged disorderly, forming a network. The dermis consisted mainly of bundles of collagenous fibers running in various directions. The hypodermis was made up of fat cells and a little amount of connective tissue. When fresh pigskin was heated in distilled water the epidermic network underwent granular denaturation slightly at 40°C. This denaturation was aggravated by further heating to 50~60°C. Around 70°C the denaturated network changed into connected spongy masses. Higher temperatures induced aggregation of these masses into bigish ones. The collagenous fibers in the dermis granulated to a small extent at 40°C. This change became more evident at 50°C and 60°C, with some even coagulated. Around 70~80°C most of them cohered into masses. Further heating to 90 100°C induced cohesion of all the masses into a much denser integrated mass. No distinct ultrastructural change was observed in frozen pigskin except that some collagenous fibers were found transversely linked by very thin filaments. From the results, we concluded that heat treatment clearly disrupted native structure of pigskin, especially at higher temperatures, but freezing showed little effect.

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Volatile components extracted from three pork muscles. A chemical and olfactive study.

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The aim of this work was to investigate the relation between the metabolic type of a muscle and its flavor. Previous studies had establish the importance of phospholipid in the development of meat aroma (Mottram & Edwards, 1983). Moreover, recent works carried out in t laboratory (Leseigneur-Meynier & Gandemer, 1991) had proved the relationship between phospholipids and metabolic type.

The studies have been performed on three muscles in order to cover a broad range of metabolic type: *Longissimus dorsi*, glycolyt *Trapezius*, intermediate and finally *Diaphragma*, oxidative. After cooking upon roasting conditions, the aroma compounds were extract by high-vaccum distillation. Qualitative and quantitative composition of the extracts were then determinated.

The results show that qualitatively, the identified compounds are the same for the three muscles. The major compounds arise fr the thermal degradation of the lipidic constituents of pork muscles. They include aldehydes (hexanal, nonanal), alcohols (saturated a unsaturated) and alkadienals. Heterocyclic compounds such as furans, pyridines are present in trace amount only. In order to find sensi interesting compounds, the aroma assement on the gas chromatography effluent was also performed. Some interesting nutty and mea aroma were detected in the sample.

Influence of pH on Physical Properties of White and Dark Poultry meats

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Breast and thigh poultry meat batters were prepared at various pH levels (4.5, 5.5, 5.8, 6.5 and 7.5). The natural meat was 5.8. Rheological properties of these batters were determined using a wide gap coaxial cylindrical rotary viscometer at 5 Modulus of rigidity (G) was evaluated during thermal processing using a thermal scanning rigidity monitor. Texture pro analysis parameters were evaluated by a two cycle compression test. Chemical composition, emulsion stability and water hold capacity (WHC) were also determined. Batters with pH 4.5 to 5.8 were unstable for both muscles. WHC increased with increase in pH. Breast meat with 4.5 pH showed the greatest pseudo-plasticity (lowest power law index, n). A sharp increase 'n' was noted with the increase in pH to 5.5. The 'n' decreased gradually with the further increase in pH to 7.5. In thigh m 'n' did not change for pH 4.5 to 5.8, however, it increased sharply with the further increase in pH to 6.5. The batters with 4.5 exhibited the lowest G peak values. The intermediate peak values were observed for pH 5.5 and 5.8, and the highest p values were observed for pH 6.5 and 7.5. In general peak G values increased with the increase in pH. There was a negligi change in hardness (first bite) (H1) from 4.5 to 5.8 pH, a sharp increase in H1 from 5.8 to 6.5 pH, and a negligible change fr 6.5 to 7.5 pH.

The Tenderizing Effect of NaCl on Cold Shortened Pork

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65 carcasses from Danish Landrace and Yorkshire breeds, slaughtered at approximately 90 kg live weight were used to study the tenderizing effect of NaCl on cold shortened meat. Paired M. longissimus dorsi from each carcass were either hot or cold boned. Hot boned loins, representing different pH levels, were cut in subsamples (20x20x60 mm) and chilled in ice water until 24 hrs post mortem to achieve various degree of cold induced shortening. Cold boned paired sides (controls) were chilled in a conveyorized chilling tunnel operating at -18°C for 60 min. followed by a conventional chilling room at 2-4°C until 24 hrs post mortem. From both hot and cold boned loins, subsamples (10x10x50 mm) were cut parallel to the muscle fibres and placed in .15, .60 or 1.20M NaCl solution for 24 hrs before heat treatment at 80°C for 20 min.

