

6. Meat Processing: Raw and Fermented Products

SCIENTIFIC STUDY AND DEVELOPMENT OF MEAT-BARIAN - A TRADITIONAL FOOD PRODUCT OF THE INDIAN SUBCONTINENT.

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Traditionally Barian are made in rural areas of the subcontinent by the wet grinding of certain legumes, spices and herbs. The muslim population of this region, however, has been adding meats to make Barian tasty and more nutritious. The wet mixture with or without added meat is hand-cast into rough shaped pieces and dried. The product is commercially stored in gunny bags for later use in wet months. The product is of wide-spread use in rural areas.

The paper deals with this legume-meat product starting with a socio-economic survey of Barian. The paper reports on the physical, chemical and nutritional evaluation of the existing varieties. The re-entry of this traditional legume-meat product in the modern urban market, with a standardized recipe using 25-50% beeflo, has been proposed.

Various meat-legume formulations comprising of beeflo and three legumes (Vigna Rediata, Vigna Mungo and gram pulse) have been tested. Although the formula using 50% beeflo on fresh basis was more likeable yet the one with 25% beeflo was more economical and marketable. Amongst different legumes, Vigna Mungo (Urd) rated best for single and multi-combinations. The possibility of using simple machine to replace the process of traditional manual casting was also tested. Three different drying methods have been compared i.e. open-sun, solar dryer and hot-air driven oven. The more uniform, controlled and quicker mechanical drying was found to be best for organoleptic qualities and nutrient retention. Cheap packing material like polypropylene (PP) and polyethylene (PE) of different densities were used to study the shelf-life of dried Barian upto 6 months. Both packaging materials appear equally good for storage except that the more clear polypropylene had the visual advantage for marketing.

Spanish Dry-Cured Ham : Physicochemical and Ultrastructural Analysis During the Postsalting Stage

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Dry-cured process has 3 principal stages : Salting, Postsalting (these stages take place at low temperature < 3.3^o C) and Dry-Maturation.

The aim of this work is the study of physicochemical and ultrastructural parameters during the postsalting stage. The study was made with 10 female hams, the samples were obtained with a hollow cylinder of stainless steel with an inner diameter of 38 mm and 160 mm of length. The zone under study were delimited between the central part of the femur bone and the perpendicular zone of that bone. In the meat cylinder we identified the following muscles : Gracilis, Semimembranosus, Semitendinosus and Biceps femoris. The samples were successively taken at 0, 7, 14, 21 days after the beginning of the process. The physicochemical parameters under study were pH, water activity, the salt concentration and the residual nitrite, for the ultrastructural analysis, the samples were fixed with Glutaraldehyde and then they were dehydrated with acetone gradient. Lastly they were included in Araldite. The samples were visualised in a Transmission Electronic Microscopy. The micrographs show that myofibrills are going to a total disorganization, a lack of A, I band and the characteristic banding patterns of striated muscle, by the way this disorganization depends on the depth and process time. Moreover, during the postsalting stage progressively increases the salt concentration in the deeper muscles, also appears an increase of residual nitrite in all muscles at the end of the postsalting stage, a pH evolution to high values, and a decrease of water activity more manifest in the upper muscles.

Effect of meat quality on tyrosine precipitates in dry cured hams

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The effect of meat quality, different breeds (Large White, Duroc, Pietrain, Belgian Landrace Landrace halotane positive, Landrace halotane negative) and comercial lines of the pi Improvement Company (L15, Duroc; L10, high muscular development; L03, Comborough) on tyrosin precipitates was evaluated.

Tyrosine concentration was significantly lower in DFD hams, but no difference was found between PSE and normal hams. The incidence of hams with tyrosine crystals and white film decreased as the pH increased. A higher number of tyrosine crystals were found in hams from halothane positive pigs and the conformed line (L10). The formation of the white film and tyrosin crystals could be explained as a crystallisation process.

Phosphate crystals in raw cured ham

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The storage of raw cured ham at refrigeration temperature causes sometimes the formation of translucent crystals in the muscles after some days. Crystals compositions were analyzed and consist of $\text{Na}_2\text{PO}_4\text{H}\cdot 7\text{H}_2\text{O}$ and $\text{Na}_2\text{PO}_4\text{H}\cdot 12\text{H}_2\text{O}$. The crystals dissolve in the crystallization water as the temperature increases. High NaCl and phosphate concentration, low humidity level and high pH in the muscle favours the formation of these crystals when the ham is stored at refrigeration temperatures.

The concentration of phosphates in nine muscles of the ham during the aging process has been studied. The P_2O_5 /protein relationship diminishes during the process, specially during the salting (due to exudation of water) and postsalting period (due to crystallisation in the outer part of the ham). The P_2O_5 /humidity relationship is always higher in the dryer areas. Therefore, the equilibrium in the concentration of P_2O_5 between the different parts of the ham does not occur during the aging process.

Relationships between tissue composition and sensory qualities of dry cured ham

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An attempt was made to relate quality traits of dry cured ham to some compositional and histological characteristics of muscle tissue.

Twenty-six hams were taken after 9 months of ageing. The following biochemical and histological traits were determined on the *Biceps femoris* muscle: pigment, collagen, glycogen, lactic acid, metabolic type and size of myofibres. Sensory evaluation was made on the same muscle, in order to describe characteristics of colour, odour, taste and texture.

