

Properties and use of fibrous texturates prepared by means of non-spinneret spinning

TOLSTOGUZOV, V.B., DIANOVA, V.T. and TCHIMIROV, YU. I.

The Institute of Hetero-Organic Compounds named after A.N. Nesmeyanov, Moscow, USSR.

ROGOV, I.A., MOSKALEV, V.A. and KIM, V.V.

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

The technology of every meat product relies upon the functional properties of protein additives. One of the prospective methods for controlling protein functional properties is their structurization by means of non-spinneret spinning. This method is universal, as far as raw materials are concerned, easy operationally, and does not require expensive equipment.

This paper reports the results of a study into the functional properties of fibrous texturates and their effect upon the qualities of combination meat products. Characteristics of the interactions between casein-pectic and co-precipitate fibrous texturates with water, viz, solubility and swelling, as well as the capacity to retain their shape during heating were determined.

Texturate solubility and swelling rate increase with the pH of the medium. Casein-pectin-based texturates are characterized with lower solubility values and a higher rate of swelling as compared to co-precipitate-based texturates. Casein-pectin texturates retain their shape after cooking at 393 K, co-precipitate ones at 373 K. The latter were used to replace 20% meat in the formulation of a semi-dry sausage, the former were used to replace 30% meat in combination ground meat products. All the test samples had a somewhat higher protein content and a lower level of fat after cooking. The addition of fibrous texturates decreases the shear stress in combination meat products. The combination meat products were similar to conventional ones with respect to amino acid profile, digestibility and organoleptic qualities.

Chemical composition and food value of soft poultry offals

SEVASTIANOVA, N.I., ABRAMOVA, L.A., MARTINIUK, T.G., PARITSKAIA, N.S., SUSHCHOVA, N.B. and GAVRIKOVA, I.P.

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

The amino acid, fatty acid, vitamin and mineral composition of soft poultry offals (liver, heart, gizzard) were studied. The ratio of essential to non-essential amino acids is more favourable in the liver and heart proteins than in the gizzard proteins. Based upon the amino acid composition, the full protein value of the soft offals is similar to the poultry meat. The fatty acid composition determines the high food value of chicken fat. Considering the vitamin content, poultry hearts and gizzards are equal or more valuable than the meat of corresponding poultry species. Maximum content of vitamins was found in the livers. Macromineral composition of soft poultry offal is similar to that of the poultry meat; it is also a rich source of microelements - zinc, copper and manganese content is much higher than in meat. Relative to the content of some microelements, poultry liver is 2-20 times more valuable than meat.

The usage of soft poultry offals will satisfy to a considerable extent the human requirements for these valuable nutritive substances.

### "Livex" - a new product from animal blood and its fractions

ZALESKI, S.J., KUMOR, L. LAWIK, B., MALICKI, A., \*SZUBINSKA, M., \*TERESZKIEWICZ, R.V.

Agricultural Academy, Wroclaw, Poland

\*Polish Academy of Science, Institute of Environment Engineering, Zabrze, Poland

New technologies in the texturization of animal blood or its fractions have been developed based upon the natural physiological clotting properties of blood. Modification of the natural clotting process by eliminating the last phase (retraction) enables basal ground brown "livex" to be obtained from the full blood of various animals (pigs, cows, horses, sheep, rabbits or poultry). After the cutting of the raw brown "livex" into pieces and its pasteurization, basic fresh brown "livex" is obtained. If, before natural clotting, skimmed milk, meat or vegetable extracts, or other compounds are added to the animal blood, then a variety of products can be obtained, e.g. fresh brown milk "livex" - a very good, high-protein material for animal feeding. In almost the same way it is possible to produce basic or modified, fresh or dry white "livex" for human consumption, as well as basic or modified, fresh or dry black "livex" for pharmaceutical or cosmetic purposes. During the very simple decolourization of fresh black "livex" it is possible to change its texture to a greasy form.

### Physico-chemical, sanitary-hygienic and toxicological evaluation of the proteins derived in the production of medicinal preparations

STEKOLINIKOV, L.I., SNITSAR, A.I., FYODOROVA, N.Yu., BELOUSOV, A.A., BABURINA, M.N. and ALYOKHINA, L.V.

The All-Union Meat Research Institute, Moscow, USSR

By means of universally accepted methods it was found that dried cakes of the pancreas remaining in the production of a large volume of an endocrine preparation, insulin, contain over 60% of protein having all the essential amino acids, their saprophyte load being less than  $1.05 \times 10^2$  -  $3.02 \times 10^3$  colonies per gram. At the same time acute and chronic tests on nondescript rats indicated the cakes in question have a toxic effect on the organism (loss of appetite, depression, changes in the morphological composition of blood and internal organs, animal's death). With this in mind, a technology has been developed which provides for cakes detoxication prior to their processing into animal feeds.

Methodological aspects of developing reference data on the properties of meat and meat products

SAVTCHENKO, A.F., SUKHANOVA, S.I., \*MITIN, V.V., \*USKOV, V.I. and \*ROTANIN, E.P.

The All-Union Meat Research Institute, Moscow, USSR

# Growth of salmonellae in fermented sausages manufactured using starter cultures

BRANKOVA, R., DINEVA, B., KRASDEV, A. and \*KALOYANOV, I.

Meat Technology Research Institute, Sofia, Bulgaria

\*Central Research Institute of Veterinary Medicine, Sofia, Bulgaria

The application of starter cultures in the manufacture of fermented meat products is important not only for the acceleration and the control of ripening processes, but also for ensuring the safety of the products from a microbiological point of view.

In recent years, we have conducted scores of experiments to understand a number of problems related to the application of starter cultures in the meat industry. Different experimental sausages were manufactured under semi-industrial or industrial conditions to determine optimum technological regimes and the suitable inoculation of starter cultures. The sausages obtained were regularly analysed to determine their sanitary and hygienic characteristics. No salmonellae were isolated from any of those experimental or industrial lots. These results led us to artificially introduce into the sausage meat 3 species of *Salmonella* encountered most frequently in the meat industry (*S. senftenberg*, *S. typhimurium*, *S. enteritidis*) so we could determine the probability of survival of salmonellae that might accidentally find their way into sausages. To this end, several series of experiments were carried out, in which a starter preparation containing *L. plantarum* and *M. varians* was used. Variants in which no such preparation was introduced served as controls. Use was made of 24-hour *Salmonella* cultures, with which sausage meat was contaminated at the levels of  $10^2$  and  $10^4$  cells/g. Contamination was effected by mixing the suspensions with the sausage meat or by injection (3 series of experiments of 8 variants each).