Hot boned muscles at pH above 6.5 showed maximum degree of cold induced shortening, i.e. muscle shortening above 30%. Coefficient of correlation between shortening and pH at boning was highly significant (r = -.88). Cooking loss and cross-sectional cooking shrinkage were reduced as sodium chloride was increased from .15 to .60M while further increase in NaCl to 1.20M had minor additional effect. Tenderness as measured by the Warner-Bratzler shear device correspondingly was most affected by increased sodium chloride level to .60M. As compared to cold boned controls, cold toughening could be eliminated by .60M NaCl treatment before cooking as long as cold chortening was below 30%.

Plant gelling agents for the production of canned meat

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For canned meat products like corned beef, coarse comminuted meat is heated in cans. An enhanced amount of meat juice separates during the heating process. After cooling this liquid has a low gel strenght and it is common to improve the strength by adding connective tissue (rind, sinew) or gelatin. This gels are stable at storage temperatures of to 20°C. At higher storage temperatures it liquefies. Higher storage temperatures are usual in Southern countries and the canned meat must be microbiologically stable and firm for cutting. This is possible by adding 1 % carrageenan or agar-agar to canned pork, beef or corned beef. Agar-agar and carrageenan are marine hydrocolloids, produced by extraction of marine algaes like "Gracilaria Gelidum" (agar-agar) and "Chondrus Eucheuma Gigartina" (carrageenan). These hydrocolloids have a high waterbinding capacity and gel strength which guarantees the firmness to cutting at 30°C.

The purpose of our experiments with carrageenan and agar-agar in canned and fully preserved "German Corned Beef" was that limited knowledge is available about the suitability of marine hydrocolloids for producing canned meat products.

The cappa structure of the carrageenan can be applied only, but it needs potassium ions for a strong jelly. The bitter taste of potassium chloride limits the content in the carrageenan-product to 20 %. The gelling capacity of the examined carrageen-products on the market was different; only some of them proved to be sufficient. Also in case of agar-agar we found a variation in the different products. An important aspect is that some agar-agar-products are able to carry a bad taste over to the meat products. With suitable agar-agar-products the use of 0,5-0,75 % agar-agar is sufficient. The application of connective tissue and these plant gelling agents at the same time hinders the formation of strong gel structures.

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The Stabilization of Dinitrosyl Ferrohemochrome and its Application in the Production of Nitrite-Free Pork Cuts

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The preformed cured-meat pigment dinitrosyl ferrohemochrome (DNFH) may be used to duplicate the colour of nitrite-cured meats, and hence it is an essential element of our multicomponent nitrite-free meat-curing system. However, the pigment is unstable to both air and light and must be stabilized to make it commercially useful. In additi DNFH is sparingly soluble in water. Care must be taken in dispersing it into solid meat cuts in order to produce a uniform cured-meat colour.

In order to enhance its stability, DNFH was microencapsulated in a carbohydrate coating material using a spray-drying technique. The most suitable encapsulating materials were combinations of β-cyclodextrin and the modified starches N-LOK or maltodextrin. A wide range of these combinations proved to be successful, but β-cyclodextrin wa an essential constituent of the coating. The encapsulated pigment, with a loading of 2%, remained stable for over one year.

The relative immobility of the sparingly soluble DNFH within the intact muscle was largely overcome by a judicio selection of processing steps. The most important variable was the particle size of the pigment. Care was taken to red it to a minimum both before encapsulation and when dispersed in the curing pickle. The pickle was then injected into solid meat cut at multiple sites using a modified needle. Tumbling was found to be helpful, and even the cooking procedure had some effect. Nitrite-free ham cuts could thus be produced which were very similar to their nitrite-cur counterparts. This had already been accomplished for comminuted products such as wieners.