Some significant relationships were observed between biological and sensory traits, i.e.:

- colour homogeneity was negatively correlated with lactic acid content,
- odour features were related to pigment level and fibre size,
- high levels of glycogen and lactic acid were associated with acid and salty tastes, whereas pigment was negatively correlated with acid taste;
- glycogen and collagen were positively correlated with taste intensity,
- collagen and lactic acid unfavourably affected texture.

Metabolic type as determined on seasoned hams by classical methods (ATPase, succinate dehydrogenase, α glycerophosphate dehydrogenase activities) appeared doubtful because of the probable degradation of the enzymes during ageing.

Volatile Compounds and Some Properties of Chinese-style Sausage

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Steam volatile fraction from Chinese-style sausage was prepared and analyzed by GC/MS. The pH, moisture, water activity, amino nitrogen, acid value, lactic acid, free fatty acids and ethanol of the product were also measured.

Isobutyric acid, propionic acid and acetic acid were major components at the beginning, while acetic acid increased, and the other two components decreased with the storage time.

Moisture content of the product was 34% at the beginning, and dropped to 15% after two week storage in the air. Water activity changed from 0.95 to 0.73. PH changed from 6.70 to 5.88, acid value increased from 2.3 to 5.6, lactic acid dropped to less than 0.2%, ethanol was slightly decreased after drying, however, amino nitrogen reminded constant.

As the results of GC/MS analysis, it could be noted that spices and wine played an important role in flavor precursors of Chinese-style sausage. Isoamyl alcohol was major component found in the volatile component. And other alcohols isolated from the products might origin from alcohol (wine) and cyclo alkanes origin from the spices. In this study, there were 48 volatile compounds being isolated and identified.

Distribution of Salt in Spanish Ham during the post-salting Period

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A minimum period of cold storage post-salting in Spanish ham is needed to reach a critical 5% salt concentration in water in the inner part of the ham. This salt strength is the required to inhibit the growth of the spoilage microbes at room temperature.

This study shows the salt distribution during 150 days post-salting at 8 different profundities in the area of the hip joint and one sample taken under the skin near tibiofibular joint. Two lots of hams have been studied, the lot A salted during 10 days the lot B salted during 11 days. A total of 54 hams have been included in the study.

The results show that the minimum period of cold storage post-salting to avoid spoilage the hip joint area is 43 days for lot B and 87 days for lot A. In the area under the skin critical period is over 150 days. The variation in time to reach the stability is due to differences in salt concentration among lots; higher in lot B than in lot A.

Studies on Conditions for Obtaining Liophilized Starter Cultures in Meat Industry

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Examinations for liophilization of milk-acid bacteria, micrococcus and yeasts, determined as possible starter cultures in meat industry are carried out.

Cryoprotective effect of different protective media, easy to use and prepare in the production of liophilized starter cultures in Bulgaria, are examined.

Conditions for freezing and vacuum sublimation drying of examined microorganisms are determined.

The obtained liophilized preparations show good quality characteristics.

Modelling the Process of Sausage Drying

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Drying is the most important stage in the manufacture of fresh sausages. It is caused by the fact that during drying there occurs the complex process of biochemical, microbiological and structural-mechanical changes in a sausage. The nature of this process is determined to a large extent by the change of moisture content or water activity. In its turn the change of moisture content is determined and internal moisture exchange. Known at present mathematical models are of little use for solving problems of automatic control and regulating the process of sausage drying. This makes it necessary to develop mathematical models, expressing the dynamics of internal moisture transfer and water output on the surface of a sausage during drying, in the form of transfer functions. We have stated the relationship of moisture content change in the cross shear of a sausage with moisture content of the surface layer. We have also determined the influence of air parameters in the chamber on moisture content of the surface layer. It is stated that the dynamics of moisture content in the cross shear of a sausage is approximated by the successive combination of aperiodic and forcing links of the first order. It is approximated by the aperiodic link of the first order in the centre of a sausage and by the link with a single transfer function - on the surface. Transfer function moisture flow along the canals of moisture transfer, water activity in the surface layer and relative air humidity which are approximated by linear proportional links have been determined.

Effect of the addition of pancreatic lipase on the lipolysis of dry fermented sausage during ripening

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The acceleration of lipolysis by the addition of animal lipases has been successfully applied to some cheese varieties, e.g. Italian hard cheeses. This approach has not been studied in dry sausages. This work is an attempt to enhance the flavour of dry sausages by adding pancreatic lipase.

Two batches of dry sausages were made adding 40,000 and 60,000 units of pancreatic lipase. A batch was made without enzyme (control). Fermentation was carried out at 22°C and 90% of RH for 20 h. Then, temperature and RH were gradually decreased to reach finally 12°C and 70% RH. For monitoring microbial changes, total viable organisms, lactobacilli and Micrococcaceae were enumerated. Lipids were extracted according to (1). Free fatty acid (FFA) methyl esters were obtained according to (2) and analyzed with a Perkin Elmer CGC-8420 chromatograph with a column (30 m x 0.25 mm I.D) J & W Scientific packed with DB-225 on fused silica.

No clear differences were observed in the pH values between batches. In the enzyme-added batches, the level of FFA was higher (aprox. 3-fold) than that of the control, but no differences were observed between the two lipase batches. At the end of ripening, the individual FFA (C-14:0, C-16:0, C-16:1, C-18:0, C-18:1, C-18:2 and C-18:3) of the lipase batches reached higher values (1.5 to 5-fold) than those of the control. Organoleptically, no differences were observed between lipase batches and the control. It seems to be necessary to add a higher concentration of enzyme to detect them. Investigations are now carrying out.