The experiments indicated that contamination by injection is not an efficient method of determining the probability of growth of salmonellae. Injection resulted in a cluster distribution of *Salmonella* cells in the sausage. The concentration of microorganisms in definite regions prevented the direct contact with the remaining sausage meat and other microorganisms. For this reason, salmonellae were still found after 15 days of ageing, although reduced to only 40-50 cells/g of product.

The series of experiments conducted by mixing salmonellae with the sausage meat (contamination with 10,000 or 100 cells/g) proved the most informative. In the experiments with *S. senftenberg*, salmonellae counts rose until day 7 of ripening in the controls, after which they decreased, and none were isolated after 17 days from 30 g of product. In the variants with a starter preparation, after 7 days *S. senftenberg* was found only upon contamination with 10,000 cells/g. In the experiments with the other two species, after 7-14 days those organisms were isolated from control variants only after enrichment. *Salmonella typhimurium* and *S. enteritidis* were not isolated from the sausages prepared using starter preparations.

# On the possibilities of producing restructured beef steaks possessing attractive red colour during frozen display

GUMPEN, S.A. and \*OLSON, D.G.

Norwegian Food Research Institute, Aas-NLH, Norway

\*Meat Laboratory, Department of Animal Science, Iowa State University, Ames, Ia, USA

Brown spots and impaired colour stability during frozen display are important reasons for the lack of popularity of restructured beef steaks at the retail level, e.g. in the US.

Several factors make these products highly susceptible to myoglobin oxidation, e.g. the addition of 0.5-1.0% salt to facilitate binding, the use of one or more freeze/thaw cycles, and the oxygenation that takes place during particle reduction and mixing. Even when produced under the best of hygienic conditions at low temperatures, flaked (or chunked) and formed beef steaks are likely to contain undesirable levels of metmyoglobin, causing brown discoloration, even before the display period.

The aim of our experiments was to study the effect of rapid processing (hot processing) on the colour and colour stability of restructured steaks. Chuck from hot boned steers was used to produce flaked and formed steaks that were frozen on the day of slaughter. Electrical stimulation of carcass sides was used to prevent cold shortening and thaw rigor. Control samples were produced from non-stimulated, conventionally deboned sides. The hot boned meat was flaked prior to chilling, mixed with 0.5% NaCl and stuffed in fibrous casings. The resulting logs were frozen at  $-30^{\circ}\text{C}$  and sawed to steaks in the deep-frozen state. Some steaks were allowed to bloom in a tempered state. The steaks were packed in  $\text{O}_2$ -permeable wrapping and kept at  $-30^{\circ}\text{C}$ . Colour and myoglobin stabilities were then studied during frozen display at  $-20^{\circ}\text{C}$  and after thawing, using the Hunterlab Labscan 5100 Spectrocolorimeter for the colour measurements, and a spectrophotometric method described by K. Krzywicki (Meat Science 7(1982), 29-36) for the metmyoglobin determinations. Steaks made of cold boned meat generally had significant amounts of metmyoglobin. Steaks made of hot boned beef typically (1) had no initial metmyoglobin, even after tempering and blooming, (2) could be stored for at least one month at  $-30^{\circ}\text{C}$  with virtually no increase in metmyoglobin, and (3) possessed a reasonably good colour stability when displayed under fluorescent light.

# Properties of meat as a raw material for use in comminuted meat products

HERMANSSON, A.-M.

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

More than 50% of a carcass is used for comminuted meat products in Sweden. This meat is often analyzed for chemical composition such as protein, fat and water content, but very little attention has been paid to what contribution the actual source of the meat might make to variations in the structure and functional properties of the final products. There are reasons to believe that the functional requirements of the meat raw material differ for different meat products and the increasing cost of meat makes it important to use it as effectively as possible.

A project was started in order to find out what differences in the meat microstructure and the functional properties of comminuted meat products could be found due to the choice of meat and to explain possible causes of observed differences.

First, the contribution made by meat from eight well-defined muscles of beef to the microstructure and functional properties of various model sausages was investigated. Big differences were found with regard to the weight loss on cooking and frying. The highest yields were observed with *M. biceps brachii* and the lowest with the anterior part of the *M. serratus*. The differences in weight loss between products made from these two muscles could be as high as 16% on cooking and 11% on frying.

Second, it was investigated whether differences of the same magnitude could be obtained for different meat from meat blends commercially used for meat comminutes. Meat trimmings from various parts of the carcass such as neck, shoulder, hind and fore legs, was separated during cutting and classification. Model sausages of the same recipes as in the work on well-defined muscles were made. Big differences in weight loss due to cooking and frying were found. The maximum difference in cooking losses were in the range of 9% and in frying losses in the range of 6%. Meat from the neck gave the highest and meat from the shoulder the lowest yields. Differences were also found with regard to texture and microstructure.

## The effect of processing temperature and effective salt concentration on the water binding ability of frankfurt type sausages made with and without added fat

TROUT, G. R. and \*SCHMIDT, G. R.

Department of Animal and Dairy Sciences, Auburn University, Auburn, Alabama 36830, U.S.A.

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

Although considerable research has been carried out to determine the effect of reducing the sodium chloride and fat content of processed meat products, little has been directed at determining the extent that these changes are influenced by the thermal processing temperature. One role of fat in frankfurt type products is to increase the effective brine concentration, due to the inability of salts to dissolve in the nonpolar lipids. This is important, since it is the brine concentration—or the effective salt concentration—that determines the functionality of meat proteins.

In this study the effect of brine concentration (1.33, 2.13, 2.93 or 3.73% NaCl) on the water binding ability (WBA), of products containing either five or thirty percent fat were compared after processing to either; 56, 64, 72 or 80°C. The treatments were arranged as a 2x4 factorial (two fat levels by four brine concentrations), with a four way split-plot for processing temperature; a total of 32 treatments. The experiment was replicated twice. WBA was determined as the amount of water, meat and salts retained in the product after cooking divided by the amount originally present; expressed as a percentage.