Effects of Blood Plasma Addition on Some Technological and Sensory Properties of Frankfurte

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The aim of this paper was to evaluate effects of adding different proportions of liqui blood plasma on some technological and sensory properties of frankfurters.

Frankfurters were manufactured using conventional manufacturing procedures. Formulatio included one control (with 2% soy isolate - PURINA 500 E) and five test variants (with 3,1 6,75, 12,5 and 25% plasma added as replace of ice). Weight losses were determined after hea treatment and after 24 h of storage. A sensory evaluation was conducted by a six-member boa Color was measured by MOM COLOR 100, and firmness by INSTRON 4301.

Weight losses of samples with 12,5 and 25% plasma were significantly lower ($p<0,01$) th the control sample. There were no differences between the control and sample with 6,75% pla sma (14,79% and 15,05% respectively). Juiciness and consistency of samples with plasma were better evaluated than the control. Color of samples with 12,5 and 25% plasma were less desi rable. Samples with 6,75, 12,5 and 25% plasma were darker than the control sample (determi instrumentally). Samples with plasma were firmer than the control (shear force for control sample was 0,0462 kN and for sample with 25% plasma - 0,0622 kN at defined conditions). Fir ness increased with increasing plasma concentracions.

Proteases in meat processing - a preliminary study

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Meat tenderization by protease is a well known approach to enhance quality for kitchen purposes.
Main h a m p e r i n g f a c t o r s against practical utilization of proteases are:

- proteases mostly make tender muscle fibre but not connective tissue,
- proteases penetrate tissue very slowly, so the influenced (outer) layer is small.

The effect of proteases on c o m m i n u t i o n processes is not well known.

O b j e c t i v e s of preliminary investigations are:

- investigate the effect of proteases in meat batter on collageneaus particles (esp. skin),
- determine the final quality of sausages with protease treated meat batter.

R e s u l t s are:

- Destructive effect on skin particles is evident but sausage structure is influenced too.
- Microscopical investigations demonstrated bigger caveoles than in the untreated sample (cooked sausage).
- Sensoric evaluations resulted in finer particles, a more "creamy" taste and larger fat deposits (liver sausage).

C o n c l u s i o n s from technological point of view are:

- Proteases diminish firmness of cooked sausage products, eventually results a "new spreadable cooked sausage" product.
- Proteases free fat from tissue in liver sausage, emulsifiers or changed production methods are needed.

Deep Frying Fats on the Base of Lards

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Deep frying fats were made of fats originating from different carcass locations (back, intestine, leg, shoulder, dewlap, abdominal cavity) with two breeds (KAHYB-39, and HUNGAHYB-39) and their chemical and physical changes were monitored during use. The significance of changes to fat life and to finished product quality were studied. Methods for determining fat deterioration were: peroxide value, iodine value, acid number, polar materials, UV-absorbance, colour, odour, flavour. The characteristics of the produced fats were compared with those of commercial frying fats and sunflower oil. There was no topping up with fresh fat during frying operation. It was established that the intestine- and the leaf-fat contain the most amount of saturated fatty acids, therefore the oxidative deterioration was less pronounced during frying. The fatty acid composition from the same carcass locations in the two breeds was not substantially different. Among the lards the intestine-fat was the most stable during frying at 180 ^{o}C with the least quantity of decomposition products, followed by the leaf-fat. The sunflower oil was the least stable; the BHT was not, the methylsilicone (5-10 mg/kg) was found to be protective against the fat oxidation at frying. According to the chemical parameters and the sensoric properties after 20 hours frying these fats had similar characteristics compared to the frying fats available in the commerce. In frying tests with meat balls the same observations were made. The intestine--fat and the leaf-fat were proposed as raw materials for frying fats.