REF. (1) Hanson & Olley (1963) *Biochem J.* **89**, 101. (2) Schlenk & Gellerman (1960) *Anal. Chem.* **32**, 1412.

Influence of the Yeast *Debaryomyces hansenii* on Dry Sausage Fermentation

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Eight batches of fermented sausages were produced with *Lactobacillus curvatus* Lc2, *Micrococcus varians* M28 and *Debaryomyces hansenii* Dh1 as starter cultures. The starters were used as single strains and in combinations with each other. As curing agent, 300 ppm potassium nitrate were used. The sodium chloride addition was 28 g per kg sausage. All sausages produced with *D. hansenii* showed a significant improvement of the surface colour already after two days of fermentation. In all batches with *D. hansenii*, the fortuitous staphylococci reached lower maximum levels and their cell number was reduced to a greater extent during ripening than in the correspondent batches without yeast. Therefore, in the batches without nitrate reducing starter organisms, *D. hansenii* caused a retarded nitrate reduction. Generally, the yeast caused an increased ammonia concentration and a higher pH in the finished products, whereas the concentration of acetic acid and lactic acid was lower. At inoculation with 5×10^5 cfu/g, the yeast exhibited growth in all batches within the first five days of ripening. The yield was dependent on the additional use of other starter cultures. Thus, *D. hansenii* was inhibited in growth, when *L. curvatus* and *M. varians* were used in addition and no higher ammonia concentrations appeared in the finished products. Our results show, how the growth of fortuitous staphylococci and the chemical composition of dry sausages can be influenced by the application of *D. hansenii* as starter culture.

Gaschromatographic Headspace Profiles of Cured in Bag Bacon and Tank cured Bacon.

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Different gaschromatographic (GC) headspace methods for meat relevant volatiles in aqueous solutions have been evaluated and a dynamic headspace method deploying purging of volatiles onto Tenax TA was found to be the most sensitive method. This method had a sensitivity at 10 ppb when measured with relevant volatiles in aqueous solutions.

The two types of bacon were produced under controlled conditions using the sides from the same carcass. GC-profiles of two different processed bacon types using the dynamic headspace method showed no systematic difference during the two weeks after slaughtering, corresponding to fourteen days after vacuum packaging of the *cured in bag* bacon type and eight days after draining of the tank cured bacon type, respectively, when the meat were kept at 2 °C. These results were confirmed by a trained sensory panel, who did not find any difference in the aromas (decided by sniffing) of the two bacon types. One week further storage of the two types of bacon at 2 °C resulted in differences in the GC-profiles of the two bacon types, which are discussed in relation to consumer preference of the two different bacon types. The volatiles were found mainly to consist of carbonyls, alcohols and hydrocarbons of which some were tentatively identified by mass spectrometry.

Meat Processing: Raw and Fermented Products

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The paper gives a review of these very special products which can be divided on the basis of acidity (low and high pH products), size of processed ingredients (chopped or intact muscle), type of fermentation (with or without carbo-hydrate; with or without microbial inoculation) etc. These differences in technology do contribute to definite differences in general characteristics of the products e.g. sensory properties, water activity values, but also critical control points may change. Although application of microbial cultures offers several advantages, like fast drying, microbial safety, good sliceability, economic production etc. products of traditional technologies are still in favor among many consumers. Since microbial changes in these traditional products can be influenced mainly indirectly, a vast majority of research work and publications are rather devoted to starter culture fermentations. Although half a century served for investigations in this field, an endeavour to ever improve technics and strains by screening, selection, genetic methods can still be observed. Aims of these investigations are: to get meat products of better sensory quality, of more safety, and to ensure faster production with high reproducibility of uniform quality.

Lactic acid bacteria have been thoroughly investigated in terms of their physiological needs (temperature range, pH-range, a_w -range and optimum values for growth, manganese requirement etc.), their inhibitory effect (acid and antibiotic production), yet nutritional and healthful aspects of lactic acid bacteria, a well-known feature of those in case of dairy products, is not a frequent research topic with fermented meat products thus dietary effect might perhaps be a field to be investigated in the future.

Modified cured hemoglobin as colouring agent for gelated pig blood plasma in livex form

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The objective of this study was to increase the nitrosation efficiency of the bovine hemoglobin /Bhb/ by NaNO_2 during 24h curing.

Native Bhb dissolved in citrate-phosphate buffer /pH 3.2/ nitrosated by NaNO_2 with NaCl and CaCl_2 added was a control sample. Molarity ratio of NaNO_2 to heme and sodium ascorbate was 1:2. Before curing, Bhb dissolved in buffer was subjected to 3 treatments: a. enzymic digestion by aspartic proteinase isolated from culture broth of *Penicillium camemberti*, b. heat denaturation at 45°C , 60 min. in 2M HCl and c. heat denaturation and enzymic digestion as "a".

All three modification treatments of the Bhb only slightly improved the reactivity of Bhb with NaNO_2 because the conversion degree to nitrosopigment was 31,4%, 37,3% and 32,5% for a, b, c respectively and 25,7% for the control. Only enzymic modification of Bhb resulted in substantially better solubility of cured Bhb in blood plasma. All experimental samples of cured Bhb were used for colouring of the livex. Its colour and physical parameters $\lambda_{d,pe,Y}$ were spectrophotometrically determined. Besides, dinitrosylferrohemochrome /DNFH/ synthesised after Shahidi /300mg% and 1000mg%/ was used for livex colouring. Preparation of DNFH /300mg%/ donated by Rubin was tested. Colouring ability of experimentally obtained cured hemoglobin was comparable with that determined for DNFH.