Analysis of variance showed that the presence of fat had little influence on the amount of water bound by the muscle proteins. Processing temperature and brine concentration had a large influence on the results, and there was an interaction between the two variables. At the lowest brine concentration, temperature had a large influence on WBA, with the WBA being lowest at the higher temperatures (WBA values of 68% at 80°C and 100% at 56°C). While at the highest brine concentration, temperature had little effect on WBA (91% at 80°C to 99% at 56°C). WBA was not influenced by brine concentration at the lowest temperature (56°C), where all treatments gave maximum yield. At higher temperatures, brine concentration had a large influence; at 80°C the WBA ranged from 69% at the lowest brine concentration, to 91% at the highest.

Hence, the presence of fat has little effect on WBA, beyond concentrating the ions into aqueous phase, while the WBA results obtained at different brine concentrations is determined by the processing temperature. These results show that as the salt concentration of meat products is reduced, control of the processing temperature becomes more critical.

Determination of the amino acid score and the biological value of fermented sausages manufactured using starter cultures

DINEVA, B., NESTEROV, N., KRASTEV, A. and BRANKOVA, R.

Meat Technology Research Institute, Sofia, Bulgaria.

Two sausage products differing in composition (different per cent proportions of beef and pork meat, and back fat with various spices) were manufactured using a microbial starter preparation, with the objective to develop fast-ripening fermented sausages of specific properties. Products obtained using the same formulae, only without the introduction of the preparation, were used as controls. Initial ripening took place at a temperature of 25°C and a relative air humidity (RH) of 95% for 48 hours, after which drying was effected at 15°C, with gradually decreasing humidity.

The effect on the biological value of the products arising from the use of a freeze-dried microbiological preparation, consisting of lactobacilli and micrococci, was evaluated by study of the chemical changes induced. The method used was that of amino acid numbers, expressing the ratio of each essential amino acid in the protein under investigation to the one in the protein selected as a standard by FAO/WHO, 1973. Further, determinations were made of the total amino acids per 100 g of product and per 100 g of protein; E/T, the ratio of essential to total amino acids, as well as the energy content of the products; A/E, the dependency of the limiting amino acid on hydroxyproline content; E, %, the energy, obtained from pure proteins, and P, %, the energy of the proteins after Dvorjak and Vognarova (1970).

No substantial differences were found in the amino acid numbers of essential amino acids in both experimental products, whether manufactured with or without the preparation.

The E/T index for the first experimental product was 43.3% in control variants and 43.96% in experimental ones, and in the second product, 44.25% and 43.80% respectively. The comparison of E/T for the initial raw material (42.6% for product 1 and 43.5% for product 2) with E/T for the finished products is indicative of the good quality of the products under investigation.

Both experimental products had a higher energy content than the initial raw materials. The high values of the remaining indices (P, A/E, E), irrespective of the small differences in them, suggest that products of a high biological value were obtained regardless of the shortened technological process in the experimental variants.

Changes in some biochemical indices characterizing the technological properties of fermented sausages manufactured using starter cultures

NESTEROV, N., DINEVA, B., KRASTEV, A. and BRANKOVA, R.

Meat Technology Research Institute, Sofia, Bulgaria

To guide and accelerate ripening processes in fermented sausages, use was made of a microbial preparation of micrococci and lactobacilli which was introduced in two experimental fast-ripening fermented sausage products. At the start of the production process, two ripening temperatures (18 and 25°C) were employed for 36-48 hours. The sausages were then left to age and dry at 15°C. In this way, 6 experimental series were manufactured under industrial or semi-industrial conditions. The levels of the pigment formed, residual nitrite, total solids, and pH were followed dynamically in the ageing sausages. In the finished products, the levels of protein and fat were also determined.

Better biochemical characteristics were found in relation to pigment formation in terms of the % total pigment converted into nitrosomyoglobin, residual nitrite, and % total solids in the products containing a starter preparation ripened at 25°C compared with the controls (no preparation introduced) and the products ripened at 18°C. In most cases, by day 3 of the ripening process, nitrosomyoglobin in the experimental batches reached 70-72% and thereafter remained approximately the same, while in controls it reached 64-69% in the finished products. Total solids on day 14 varied depending on the composition of the sausage, being 56-58% in control variants for product I and 62-63% for product II versus 59-63% and 64-66% for the experimental variants, respectively.

The results obtained indicate that by application of a starter preparation and a ripening temperature of 25°C, faster pH reduction occurs; also faster pigment formation and meat particle binding is obtained and this accelerates product drying. Since the process is considered to be completed upon reaching a definite per cent water content (40-42%), this is achieved earlier with the faster drying. According to this index, the necessary limits are reached on day 7-10 for the experimental variants, while for the controls a minimum of 14 days is required.

# Data for the levels of substitution of meat protein by unconventional proteins in sausage products

CHOLAKOVA, A., KRASDEV, A. and NESTOROV, N.

Meat Technology Research Institute, Sofia, Bulgaria.

Experimental samples of combined meat products obtained by the substitution of meat protein by unconventional proteins were developed. The levels of substitution were determined by the mathematical method developed by the authors.

Two patterns of substitution were employed in the development of experimental samples:

- (1) Direct substitution of meat protein in sausage products in accordance with the computer-estimated optimum per cent ratios:  
Hamburger Sausage, with sodium caseinate, 98:2; with soy protein isolate 500E, 82:18; with wheat gluten, 68:32.  
Prague Frankfurters, with sodium caseinate, 78:22; with soy protein isolate 500E, 62:38; with wheat gluten 58:42.
- (2) Substitution of meat protein in sausage products with pre-balanced mixtures (with respect to amino acid composition) of sodium caseinate and wheat gluten in the ratio of 73:27, and of soy isolate and wheat gluten in the ratio of 70:30, where the ratios were computer-estimated.

In an experiment with white rats, the biological value and the digestibility were determined for sausage products with a different per cent substitution of meat protein by soy protein isolate 500E. The theoretically predicted biological value of the combined meat products was also confirmed practically on experimental animals.