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PHYSICAL AND LIPIDS ALTERATIONS OF IRRADIATED MEAT

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The physical and lipids changes were studied during storage of irradiated camel meat. Irradiation with 200 and 100 Krad aided in acceleration of meat aging and increased its tenderness at room temperature without bacterial decomposition when compared with aging of unirradiated meat at 4 C. The use of CTC and propolis reduced the lipids changes and deterioration of meat color during aging of irradiated meat. Heating of meat before irradiation, although increased the storage life, was found to reduce the tenderness, water holding capacity and color intensity, while enhanced the lipids oxidation.

Effects of the Rinds Cooking Method and a Second Chopping Procedure on the Stability of Rind and Fat Emulsions

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The addition of pre-cooked rinds to the fat emulsions, for further incorporation into pasteurized or sterilized finely comminuted meat systems, is a common practice in the Portuguese meat industry. Despite that, cooking temperature and time as major technological factors affecting its functional behavior as stabilizing and emulsifying agent, are not standardized in most meat plants. In order to optimize the final stability of Na-caseinate and soy isolate rind and fat emulsions, pork skin was previously cooked at atmospheric pressure (AP-100°C) and under high pressure by using a pressure cooker (PP-113°C), during 10, 15, 30, 45 and 60 minutes. All emulsions were prepared in a bowl chopper in a pilot plant scale.

The influence of a second chopping processing on the stability of sterilized over night cooled emulsions was also evaluated, to simulate their behavior when added to meat emulsion preparation.

The Na-caseinate pasteurized or sterilized emulsions were much more sensitive than similar soy isolate emulsions, in the tested range of cooking time.

For both cooking methods, soy isolate emulsions reached the highest stability value at short cooking times, when compared to Na-caseinate emulsions.

Pressure cooking method was more efficient than AP-100°C regarding emulsion stability, with exception of Na-caseinate emulsions prepared at 45 minutes of cooking time.

A second chopping procedure, after over night emulsion cooling, slightly improved Na-caseinate emulsions stability, while the results for soy isolate depended upon the rinds cooking method.

The Effect of Marinading with Organic Acids on Composition and Sensory Properties of Beef

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Studies about the effect of organic acids on the composition and sensory properties of beef were carried out in order to compare theoretical knowledge with the application in practice.

For the experiments M. mastoideus from young bulls (4 days post mortem) were cut into pieces of 200 g. The marinades of acetic and lactic acid varied in concentration (0.05; 0.1; 0.175 and 0.25 mol/l). The meat pieces were placed in polystyrene bags and covered with 200 ml of marinade and stored for 2 resp. 10 days at 4°C. After marinading the meat was heated for 2 h at 90°C in a water bath.

The content of water, protein, collagen, solubility of proteins, pH, sarcomere lengths and shear force were determined.

The pH of meat homogenates decreased with increasing marinade strength before and after cooking. Marinade with lactic acid was more effective in lowering pH than acetic acid of the same concentration. Marinading resulted in a marked increase of weight in the uncooked state. The uptake of liquid is related to the pH of the meat. After cooking all samples showed loss of weight. Retention of water increased with decreasing pH of meat during cooking, caused by swelling of the myofibrils under acidic conditions below the iso-electric point of its major proteins. It is known that the water holding capacity of meat increases with changing pH above or below the iso-electric point of the meat proteins.

The content of soluble protein in the marinades changed negligibly. In the cooking juice the concentration of collagen increased with increasing acid concentration of the marinade, whereas in meat the values fell slightly.

Changes of the structure are very important for the sensory evaluation. Assessment of shear force indicated that cooked meat was more tender after marination with higher acid concentration. But the sensory evaluation of cooked meat showed that marinading with acid concentrations above 0.15 mol/l resulted in an undesirable sour taste. Therefore pH values below 5.0 in cooked meat are not unrestrictedly acceptable.