A study on the process of drying and ageing of chopped meat raw-dried products at pulsatory hydrodynamic regime of the drying agent

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Abstract: The hydrodynamics within the conditioning chamber is achieved by cyclic alteration of the drying agent rate in its cross-section by means of air-pressure ducts. Using a reversing valve, at preset time periods, the percentage ratio of distribution of the air stream (drying agent) is changed leading to a change of velocity among the sausages in the conditioning chamber cross-section. The hydrodynamic conditions thus arranged in the conditioning chamber interior primarily intensify the mass-exchange processes, shorten the technological cycle and improve the quality of the finished product.

The object of this study are the processes of drying and ageing of chopped meat raw-dried meat products at preset temperature and humidity, and pulsatory hydrodynamic conditions of the drying agent (conditioned air).

The studies have been carried out with some traditional pressed and unpressed raw-dried sausages ("Panagyurska" loukanka, "Tarnovska" loukanka and "Hemus" sausage). The samples were prepared according to the established technology. During the drying and ageing period the sample weights were taken down for all batches. The water content was also controlled to mark the end of the drying process for each batch.

The results obtained indicate that the used new method of drying and ageing of chopped meat raw-dried products under pulsatory hydrodynamic conditions of the drying agent accelerates the drying process where the cycle is completed in 24 days, prevents the formation of superficial water-resisting ring, and improves the quality of the finished product.

The effect of different starter cultures in spreadable raw sausage

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Spreadable raw sausages were prepared using different starter cultures including **Staphylococcus carnosus** and **Lactobacillus plantarum** (batch 2), **Lactobacillus curvatus** + **Micrococcus varians** (batch 3) and **Lactobacillus sake** + **Staphylococcus xylosus** (batch 4). Batch 1, without starter cultures, was used as control. Ripening was followed by measuring parameters including pH, firmness, colour, weight loss, a_w , density, composition of the microflora and organoleptic quality. - The results confirm the practical experiences, that when using starter cultures, there will be a better and qualitatively higher spreadable sausages: Without starter, the pH remained above 5.5. This resulted in unsatisfactory colour and flavour. Sausages prepared with starter cultures containing **Lactobacillus** differed only moderately in pH, spreadability, weight loss, density and microbial composition. Batch 2, inoculated with **Staphylococcus carnosus** and **Lactobacillus plantarum**, ranked best with respect to aroma and flavour, while pH drop was fastest in batch 4 containing **Lactobacillus sake**, and spreadability was best and weight loss lowest in batch 3 containing **Lactobacillus curvatus**. In no batch, undesirable microorganisms did reach levels of concern.

Investigations on the Formation of Histamine in Raw Sausages

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Histamine can be detected in fermented foods including raw sausages. The contents of histamine are quite different in various raw meat products. The objective of this study was to find the causes of an excessive histamine formation which occurs in products of individual manufacturers. Investigated materials were Salami "Mettwurst" which are produced from raw material stored under different conditions. To some samples histamine producing lactobacteria were added. Histamine was determined fluorimetrically and histidine by means of an amino acid analyzer.

The content of histamine of raw meat was less than 10 mg/kg. Storing of meat produced no significant increase. The concentration of histidine was between 20 and 100 mg/kg depending on the age of the meat. A number of 500 to 5000 histidine decarboxylating microorganisms/g meat could be determined. Storing "Mettwurst" at 18°C for 18 days no excessive formation of histamine could be obtained although up to 600 mg histidine/kg were liberated. The addition of approximately 10^5 histamine producing microorganisms/g meat resulted in an increase of the histamine content of up to 1000 mg/kg corresponding to the storage time of the raw material. Approximately one tenth of the histamine content of raw sausages stored at 18°C was found at a storage temperature of 7°C. These investigations indicate that an excessive formation of histamine in raw sausages requires both - a sufficient number of histidine decarboxylating microorganisms and available histidine and is further increased by storage temperature and the age of the raw material.

Theoretical Basis of Optimal Regime Regulation for Sausage Drying

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For development of packet of programs, ensuring optimum drying regimes for different types of sausages, it is necessary to create mathematical model of interrelation between thermodynamic and heat-and-moisture exchange characteristics of sausages and regime parameters of drying chamber medium. On the basis of experimental curves of desorption, temperature fields and moisture distribution along radius of a sausage long loaf, the following parameters are determined: distribution of water activity (a_w), wet bulb chamber medium (t_m) and surface temperature, ratio of moisture-exchange (β), value of boundary layer of vapour-air medium, moisture-exchange criterion by Nusselt (Nu_m). Besides, method of regulation of regime parameters of chamber medium was developed, ensuring optimal drying regime with the account of sausage properties.

Principle of control and regulation of regime parameters is based on experimental dependence $\Delta T = f(a_w, \varphi, W_p)$, where: φ - is relative moisture of medium, W_p - equilibrium moisture content in a loaf.

Drying conditions: for period of constant drying rate $a_w \leq 1$, $T = T_m - T_s \cdot a_w > 0$, where T_m is wet bulb temperature of chamber medium; $T_{s.w}$ - wet bulb temperature of loaf surface. For period of decreasing drying rate $0 \leq a_w \leq 1$ $\Delta T > 0$. Drying is stopped at $a_w = \varphi$, $T = 0$.