Proof was obtained of the precision of the mathematical method used to estimate the levels of substitution of meat protein by unconventional proteins, by which combined meat products are obtained with a balanced amino acid composition at a level identical with the human requirements of essential amino acids.

# A study of commercial fermented sausage production using natural fermentation, starter cultures and glucono-d-lactone.

PANERAS, E.D. and BLOUKAS, J.G.

Laboratory of Food Science and Technology, School of agriculture, Aristotelian University of Thessaloniki, Greece.

Traditionally the industrial production of fermented salami sausages in Greece is based on natural fermentation and/or on the use of a natural starter made from a finished product, ie. from previous runs. Some manufacturing plants have recently started experimental production using pure starter cultures or addition of glucono-delta-lactone. This comparative study was undertaken to determine the relative effects of commercially produced fermented salami sausage using as variables: (a) natural fermentation, (b) sausage starter from previous runs, (c) commercial mixed culture of lactobacilli and micrococci, (d) commercial pure culture of micrococci and (e) 0.4% glucono-delta-lactone (GdL). These five treatments were reproduced three times in a modern sausage factory during the course of its normal daily production utilizing the same ingredients and standard fermentation and ripening conditions for this product.

During production samples were examined for pH, total acidity as lactic acid, firmness, moisture, water activity, colour (L,a,b). Microbiological examination included: total count, lactobacilli, micrococci and staphylococci, enterobacteria, Staphylococcus aureus and yeasts. The finished product (30 days old) was evaluated organoleptically for colour, flavour and overall acceptability using an eight point hedonic scale (1 = dislike extremely, 8 = like extremely).

Sausages produced by natural fermentation had the highest pH values, the lowest total acidity and the least firmness during all stages of production. Salami made from sausage starter from previous runs were also softer. The lowest pH, the highest total acidity and the firmest sausages were produced using a mixed culture of lactobacilli and micrococci and GdL. The sausages produced with a mixed culture had the lowest moisture content during the study. There were no significant differences in measured colour or in total bacterial count, lactobacilli, micrococci and staphylococci and yeasts. The highest counts for enterobacteria and S. aureus during all stages of production were found in the naturally fermented salami and the sausages produced with sausage starter.

The organoleptic evaluations for colour, flavour and overall acceptability showed no significant differences (P < 0.05) among the various products.

# Effect of heat treatment and storage on the level of residual nitrite in large diameter cooked sausages

MARINKOV, M. and \*JOVANOV MERIMA

Yugoslav Institute of Meat Technology, Beograd, Yugoslavia

\*Meat Industry "Coka", Coka, Yugoslavia

Since cooked sausages occupy an important place in the overall assortment of Yugoslav meat products we set ourselves the task of examining the effect of heat treatment and storage on the level of residual nitrite in concentric layers of cooked large diameter sausages (diameters 60 and 100 mm respectively). The examination comprised the peripheral, intermediate and central layers. The decomposition of nitrites was monitored after curing, heat treatment, and during the storage of the sausages.

Under trial conditions, a meat batter was prepared without ascorbate addition (water = 53.5-54.6%, proteins = 12.9-13.4%, fat = 28.0-29.8%) which was filled into Faser Top Braun  $\varnothing$  60 and  $\varnothing$  100 mm casings. The sausages were steam-cooked at 80°C - those of smaller diameter for 60 min, whilst those with the wider diameter for 115 min, to ensure that 70°C was reached in the centre of the product. After cooling with water at 18°C, the sausages were stored for 15 days at 8°C. By means of a thermocouple, "Ellab" heat treatment was recorded in all three layers of the sausages. The residual nitrites (reaction according to Zambelli) were determined in the raw sausage, in sausage 1 hour after heat treatment, and on 1st, 8th and 15th day of storage.

During the preparation of the meat batter and the curing process (1 hour after the curing ingredients were added) 174.0 mg/kg of nitrite was found in the  $\varnothing$  60 mm sausage and 178.7 mg/kg in the  $\varnothing$  100 mm sausage from an initially added 200 mg/kg of NaNO<sub>2</sub>, these figures representing a detection of 87.0% and 89.3% respectively.

The content of residual nitrite dropped 1 hour after heat treatment in the peripheral layer of the smaller diameter sausage to 116.9, in the intermediate layer to 120.4, and in the central layer to 124.2 mg/kg. In the wider diameter sausage the nitrite contents were recorded as: 141.3, 146.6 and 156.6 mg/kg respectively. Comparing the average values, it appears that the decomposition of nitrite in the smaller sausages was 1.5 times higher than in the 100 mm diameter sausages. In none of the layers of the sausages examined did the decomposition exceed 50%.

During the 15 day storage, the decomposition of nitrite continued in all the layers of both sizes of sausages. The level of the residual nitrite remained at its highest in the central layers (91.5 and 93.8 mg/kg respectively in the 60 and 100 mm diameter sausages), whereas it dropped to its lowest level in the peripheral layers (82.2 and 89.6 mg/kg respectively).

Decomposition of 50% of the added nitrite was found in the cooked sausages that were examined only after 8 days storage at 8°C.

# Influence of ethereal oils on the quality of semi-dry sausages during storage

MAMEDOV, A.G., \*GUSEJNOV, V.M., \*ALIEV, S.A. and SHUKYUROV, N.N.

The Azerbaijan Ministry of Meat & Dairy Industries, Baku, USSR.

\* The Baku Branch of the All-Union Meat Research Institute, Baku, USSR

The quality of semi-dry "Poltavskaya" sausages prepared with either aromatic ethereal oils or dry seasonings was compared.

The test samples contained a composition of ethereal oils (eugenolic basil, savoury, rosemary in the ratio 1:1.5), whilst the controls contained dry seasonings (black pepper, all-spice). The controls and the test samples were stored for 5 days at +20°C, 12 days at +12°C, 19 days at +6°C and 100 days at -7 to -9°C.

Sausage quality was investigated during storage. The following parameters were studied; - sensory characteristics - appearance, colour upon slicing, aroma, taste, consistency, juiciness and overall evaluation; physico-chemical parameters - content of water, fat, protein, nitrite, iodine and peroxide number, total number of pigments, brightness of aqueous-acetone extract colour; microbiological parameters - total number of microorganisms per 1g of product, conditionally pathogenic microflora.