Soybean Derivatives in the Sausage SHELF Life

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Soybean concentrated and isolated are largely utilized in our country to produce sausage as emulsifier, because they present in its composition carbohydrates that can be used by microorganisms and can therefore theoretically collaborate to the development of microbian organisms, thus reducing the shelf life of the sausage. Three parties of sausage (Viena) were run using the usual formula each one of them containing 2% of PS-60 (I), PS-70 (II) and HG-90 (III), respectively. PS-60 and PS-70 are concentrated soybeans which contain 60% and 70% of protein while HG-90 is the isolated soybean which contains 90% of proteins. The parties were then stored under refrigeration at the temperature of 5^{o}C. In the zero moment and each week, samples were withdrawn and analysed for rancidity (Kreiss reaction), total count of mesophilus microorganisms, total count of psicrophilus microorganisms and sensorial analysis., The pH of parties I and II started to change from the third week of strage on- they changed from 6.43 and 6.32 to 6.21 and 6.19 respectively. The pH of party III started to vary only from the 5th week on when it reached the pH 6.11. The total count of mesophilus microorganisms reached 10^{6} ufc/g for the party I at the end of the 2nd week and for the parties II and III at the end of the third week. The development of the psychrophilus microorganisms was similar to the mesophilus. All the parties (I, II and III) presented a negative Kreiss reaction during the 6 weeks of observation. Sensorial analysis consisted of a weekly evaluation of color, odor, taste and texture of the different parties of sausage. This evaluation was done by ten panelists well trained. Statistical analysis (Friedman test) has not shown significative differences at the 5% level concerning sensorial analysis. PS-70 and HG-90 behaved similarly as far as the Viena sausage conservation was concerned; a correlation between its carbohydrate content and quicker development of microorganisms was not found. This correlation was only found for the party where the sausages developed with the PS-60.

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Effect of a proteolytic enzyme on the morphological structure of the filling mass of cooked smoked non-perishable sausage

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The present study covers the microstructural changes in cooked smoked non-perishable sausage prepared from 30% cat meat, 40% semifat pork, and 30% nonfat pork. The meat of the test sausages has been treated with 0.01% and 0.02 "Mezenterin 11-11" enzyme preparation which is of bacterial origin and its proteolytic activity is 210 PU/g. The studies ha been carried out using a transmission electron microscope, The analysis of the microstructural changes that have occurr in the filling mass of the cooked smoked non-perishable sausage without enzyme shows light strips in the zone of the Z-lin among which are the optically thicker parts of the Z-lines. In the middle of the anisotropic sections have been observed cle traces of the H-zones and M-lines. In the sausage with 0.01% and 0.02% added enzyme the protease hydrolyzes t myofibrils to a different extent, and as a result the outlines of the sarcomers have disappeared, and a net of fine-grain myo brillar proteins has been formed. This fine net of myofibrillar proteins has been found to be less thick giving better organol tic qualities to the sausages. Significant changes have been also established in the collagen fibers where sections of tra verse ribbing have disappeared. The changes observed by us determine the better texture of the sausages in the ca where their meat has been protease treated. The highest organoleptic grade - 8.82 has been observed for the sausages w 0.01% enzyme as compared to the controls - 7.20.

The Stability and Distribution of Emulsifiers in Frankfurter-Type Sausage Batters

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The chemical stability and distribution of monoglycerides (glycerolmonooleate and -monopalmitate) and lecithin has bee examined by means of radiotracer compounds in order to elucidate their mode of action during the process of manufactur frankfurter-type sausages. In the product without jelly release the substances were localized by autoradiography, in the pro with jelly separation by liquid scintillation counting.

The autoradiographs show that in the raw (unheated) batter the distribution of the emulsifier molecules within the fat par is very inhomogeneous. This low "mobility" points to the colloidal system of a suspension (solid fat in the batter) in the mea "emulsion". In the heated product the monoglycerides are concentrated in the lipid phase. There is no indication of emulsifi phase boundary areas of fat and water.

Considerable amounts of lecithin can be found in the batter component which contains the structure forming proteins. T fact supports the theory that lecithin molecules bind to proteins with the consequence of inhibiting the formation of a netwo thus lowering the water holding capacity and quality of the product.