Formation of biogenic amines in fermented sausages - pilot trialR. MAIJALA¹⁾, E. LINDFORS¹⁾ and P. HILL²⁾¹⁾ National Veterinary Institute, P.O.B. 368, 00101 Helsinki, Finland²⁾ College of Veterinary Medicine, P.O.B. 6, 00581 Helsinki, FinlandObjectives

The purpose of this study was to investigate the reasons for the formation of biogenic amines in dry sausages. The factors studied were sausage mass and five different starter cultures.

Experimental methods

The work was done by two pilot trials in the same processing plant. The process itself was: 2 days with 23°C in 93 rh%, 1 day with 21°C in 85 rh% and 4 days with 20°C in 85 rh%. The rest of the ripening and storage was with 10°C and 70 rh%.

The sausage mass originating from the commercial meat plant was divided into five samples, each of which was fermented by different starter culture. Four of the commercial starter cultures used had both staphylococcus and lactic acid bacteria strains. To these samples glucose was added 0.6 %. Because the fifth starter culture contained only Staphylococcus carnosus glukonodeltalaktone (GDL) was added (0.7 %) and the amount of glucose was decreased to 0.15 % in this sample.

pH, a_w and microbial counts were examined 6 times during ripening and storage (up to 49 days). The parallel samples were stored in - 20°C until they were extracted by methanol and dansylated in acetonitrile. Biogenic amines (histamine, tyramine, serotonin, putrescine, cadaverine, spermidine and spermine) were measured by HPLC (UV-detector).

Principal results

In the first pilot trial there were no differences between five starter cultures examined. The concentrations of all biogenic amines studied were very low (< 20 mg/kg) and they did not change during ripening.

Anyway, in the second trial, where the process, the plant and the starter cultures examined were exactly the same as with the first one (the sausage mass was different), tyramine concentrations were increasing during ripening process. There was also a difference between five starter cultures studied. In sausages fermented by four starter cultures, which had both staphylococcus and lactic acid bacteria strains, tyramine content was 129-166 mg/kg after 49 days of ripening (no GDL was used). In the sausages fermented by starter culture containing only S. carnosus (GDL added) the final amount of tyramine was only 76 mg/kg.

Conclusions

First, the influence of the quality of meat is quite obvious according to these results while there was a big difference between two different experiments where nothing else but raw materials were different. Secondly, the acidification method (lactic acid fermentation or GDL) used in the fermentation process seems to have some effect on the concentrations of tyramine.

Two New Staphylococcus carnosus Bacteriophages Isolated from Salami Factories in Germany and Italy

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Staphylococcus carnosus is an important component of meat starter cultures where it is used to improve colour and flavour of fermented meat products. In the dairy industry, bacteriophages, bacterial viruses which kill bacteria, cause serious economic problems with starter cultures. The situation with meat starters has not been investigated as thoroughly as with dairy starters and there are conflicting reports as to the importance of bacteriophages in these products.

No bacteriophages attacking S. carnosus strains have been isolated from fermented meat products, and only one has ever been reported, from a starter culture. We have isolated similar, but not identical, S. carnosus bacteriophages from salami factories in Germany and Italy, which attacked a wide range of S. carnosus Strains from commercial starter cultures. Further details of the bacteriophages will be presented together with a discussion of the practical importance of bacteriophages in fermented meat products.

Study of an Intermediate Moisture Meat Product - Salpicão - Processing and Characteristics

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Traditional meat products are still manufactured on the basis of tradition and empirical experience.

Salpicão, produced in the northern part of Portugal is a kind of large smoke-cured sausage (± 50 mm of diameter), varying in composition, spices and technological process according to the region.

The objective of this work was to study the processing and characteristics of this meat product by the traditional producers.

The following variables were studied: pH, aw, moisture, protein, fat ash and salt (NaCl). In addition plat counting for *Lactobacilli* and *Micrococcaceae* were performed in appropriate media.

According to the technological process the salpicão of this region exhibit three different types with variations in cut of the meat, seasoning and curing time.

The finished product composition estimated on 273 samples show that salpicão is an intermediate moisture meat product with low aw (0.87 ± 0.09 - 0.83 ± 0.05) the main factor responsible for its safety without recourse to refrigeration. The other studied parameters exhibit some variation reflecting the different procedures of different producers.

Lactobacilli are present in a higher number (7.9 ± 1.90 - 9.6 ± 1.23 Log cfu/g) than *Micrococcaceae* (1.7 ± 1.34 - 4.48 ± 0.70 Log cfu/g) and it is an interesting aspect that needs more study with the objective of increasing quality, safety and uniformity of this meat product.

Effect of Sugars on Texture of Dried Meat

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In order to examine a role of added sucrose for the texture of Chinese style dried pork, moisture content of sliced pork, and biochemical properties of myofibrills prepared from the sliced pork such as Ca-ATPase activity and solubility with 0.6 M KCl (pH 7.5) solution were measured during drying of sliced pork containing various concentrations of sugars.

When sliced pork was dried, all indices employed changed according to a first order reaction rate. Plotting the logarithm of rate constant against the initial molarity of sugar, the liner relations were obtained for all indices employed. A slope of the logarithm of rate constant versus the initial molarity of sugar expressed the additional effect of sugar against drying treatment of sliced pork. And it was suggested that the added sugar during drying of sliced pork effectively delayed the speed of the denaturation of contractile protein compared with that of the decrease of moisture content of sliced pork.

We assumed that the dried pork would be hard as the denaturation of contractile protein would occur prior to the decrease of moisture of sliced pork during drying without sugar, and that, the dried pork would be soft as the decrease of moisture of sliced pork would occur prior to the denaturation of contractile protein during drying with sugar.