It was found that the test samples had a brighter colour upon slicing and more expressed aroma. There was a tendency towards decreased iodine and peroxide numbers in the test samples.

Structure and properties of the protein casings prepared by adding a collagen solution

GORBATOV, V.M., GOLOVANOVA, P.M., TUZOVA, N.N., MAKAROVA, L.R., YAZIKOVA, G.M., \*SHUKHRINA, M.N., \*\* BABLOYAN, O.O. and \*\*\* BAGROV, S.N.

- The All-Union Meat Research Institute, Moscow, USSR.
- \* The "Belkoshin" plant, Luga, USSR
- \*\* The Central Leather Research Institute, Moscow, USSR.
- \*\*\* Ophthalmomicrosurgery Research Institute, Moscow, USSR.

One of the most prospective trends in the utilization of collagen-containing meat wastes, i.e. the solubilization of the latter followed with sausage casing moulding while adding a collagen solution (CS) to a loose fibrous mass, is presented. Solubilization conditions have been determined, which provide flowing concentrated CS. Physico-chemical and physico-mechanical properties of casings with CS added have been studied. Such casings are shown to be similar in their characteristics to those produced by the conventional technology. By means of raster electron microscopy the structure of the casings thus prepared has been examined and found more homogeneous, with fibres being distributed more evenly, and with the mass being more homogeneous and plastic.

Cooked sausage qualities as influenced by addition of fungal mycelium

SALAVATULINA, R.M., OVTCHINNIKOVA, L.P., OVSYANNIKOVA, E.N., MIKHAILOVA, M.M. SOLODOVNIKOVA, G.I. and GRISHINA, T.V.

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

The search for additional sources of protein is a most important problem at present. Because of this, the possibility of using non-traditional protein materials for edible purposes is of special importance, one such source being single-cell microbial proteins, including mycelial biomass.

The physico-chemical, biochemical and organoleptic characteristics of model cooked sausages as affected by mycelial biomass were studied. 1-6% of it was added to the sausage formulations. The mycelial biomass contributed to a higher level of moisture and a lower level of fat in the product; for example, the addition of 6% of the mycelial biomass to the formulation increased the moisture in the finished product by 4.7%. The levels of VFA, carbonyls and free titratable acids increased with the amount of the mycelial biomass added, but caused no marked changes in lactic acid and pH.

More than 1% mycelium clearly increased the biochemical indices, causing the development of very poor taste and aroma, not typical of meat products. 1% mycelium plus up to 3% soy isolate tended to raise acid radicals and carbonyls compared to control samples. In this case the organoleptic scores for the test and control samples were close to each other.

In principle, the possibility of using a fungal mycelium as a food additive in the development of new cooked sausages is indicated.

# Influence of grinding method on the microstructure of cooked non-persistent sausages

\*DANTCHEV, St., \*\* GIRARD, G.P., \*\*\*VELINOV, P. and \*SCHNECKEL, V.

\* Higher Institute of Food Industry, Plovdiv, Bulgaria

\*\* Meat Technology Research Institute, Theix 63122 Ceyrat, France

\*\*\* Meat Technology Research Institute, Sofia, Bulgaria

Two methods of preparation of the filling material were studied: 1. using grinder SM - 120 K and 2. using grinder and colloid mill KM-3.

The results from the light microscopy indicate that the first method of preparation provides unground muscle fibres and fatty cells distributed mainly in groups. The second treatment ensures considerably finer structure lacking solid particles of muscle fibres and fatty tissue. Fat is uniformly distributed amidst the protein mass forming approximately equal-sized fatty globules.

Examination with an electron microscope revealed fragments of muscle fibres of intact structure resulting from the first grinding method. The fatty globules visible had poorly shaped protein covers.

With the second method a homogeneous protein structure was observed and fatty globules with well-shaped protein shells. The rougher microstructure of the filling mass from the first method demonstrated lower water-holding capacity.

# Application of milk-protein concentrate to the production of chicken sausage

VASSILEV, K. and KOSTOV, K.

Higher Institute of Food Flavour Industries, Plovdiv, People's Republic of Bulgaria.

The application of milk-protein concentrate from sour-cream buttermilk in the production of chicken sausages was studied by comparing two chicken products made from a mix consisting of either (a) 70% chicken (mechanically boned whole chicken carcasses - the control; or (b) 10% milk protein concentrate (pH 6.5, dry matter 20-23%) added to the control. Products were made up within the mix and 30% fat, or 20% fat, 10% semi-lean pork. The results show that the added protein concentrate had no significant effect on the water retention capacity of the mix, but in the filling mass the water retention capacity was improved probably due to the addition of the other product ingredients. The stability of the emulsion increased with the addition of the protein concentrate both in the mix and the filling mass. The added protein concentrate caused no significant change in the water content and mineral substances, but the protein:fat ratio increased. The tryptophan:oxiprolin ratio also increased in the test samples. There was a higher amino acid content including the essential amino acids in the products with added protein concentrate. These results substantiate the application of milk-protein concentrate into a chicken sausage by producing a foodstuff of higher nutritive and biological value.

# EFFECT OF ADDED SALT ON NITROGEN LOSSES DURING BEEF STEWING

METRO F., GANDEMER G., LAROCHE M.

I.N.R.A. - Laboratoire des Aliments d'Origine Animale, 44072 NANTES CEDEX, FRANCE

In an effort to get information on losses during meat cooking, the nitrogen content of broth from beef stews was investigated.

4 beef *Pectoralis profundus* muscles were cut into 200 g ( $\pm$  50g) pieces measuring 10 cm in the direction of the muscle fibers. Pieces together with half their weight of soft or salted water (3% w/v NaCl) were canned in tins, heated for 4 hours in a boiling water bath, and finally cooled at ambient temperature by air.

Kjeldahl determinations of nitrogen were carried out on the broth, later referred to below as total nitrogen concentration. The sediment and the supernatant resulting from centrifugation of the broth were investigated in the same way. Subsequently, supernatants issuing from the same individual muscles were pooled, treated with TCA (ultimate concentration, 12.5%) for fractionation of protein and non-protein-nitrogen (NPN).