There were no chemical changes in the structure of emulsifiers during the process of manufacturing frankfurter-type sausa

A study on the possibiliries to insert a preparation from desugarized beet slices in cooked perishable sausages. I. Effect of the preparation on the hydrophilic properties of the filling mass, product chemical composition and yields

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One of the ways to compensate lack of ballast substrances in man's food in today's living conditions is to obtain and afterwards insert them in food products. With regard to this, the object of the present work is to study the possibility to use an additive with a high content of nutritive fibers from desugarized beet slices in cooked perishable sausages.

The additive was inserted in pork sausages in amounts of 1,3 and 5 % in relation to the meat raw materials under three different states (dry, prehydrated and emulsified). The effect of the additive on the water-holding capacity and meat emulsion stability has been studied. The sausages have been measured for yield and protein, fat, and water contents.

The results obtained indicate that the above additive has increased the water-holding capacity and meat emulsion stability irrespective of the type of additive state. However, 5 % of dry additive upset the dispersion of the filling mass. It has been established that the additive elevates the protein content of the dry matter. With 1 and 3 % additions, the protein in the samples rose to 19.53 % and 20.31 %, respectively, while in the controls it was 18.80 %. With 1.3 and 5 % prehydrated additions, protein contents rose to 19.40 %, 20.02 % and 20.74, respectively. With emulsion additions these levels were 19.93 %, 20.18 % and 20.41 %.

The additive does not influence the fat content of the finished product but increases the yields up to 106.03 % whereas the yield for the samples is 104.50 %.

Use of whole sunflower kernels in cooked perishable sausages

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It has been studied the possibility to use whole sunflower kernels in cooked perishable sausages to act not only as a protein enricher but also as a substitute of the animal fat, and also to improve the fatty acid composition of the finished meat products. Whole sunflower kernels without their husks have been used in the tests, and were added in amounts of 3.5% and 10% in relation to the meat quantity, in cooked perishable sausage (50% nonfat pork, 50% semifat pork), and in Prague frankfurters (40% veal, 60% semifat prok). The water-holding capacity and emulsion stability of the filling mass have been established. The finished product was measured for protein, fat and ash contents, and yield. It was also subjected to organoleptic evaluation.

It has been established that the addition of whole sunflower kernels in amounts up to 10% in relation to the meat quantity improves both the water-holding capacity and emulsion stability of the filling mass whereas the best results have been observed at 3% additions where the level of free water is the lowest (0.70%) compared to the controls (4.06%). The sunflower kernels do not cause significant changes in the pH of the filling mass. Higher additions have led to respectice decrease in the water and fat contents fort both kinds of sausage. At the same time, the amount of protein increases by an average of 3%. The ash content which is 1.23% and 1.31% in the controls has increased to 2.39% and 2.11%, respectively, in the test sausages. The yield for the test sausages with 10% addition of sunflower kernels is on the average 12% higher than that for the controls. The highest organoleptic grade has been given to the pork sausage with 3% addition of sunflower kernels (8.96) followed by the Prague frankfurters (8.90) compared to the controls evaluated with 8.23 and 7.26, respectively.

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The Role of Sodium and Potassium Lactates as Chloride Salt Replacers in Low Salt Frankfurters and Uncured Sectioned and Formed Turkey Rolls

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To test the feasibility of partially replacing sodium and/or potassium chloride with sodium and/or potassium lactate, the effects of lactates were compared to control untreated low salt products and to equimolar sodium or potassium chloride treated products. Parameters measured included: purge, smokehouse yield, water activity, cohesiveness (peak force to separate), emulsion stability and shelf life (total plate counts - TPC, and Lactobacilli counts - LAC). Products manufactured were - a low salt, low fat "health conscious type" frankfurter and a similar lean low salt uncured sectioned and formed turkey roll.