Research on Chemical Components of Goaty Odour

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The purpose of our research is to reveal the chemical components of goaty odour of goat meat and its products, and establish theoretical basis for producing goat meat products with goaty odour removed, improving the competitiveness of goat meat products. The measured data show that $C_{10}H_{20}O_2$ is one of the main components causing goaty odour in goat meat. The content of $C_{10}H_{20}O_2$ is positively correlated with goaty odour intensity. Through measuring C content of products with goaty odour removed, we further prove that the results of our experiment are sound

Study on the Production of Goat Meat Sausage with Goaty Odour Removed Using Cover Pickle from Pickled Cabbage

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The paper presents the study of goaty odour removing mechanisms of cover pickle from pickled cabbage. In the experiment the cover pickle was used as a starter to produce goaty odour removed sausages, its effect being obvious. Measured with modern precision instrument, C_{10} ($C_{10}H_{20}O_2$), the main component causing goaty odour, of fermented sausages is 30% lower than that of raw goat meat. We could not feel the presence of goaty odour by our sense organ. However, the goaty odour removed products still have peculiar sweet scent of goat meat sausages.

Fermentation of dry sausage - The importance of proteolytic and lipolytic activities of lactic acid bacteria.

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Various groups of microorganisms are used to ferment dry sausage. The lipolytic and proteolytic activity of the involved microorganisms contributes to the formation of flavour and aroma. Sensory analysis were applied in practical experiments in order to evaluate the contribution of added lipase and proteinase to the development of aroma in fermented dry sausage. By adding these enzymes to sausages, significant differences in off-odour, meat-whiteness, colour tone, bitter taste, hardness and stickiness, were observed. Thus, it is of importance to study proteolytic and lipolytic properties of starter cultures. Strains of lactic acid bacteria were, therefore, screened for lipolytic and proteolytic activities. Approximately 100 meat associated isolates have been tested for lipolytic activity against porcine fat, leaf fat, tributyrin, Tween-20; -40; -60 and -80. Ten strains showed lipolytic activity towards one or more of the substrates. Lipases from three of the strains have been partly purified and characterized. Temperature and pH optima of one of the lipases were 37 °C and 6.0, respectively. A cell-envelope associated proteinase from *Lactobacillus casei* NCDO 151 has been purified to homogeneity and characterized. The proteinase has pH optima at 4.8 and 5.6 when using hemoglobin and casein as substrate, respectively. The temperature optimum is 35-37 °C. Serine proteinase inhibitors and metal-chelating compounds strongly inhibit the enzyme, indicating a serine proteinase. The enzyme is shown to contribute to the sensory qualities of fermented sausage.

Salt Diffusion in Dry-Cured Ham

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Diffusion of salt into muscle is the main factor affecting the final keeping quality of dry-cured ham, but the salting process of this important product has never been the object of diffusion theory-based studies; aim of this study was to check the reliability of a solution of the Fick's second law in the representation of the chloride distribution in factory-salted hams. For this purpose four hams, supplied at the end of the salting period by a factory where the preparation technique allows a dry salt excess to cover the ham for the duration of the salting, were analyzed for salt content and to obtain the concentration profiles of chloride. The classical solution of the Fick's second equation expressed by:

$C = 1/2 C_0 \operatorname{erfc}(x/(2\sqrt{D_e t}))$, in which C = concentration (kg/m^3), C_0 = external concentration (kg/m^3), x = penetration distance (m), t = time (s) and D_e = effective diffusion coefficient (m^2/s), proved to adequately represent the experimental data points. Therefore the model was adopted in the computation of D_e ; the D_e values have been determined from concentration profiles (ten data points per ham) by minimization of the sum of the squares of the deviations between the observed and the calculated values; the mean D_e value of chloride in pork muscle Semimembranosus, at a temperature ranging from 1 to 4 °C, was $0.225 \times 10^{-9} \text{ m}^2/\text{s}$ with a standard deviation of $0.0191 \times 10^{-9} \text{ m}^2/\text{s}$; the D_e value lies within the range of the published ones generally obtained under strictly controlled laboratory conditions. The verified reliability of the basic diffusion theory as applied to this particular factory processing technique lets a possible way of objectively evaluating the processing state to be foreseen and the changes in the course of ripening of some parameters related to the final keeping quality of the product to be forecast.

Gelated and cryogenically structured pig blood plasma used in fermented sausage manufacture

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The investigation was carried out to assess the possibility of substitution of cryogenically dehydrated and structured white livex, i.e. thermally gelated pig blood plasma manufactured according to the technology patented in Poland for 10% and 15% of meat tissue in the processing of salami type fermented sausage.

The quality of sausage was assessed organoleptically / colour, taste, aroma and consistency / using a 5 point scale.

Besides, crude protein, lactic acid, volatile fatty acids and pH were determined in sausage mixture / 0 day / and after 5, 10, 20 and 30 days of ripening.

The dehydrated livex used as a substitute influenced the dynamics of fermentation processes and resulted in 27-31% increase in lactic acid content and 6.1-7% decrease in volatile fatty acids in comparison to the control sample. Diminishing of crude protein contents by 1.2-1.5% was also observed. Slight lowering i.e. by 0.09-0.20 points of the overall organoleptic desirability of the final product was noticed.

It is concluded that dehydrated, structured livex could be considered as full value meat substitute in fermented sausage processing although its colour and flavour should be improved.