## Results:

- 1 - Total nitrogen in the broth was about one tenth of that in the raw meat whether salt had been added or not before cooking.
- 2 - Protein nitrogen accounted for 23% of total nitrogen in the broth. More soluble proteins were found when salt was added (respectively 11% vs 9% for unsalted samples).
- 3 - In any case, NPN made up more than 75% of total nitrogen. It was found that NPN could be divided into 3 main fractions
  - amino acids and dipeptides (ninhydrin method)
  - polypeptides (Biuret method)
  - an unknown fraction tentatively identified as nucleotides from gel filtration experiments and photometric studies.

These fractions made up respectively 35, 15 and 50% of NPN.

# Canthaxanthin for meat products colouration

BARACCO, P.\*, BERGER, Y.\*\*, DROUIN-DUPRONT, C.\*\*\*, JACQUET, B.\*\*\*\*, PINSON, M.\*\*\*\*, VENDEUVRE, J.L.\*\*\*\*

\* Ecole Supérieure des Métiers de la Viande 75012, Paris - France

\*\* F. Hoffmann-La Roche & Cie, 92521, Neuilly sur Seine - France

\*\*\* Ecole Nationale des Industries du Lait et des Viandes, 74800, La Roche sur Foron - France

\*\*\*\* Centre Technique de la Salaison, de la Charcuterie et des Conserves de Viande, M.N.E., 75595 Paris Cédex 12 France

Canthaxanthin (E161g) is a naturally occurring carotenoid which can also be synthetically produced. It has been classified by the joint FAO/WHO Expert Committee in Food Additives in class A and is therefore authorised in foods.

The available application forms of canthaxanthin are water dispersible. They yield a range of colours from orange to violet. Their possible uses in meat products have been investigated.

The studies were undertaken in France in three different Meat Institutes. The most frequently coloured meat products were prepared under current food technological practices. Cochineal was considered as the reference because it is widely employed in France in the meat industry.

The colours of the different meat products were evaluated subjectively by comparison with samples coloured with cochineal. The colours were also measured directly using a, b and L values obtained with a Gardner automatic colorimeter. The correlation of colour readings with visual judgement was good. Canthaxanthin content was analysed in the finished products. The stability was satisfactory.

Both the formulation, the processing conditions and the chosen forms of canthaxanthin influence the final product colour.

In sausages to be cooked such as garlic sausage or french "saucisson à cuire" the shade has to be violet. Consequently trials were only made with a violet form of canthaxanthin. Unfortunately, on heating, the colour changed to orange when part of the canthaxanthin dissolved in the fat. Canthaxanthin was not suitable in such meat products.

In other products tested i.e saucisson sec, danish type salami, Frankfurter, Strasbourg sausage, chorizos, pâtés, sausage meat, canthaxanthin, depending on the form chosen and addition levels, gave correct colours in these products. Processing conditions did not adversely affect the added colour which was fairly stable.

Incorporation levels could be defined for every type of meat product studied.

Substantiation of technology of combination canned minced meats with the components of structurable protein compositions

ROGOV, I.A., ZABASHTA, A.G., LIPATOV, N.N., TITOVA, N.V., \*BABANOV, G.L. and \*OSADTCHAYA, I.F.

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

\* The Ukrainian Meat & Dairy Research Institute, Kiev, USSR

Results of a study into qualitative characteristics of canned structured protein products (SPP) obtained after sterilization of structurable protein compositions (SPC) on the basis of blood plasma and of canned meats with these compositions are given. There are 3 types of structurable protein compositions:

- 1 - mixture of blood plasma and soy isolate;
- 2 - mixture of blood plasma and milk proteins;
- 3 - mixture of blood plasma and soy isolate and milk proteins.

Combination canned minced meats were produced from pre-salted comminuted pork and SPC with spices added. For

# Effects of frozen storage on hamburgers containing different proportion and types of mechanically recovered meat

JIMENEZ-COLMENERO, F. and GARCIA MATAMOROS, E.

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

The effects of frozen storage on the characteristics of hamburgers containing different proportions (0, 10, 20, and 30%) and types (from different source bones) of mechanically recovered pork (MRP) were studied. Analyses were performed on the hamburgers five times during the storage period (7 months) to measure such parameters as cooking loss, shear value (Kramer shear cell), objective colour (HunterLab colourimeter), and 2-thiobarbituric acid (TBA); sensory evaluation of flavour and texture (scale method performed by a semitrained panel of six laboratory staff members) was also carried out.

The storage time had no significant effect ( $P < 0.05$ ) on the shear value, cooking loss, or sensory characteristics of the hamburgers, but it did affect their colour, in that the redness (a) value decreased significantly ( $P < 0.05$ ) as the storage period progressed.

Although the TBA values depended on both the source as well as on the proportion (30%) of the MRP added to the hamburgers, the oxidative rancidity rate did not attain levels detectable by the taste panel.

# The effect of processing method on the functional behaviour of globin protein

AUTIO, K., KANKO, S. and KIESVAARA, M.

Technical Research Centre of Finland, Food Research Laboratory, Biologinkuja 1, SF-02150 ESP00, Finland

Blood represents the most valuable by-product of the slaughter-house. Blood plasma has been used as an ingredient of sausage. However, if blood corpuscle concentrate is to find wide utilization, the strong flavour and dark colour must be eliminated. This can be achieved through the separation of haemoglobin into haem and globin fractions. The methods used in isolation, concentration and drying of proteins exert a significant effect on the physical properties of the final product.