Results, using S.A.S. systems package, showed potassium lactate (KL) and sodium lactate (NaL) reduced the accumulation of purge in the frankfurters and turkey rolls respectively when compared to the low salt controls ($p<.05$) and performed equally as well as the equimolar potassium chloride (KCl) and sodium chloride (NaCl) treatments in the same products ($p>.05$). In the frankfurters, no difference was seen in smokehouse yields between the NaL or KL and the equimolar NaCl or KCl treatments ($p>.05$ in both cases). NaL was favored over KL in frankfurters as measured by emulsion stability ($p<.05$). In contrast to previous research, no differences were demonstrated in water activity in either product with either lactates or equimolar chloride salt treatments. However, KL extended shelf life in frankfurters as measured by Lac_{64} and TPC_{64} compared to the control treatment and performed equally as well as the equimolar KCl treatment. Finally, consumer taste panelists were unable to differentiate KL treated frankfurters from the industry standard salt level control treatment ($p>.1$) while they were able to differentiate the industry standard salt level control from the low salt control ($p<.01$).

Results indicate NaL and KL may serve as adequate replacers for part of the NaCl and/or KCl in a low salt frankfurter and in uncured turkey rolls.

Studies on the Techniques of the Non-vacuumized Ham Processing

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Some advanced meat vacuum-processing facilities have been imported into China. Bacause of the higher investment and energy energy consumption, the economic benefits of factories had been affected. In order to enhance the rate of finished products and benefits for the enterprises, some processing facilities, techniques and ingredients had been improved, and also the vacuum facilities had been replaced by the general facilities. The structure-resilence, the rate of fat loss and water holding capacity of hams from the vacuum and non-vacuum processing methods were tested, and also the structure in and outside hams were tested with sensory scores. It was found that the hams from the non-vacuum processing with low humidity, low heating and higher pH value of the curing had no obvious differences in quality scores from those made by vacuum processing ($p>0.05$).

Fractionation and identification of lipids of processed rabbit meat

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This investigation was carried out on California and New Zealand White rabbits meat (both sexes) of a marketable age (2 and 3 months). Fore limb, loin and hind limb cuts were used for fractionation and identification of lipid components. Meanwhile, the influence of certain processing methods, namely: pressure cooking, roasting and smoking on the lipids composition was assessed as well. Extracted lipids of fresh meat were fractionated using thin-layer chromatographic technique to seven fractions, namely: phospholipids, monoglycerides, cholesterol, diglycerides, free fatty acids, triglycerides and hydrocarbons. Triglycerides recorded the highest percentage among lipid classes (49.08 and 47.04% of total lipids) in the two afore-mentioned studied rabbit strains; respectively. Females had slight higher phospholipids level than males, while an opposite trend in other lipid classes was recorded. Slight differences were observed between studied ages. However, among all studied cuts the fore limb recorded the least phospholipids content, while the triglycerides rated the highest levels. With regard to the effect of pressure cooking and smoking processes on the lipid fractions in rabbit meat the data revealed that no compositional changes compared with that of fresh meat were detected. However, an extra unknown lipid fraction appeared in roasted rabbit meat. In general processing methods reduced phospholipids and triglycerides contents, while the contents of monoglycerides, diglycerides, cholesterol and free fatty acids were increased. On the other hand the hydrocarbons content decreased after pressure cooking and roasting processes of rabbit meat, while it was increased after smoking process.

A Comparison between Pea Starch and Potato Starch in a Meat Emulsion Model.

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Since insufficient information is scant on systematic investigations of the effect pea starch has on the functional properties of meat emulsions, the effect of pea starch was compared with potato starch as an ingredient in a meat emulsion model which was subjected to various technological conditions.
In order to avoid the influence of too many disturbing factors on the final results, the recipe of the meat emulsion was kept very simple. The ingredients were lean pork, back fat, curing salt, water, ice and starch. The two starch types were compared at 2 and 4 per cent levels. The models were heated to 75°,85°,95° or 112°C and were subjected to chilled storage at +5°C for 2 weeks or frozen storage at -18°C, also for 2 weeks.
The comparison was made by measurements of texture, fat and water holding capacities of the various groups.
The results of the investigation showed that heat treatment at increasing temperatures in all samples, including the control, resulted in differences in functional properties in all cases, but although pea starch does not start to swell until at 75°C whereas potato starch swells at 64°C, the performance of both starches was quite similar to one another during chilled and frozen storage. Thus, there seems to be no technological advantage in using pea starch.