Early Estimation of Seasoning Loss in Parma Ham Production

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The aim of this research was to estimate the weight loss of Parma ham after seasoning through objective measurements taken at the slaughter-house and during salting of hams. A sample of 158 left hams from heavy pig carcasses (average weight kg 136.8 ± 15.4) was examined. On slaughter-line pH and colour (L^*, a^*, b^*) at 45 min and at 30 h post mortem were measured on semimembranosus, biceps femoris and longissimus dorsi muscles. On the last day drip loss and water holding capacity (Filter Paper Press method) were also determined. Weights were recorded after carcasses cutting (45 min post mortem), after trimming (30 h post mortem), at the end of 1st and 2nd salting (9 and 27 days from slaughter) and after the seasoning period (394 days from slaughter). Relative weight losses and the amount of water absorbed were calculated. Seasoning loss, expressed as percentage of trimmed weight, was equal to 26.22 ± 2.82 . Correlation coefficients between seasoning loss and measurements taken by pH 45 min after slaughter resulted generally low, ranging, in absolute value, from 0.01 to 0.38. High correlation have been found between weight losses at the end of 1st and 2nd salting and seasoning loss, with coefficients between +0.16 to +0.73. The best prediction equation was found to include weight losses after 1st salting, colour measurements and carcass weight ($R^2=0.65$; $RSD=1.69$). Results suggest that it is possible to estimate seasoning loss of Parma ham with an acceptable degree of accuracy using measurements taken in the early steps of the production process.

Centralised Pre-packaging of Fresh Pork

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Efficiency in the fresh meat industry could be increased with the application of centralised processing and packaging of retail cuts. The South African meat industry has only recently started to investigate the concept of centralised packaging. During this trial a bulk packaging method (mother bag) was evaluated to determine its influence on the quality and shelf life characteristics of fresh pork. Three pig carcasses were selected according to muscle pH_i (>6,0) and mass (~65 kg). The six loins represented 3 repetitions. Two loins from the same carcass each represented one control (6 chops) and two experimental groups (6 chops each). Twelve PVC-overwrapped samples from each loin were bulk packed. Each bulk pack contained 6 PVC-overwrapped samples. PVC-controls were included in each loin. The bulk packed samples were stored (0 °C) for either 0, 7, 14 or 21 days (being the 4 experimental groups of the two loins from each carcass). After each specified storage period mother bags were opened, the chops (2 chops for each period) were displayed for 0,2 or 4 days and assessed according to colour, odour and microbiology.

Both the storage period (days in the mother bag) and the subsequent retail shelf life had a significant influence on the total counts. A storage period of 21 days in the mother bag with a subsequent retail display shelf life of a further 4 days was possible. The odours of the mother bag packaged samples were only slightly unacceptable after 21 days bulk storage and 4 days retail display.

The mother bag centralised packaging method is a feasible alternative to the traditional wholesale and retail PVC-packaging system for fresh meat. Furthermore the concept may be a suitable, cost effective centralised packaging system to use.

Ripening of Dry Fermented Sausage without Controlling Temperature and Relative Humidity

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In view of the hot climate in Egypt, sausage industry should not only produce the fresh highly perishable sausage preserved by freezing, but also should be directed, at least to some extent, to processing the fermented dry-sausage, which survive much better the storage without cooling facilities. To save electricity and facilitate production process, a fermented sausage was ripened under ambient conditions, without controlling temperature or relative humidity which is done for fermented produced by traditional methods. Two treatments were investigated, i.e. the smoked dry fermented sausages and smoked then coated sausage with a layer of pastirma spices paste. It seems that ripening was associated with the decrease of moisture, pH, NO₂, NO₃ and total NO₂ and the increase of NO₃/NO₂ ratio, NaCl, colour intensity, lactic acid, acetic and total lactic + acetic. The changes of acids contents and eating qualities are more important. Such changes were more rapid for coated than the control (uncoated) samples, indicating that coating enhanced the ripening process. Apparently, the ripening of dry fermented sausage (no pigs meat or fat were added) could be easily achieved without controlling temperature or relative humidity.

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Production of Fermented Sausage through Addition of Isolated Soy Protein

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The present study was intended to evaluate the utilities of ISP (Isolated Soy Protein) for fermented sausage production as well as to find a way to reduce the amount of salts added for production of fermented sausages through the substitution of ISP for salts.

In the study, the physico-chemical and microbial properties were investigated by commercial manufacture under the addition of 0, 2, 3, 4 and 5% of ISP added levels during production of European style fermented sausages and the panel test was conducted for the final products.

With the increment of ISP level, there was no difference of growth in *Lactobacillus plantarum* and *Staphylococcus simulans* used by starter culture between control and treated groups, although an increase of pH ($P < 0.01$) and a reduction of water activity ($P < 0.01$) were observed. In Hunter Color Value, increment of ISP added level resulted in a decrease of a value (redness) in both 4% and 5% of ISP treatment but not in 2% and 3% compared with control one.

However, an increase of b value (yellowness) was observed in final products of all groups ($P < 0.01$). But, there was not any differences of color in 2% of ISP treatment compared with control from panel test. No difference of texture and taste was also shown in 2% and 3% of ISP added groups compared with control.

In conclusion, the results from the study suggest that it is possible to add ISP up to 2% for production and since such addition of ISP produced a reducing effect of A_w as good as reducing about 0.4% amount of salts in sausage materials, low-salted fermented sausages might be produced through the substitutional use of ISP for salts.

Utilization of Mechanically Separated Chicken Meat in Salami Type Product.

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This work aimed to determine the influence of using MSCM from backs and from necks, at two levels, on sensory and microbiological properties of a salami type product.