In this work, globin was prepared by the cold acetone method (Clegg et al., 1966) and by the CMC-precipitation method (Autio et al., 1983). CMC-treated globin was frozen, freeze-dried or spray-dried. The solubility, emulsifying activity and stability, water-binding capacity and gel characteristics of these preparations have been compared. The effects of NaCl concentration and pH were also studied. The status of the proteins was examined by isoelectric focusing. Globin fractions made by the cold acetone method and by CMC-precipitation showed similar bands in the isoelectric focusing study. The solubility, water-binding capacity and emulsifying quality of both preparations decreased drastically when the pH was increased towards the isoelectric point. At pH 6.0 the solubility varied from 80 - 90%, the emulsifying activity from 55 - 60%, emulsifying stability from 60 - 90% and water-binding capacity from 3.5 - 4.0 ml/g. The solubility, emulsifying properties and water-binding capacity of the acetone-treated globin were slightly better than those of CMC-treated globin around the pH 6 - 7. These differences were concluded to be due to the higher salt-content of globin made by CMC-method. Salt reduced the solubility and water-binding capacity and led to poorer emulsifying properties above the pH value 6.0. The CMC-treated globin formed a gel even at 1.5% concentration. Further drying of the globin decreased its gelation ability.

The globin protein preparations are interesting because of their unusually good gelation and emulsifying properties, especially in meat products.

# The effect of protein additives on emulsion stability in meat systems

MULLINS, A., and BUCKLEY, J.

Meat Section, Department of Dairy and Food Technology, University College, Cork, Ireland.

The meat processing industry is placing more and more emphasis on the utilisation of protein additives to provide specific functional properties in a wide range of meat products. Milk protein isolates represent an important and valuable source of protein because of their recognised nutritional, organoleptic and functional properties. The effects of adding milk proteins to meat products both as a meat replacer and as a functional additive have been reported in the literature.

The aim of this study was to examine the effects of some functional properties (emulsification, viscosity and gelation) of non-meat proteins on emulsion stability. The emulsions were made from water, fatty tissue and a protein additive such as caseinate (high viscosity), whey protein concentrate, total milk protein or soya isolate. Emulsion stability was examined by cooking, light microscopy, viscosity and gelation studies. Initial work compared sodium caseinate emulsions made with fresh or thawed pork back fat. Both emulsions were very stable (fat losses < 1%) even though slightly higher cooking losses occurred in the thawed pork back fat emulsion. The results to date indicate that fresh or thawed fat does not adversely affect fat losses in pre-formed emulsions.

Cooking losses from an emulsion also depend on other processing conditions for example, chopping times, type of protein additive, and method of cooking. As chopping times increased, fat losses and fat globule size decreased. The sodium caseinates, whey protein concentrate and soya isolate were considered to be suitable protein additives in pasteurised and sterilised pre-formed emulsions. The total milk protein emulsions, however, were only completely stable when pasteurised (cooking losses < 1%), whereas cooking losses from sterilised total milk protein emulsions were as high as 10%. Frying as a cooking method proved to be a more severe test of emulsion stability than pasteurising and sterilising and as a result gave higher cooking losses. Total milk protein emulsions were the least stable of the emulsions with frying losses of 37%.

Results from this study show that cooking losses from emulsions are indicative of emulsion stability and can be used to determine the suitability of protein additives as emulsifiers. High viscosity and good gelation also exert an influence on emulsion stability. Sodium caseinate and soya isolate were considered to be the most suitable protein additives for emulsion manufacture.

# The effect of the level of hot boned pork fat on water binding capacity and fat retention in cooked sausage

EERO PUOLANNE and PEKKA TURKKI

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

The object of this study was to test ways of using hot boned pork fat while still hot.

Hot pork fat was dissected from the ventral side of ham and kept at 30°C until used in cooked sausage within two hours post mortem. Sausages were made from lean cold boned beef and hot boned pork fat using the laboratory sausage method of Puolanne and Ruusunen. Sausage batter ingredients were chopped in a kitchen cutter with large amounts of added water (300 g water with added phosphate or 142 g without added phosphate per 100 g lean beef) to a final temperature of 20°C. The sausages were stuffed, cooked and chilled in the normal way. Water binding capacity was determined from the difference between the weight of stuffed sausage (weight of casing excluded) and the weight of the chilled and peeled sausage after removing the released water and jelly. Calculations for released fat are based on the weight of fat physically separated from the cooked and chilled sausage.

Without added phosphate the amount of bound water increased linearly as the fat level increased from 0 g to 86 g/100 g lean beef. The amount of fat released was significantly higher with 86 g of fat/100 g lean beef than with lower levels of added fat. With added phosphate the addition of 50 g or more fat increased the water binding capacity significantly. The amount of released fat was significantly higher with the addition of 150 g of fat to lean beef than with lower additions.

It was shown that the addition of fat improves the water binding capacity of lean chopped beef. The amount of fat released was slightly higher at a higher level of added fat, which has not been noted earlier with cold boned pork fat by the same research team. It was concluded that hot-boned, hot pork fat can be used in cooked sausage, but the possibility of a small release of fat cannot be excluded.

The effect of inclusion of mechanically recovered chicken on the colour of a British style fresh sausage during storage under simulated retail display.

JOLLEY, P.D., ALLISON, G.B., SAVAGE, A.W.J., MACDOUGALL, D.B. and J.W. MOORE\*

AFRC Meat Research Institute, Langford, Bristol, BS18 7DY, UK  
\*T. Lucas and Co., Bristol

Fresh sausages were produced to a typical UK recipe with three levels of mechanically recovered meat (MRM) from chicken and their colour stability under simulated retail display assessed. Each formulation was designed to produce sausages with identical apparent meat contents and lean to fat ratios, and to satisfy existing UK regulations. The control sausage (0% MRM) contained 25% belly pork and 25% pork head meat, and MRM was substituted for the more expensive meat (belly pork) at 6 and 18% (nominal). Fresh MRM was used as soon as possible after separation and freezing, and after a further 6 weeks and 7 months storage at  $-18^{\circ}\text{C}$ .

Sausages were overwrapped, eight to a pack, and held at  $5^{\circ}\text{C}$  either in the dark or on a wire tray below fluorescent tubes (Natural) which gave an area with a maximum light intensity of 1200 and a minimum of 800 Lux. Changes in colour saturation, hue angle, and lightness were monitored over a 7 day display period and the reflectance spectra measured at the start and end of display.

In the experiment incorporating fresh MRM the sausages at the beginning of storage had noticeably different appearance with saturation values of 14.4, 15.1 and 16.2 units for 0%, 6% and 18% MRM respectively. On the sixth day of display all sausages had a saturation of about 12.6 units. These changes imply increased rates of fading with increasing substitution with MRM. The sausages produced following the six week storage of MRM had similar values to each other, and the patterns of change with display time were also similar. At the end of 7 months storage of the MRM the sausages again differed markedly, but now those without MRM were more saturated (14.5 units) than those with either 6% MRM (12.3 units) or 18% MRM (13.3 units). The degree of saturation of the control sausage fell more during display (i.e. the sausages faded faster) than those with MRM although the relative positions of the three treatments remained the same. A comparison of all results suggests that the rate of fading depends on the degree of colour saturation of the sausage at the beginning of display and although this will in turn depend in part on the level and oxidative state of the MRM used no additional acceleration of fading arises from the use of MRM.

Attempt at determining the criteria of the dietetic system for meat products

JAJCAY, J.

Research and Development Centre, Meat Industry Trust General Management, Bratislava, Czechoslovakia

The dietetic system in Czechoslovakia consists of 13 kinds of diets. Each of them determines which are the forms of diseases improved by the respective diet, and it generally supplies the names of the respective food-stuffs and the requirements for their culinary preparation. The diet does not determine, however, the actual criteria of the food-stuff composition.

In the present studies an assessment of the Czechoslovak dietetic system and determination of actual requirements with regard to meat products were dealt with. The requirements were set from the point of view of organoleptic properties, chemical composition, energetic value and other criteria of nutrition.

### The chemical composition and vitamin content of meat products for children of various age groups

KARMYSHOVA, L.F., ILYUKHINA, V.P., BABURINA, M.I., USTINOVA, A.V., \*STEPANOVA, E.N. and GRIGORYEVA, M.P.

The All-Union Meat Research Institute, Moscow, USSR

\*The Institute of Nutrition of the USSR AMS, Moscow, USSR

The chemical composition of meat products for children of various age groups has been studied. The levels of the basic components (moisture, fat, protein, ash, carbohydrates), nitrogenous extractives and vitamins (thiamin, riboflavin, niacin, folacin, vitamins B<sub>6</sub> and E) have been found in infant canned meats, in ready-to-cook products and "Children's" sausages for pre-school and school feeding programs.

The chemical indices under study were found to meet the required standards. Ready-to-cook meats and "Children's" sausages contain a relatively high amount of B-group vitamins, especially of thiamin, due to pork incorporation. Canned meats are characterized with a lower level of vitamins, this being due to their losses during pre-cooking and autoclaving.

### Predicting quality increase of commercially prepared meat products

SAVTCHENKO, A.F., GUBANOV, I.V. AND \*MIZERTSKY, N.N.

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

\*The Moscow Technological Institute of Meat & Dairy Industries, Moscow, USSR.

On the basis of the methods of statistical and mathematical analysis, the data on the average daily consumption of food products in the USSR in grams per capita are given. It is found that the consumption of vegetables, fruit, meat, poultry, fish, milk products and sugar is increasing, whilst that of bread products is decreasing.

The calculation formulae for probable annual increase of population and the corresponding annual energy consumption and annual meat production in slaughter weight are developed on the basis of the method of mathematical modelling. The relationships of these parameters with time are given in the form of:

$$= (K)$$

where:

- an unknown quantity
- an original value of the quantity
- time constant
- period of calculation (0 - 25 years)

Proceeding from the saturation of several classes of meat industry technological subsystems with theoretical, experimental, designing and implementing developments the level of quality increase of the products of each technological subsystem class is predicted. On the basis of the theory of balanced man's nutrition and the proposed model of quality parameter of meat production processes the calculation of formulae for the supposed level of the annual meat production and energy consumption at the present rate of the world population increase determination are obtained. It is shown that the efficiency of meat production can be significantly increased with product quality improvement. The probable prediction of meat products quality improvement by several classes of the branch up to the year 2000 is given.

### A high biological value of meat products for babies

TIMOSHCHUK, I.I., DENISENKO, V.S., SHAPOSHNIKOVA, T.M. and \*USTINOVA, A.V.

The Ukrainian Meat and Dairy Research Institute, Kiev, USSR

\*The All-Union Meat Research Institute, Moscow, USSR

The newly developed baby-sausages, viz, a meat paste, Detskaya Slivotchnaya and Shkolnaya cooked sausages, Malyutka and Krepysy sausages, have a high nutritional value, their protein/fat ratio being reasonably balanced. In these products the levels of salt and sodium chloride are lowered, the content of spices is limited. Raw meat (beef and pork) constitute 80-90% of the total formulation, only freshly killed or freshly chilled meat is used; raw milk additives are 2 - 4% of the formulation. Decoloured powdered blood is a source of essential minerals. Oil is included into the formulations to enrich them with polyunsaturated fatty acids.

The above-mentioned baby-sausages are manufactured on the available sausage equipment.

### Soybean curd as a meat substitute

ABOU EL ELLA, W.M.

Food Science Department, Faculty of Agriculture, Zagazig University, Zagazig, Egypt

Meat substitutes have received special interest in order to overcome the relatively low meat production, mainly in developing countries. Soybean products have played a major role for many centuries as a source of protein in the diet of millions of people in Asia (Hong and Jackson, 1974). Also it has been reported that soybeans contain a high percentage of protein with a good balance of amino acids (Smith and Circle, 1972). Soybeans are generally used in some diets. Wel et al. (1973) prepared nutritious canned pork and soybeans.

The objective of this work was to study some properties of fried soybean curd comparable to meat. Soybean curd samples were prepared from "Wane variety" soybean. Soybean milk was prepared according to Hwa (1967). Curds were prepared either by inoculating the milk with a starter culture or by addition of lactic acid. The curds were then cut into small pieces and fried in heated butter. Resultant samples were analysed for moisture, fat, protein and ash contents. Also the samples were scored for flavour, body and texture, colour and appearance.

Results indicated that fried soybean curd produced by both procedures had lower protein and fat contents than meat, figures for protein and fat being 10.6 and 5.3 respectively in curd processed by using starter and 7.8 and 4.3 in curd prepared by using lactic acid. Corresponding values for meat were 20 and 13% respectively.

The fried soybean samples were characterized by a flat flavour comparable to meat; however the body and texture as well as the colour of the curds produced by both treatments were acceptable.