Dry fermented sausages were made, incorporating MSCM from backs and necks at 20 and 50% of the meat block. A control sausage contained beef, pork and pork back fat. A mixture of *L. plantarum* and *Micrococcus violagrabielle* was used as starter.

The sausages were ripened at 20 - 22°C at appropriate relative humidity for 13 days. Proximate composition, pH, water activity, weight loss, shear compression, *Salmonella* presence, total mesophile, *S. aureus* and lactic acid bacteria counts were determined in final products. Firmness, juiciness, flavour and overall quality were evaluated using descriptive analysis with scale, with a line 10cm long.

For all treatments, final weight losses ranged from 32 to 34%. Ratios water/protein ranged between 1,7 and 2,2. Products containing 20% and 50% MSCM had pH in the range 4,7 - 4,8 and 4,9 - 5,0 respectively. Water activities were around 0,91, and therefore products were shelf stable. Firmness (shear compression), significantly decreased with the increased of MSCM levels. At 20% level, products with MSCM from necks were significantly less firm than those with MSCM from backs. At the 50% level differences were not significant.

Subjective evaluation revealed 20% MSCM products significantly firmer than 50% ones. Overall quality showed control and 20% MSCM as moderately desirable products and those with 50% MSCM slightly undesirable. *Salmonella* and *S. aureus* were not detected in all final products. Lactic acid bacteria counts reached 10^8 UFC/g representing the total of mesophiles.

Conclusions: a) rate of fermentation was not affected by the inclusion of MSCM at high levels; b) acceptable fermented products could incorporate up to 20% MSCM from backs or necks; c) there was no growth of pathogens neither in the control nor in MSCM products.

Study of Technology for the Manufacture of Chinese Fermented Sausage

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Fermented sausage will be a new meat product in China, though sausage products have a long history in this country. The aim of this contribution is mainly to discuss processing technology on Chinese fermented sausage, which we studied with starter cultures of lactic acid bacteria in our laboratory. This is a new technology for producing sausage products in China. Chinese fermented pork sausage was made from selected cuts of fresh or chilled pork which were obtained from a local abattoir in Tianjin Municipality. It was produced using starter cultures of lactic acid bacteria and some other materials. The main materials in fermented sausage we studied are sugar, sodium chloride, glucono-delta-lactone, sodium nitrite and some spices, etc., of which the starter culture is the most important ingredient. Because the effect of starter culture is very important for producing fermented sausage. All materials of fermented sausage were mixed and comminuted together until the desired texture and particle size of fat is achieved. At the same time, a starter culture of lactic acid bacteria was added. Then the inoculated meat mixture was stuffed into sheep casings (or collagen casings) which had a diameter of 80 mm and incubated at 30°C (86°F), 35°C (94°F) and 40°C (104°F) fermenting temperature respectively (given 80% relative humidity at the same time). And then taking sausage samples to smokhouse and cooking at the same place for about 1 to 2 h. Due to the effect of lactic acid bacteria, the final pH of fermented sausage samples were decreased to 5.2 from initial 6.5. The sensory evaluation was done by randomly selected panelists using the scoring method. Finally we carried out statistical analysis. The results for analysis of variance showed significant differences. Chinese fermented sausage product will be a good meat product in China. In other words, there is still a lot of work to be done for us in the future. Further studies on microbiology of Chinese fermented sausage are advisable.

ENZYME ACTIVITIES IN THE PROCESSING OF DRY-CURED HAM

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The knowledge of the evolution of the enzyme activities along the dry-curing process may be of help for a better comprehension of the biochemical basis of the dry-curing process. Proteolytic, lipolytic and glycolytic enzymes from muscle and adipose tissue have been assayed for activity at different key points (Raw, post-salting, mid-curing and end-curing) in a standard process for dry-cured ham production. The assayed enzymes are lysosomal proteinases (cathepsins B, D, H and L), aminopeptidases (Leucyl, arginyl and tyrosyl hydrolyzing activities), glycosidases (β -glucuronidase and N-acetyl-1-glucosaminidase) and lipases (lysosomal acid lipase, acid esterase, neutral and basic lipases). Specific substrates were used for each enzyme. The recovered activities indicate that these enzymes are, in general, quite stable even after 8 months of dry-curing. Thus, these recovered activities were in the range 15-25 % for cathepsins, 50-70 % for glycosidases, 40-50 % for lysosomal acid lipase and neutral lipase, 30-40 % for arginyl and tyrosyl hydrolyzing activities while remained very similar to the initial activity in the case of the basic lipolytic and leucyl hydrolyzing activities. All these enzymes appear to be active along the complete process. In the case of adipose tissue, however, the neutral and basic lipolytic activities almost disappear after the post-salting stage. These enzymes are less stable than muscle enzymes and their participation in the biochemical changes is expected to be restricted to the first stages of the process.

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Sucuk is a very popular and traditional Turkish fermented meat product. However sucuk production is generally made by manufacturers who apply traditional methods which aren't based on appropriate and controlled conditions. This production causes many defects in quality and also economic loss. The aim of this study is to investigate the effect of production which is made at controlled atmosphere on sucuk quality.

For this purpose, the effect of relative humidity on the physical, chemical and sensory properties of Turkish sucuk was investigated during an 8 days of fermentation and drying period. Relative humidities for three experimental groups were selected as 85%, 75% and 65%, respectively. Air velocity and temperature of fermentation and drying were 2m/s and 30°C, respectively.

In three experimental groups pH, total acidity, loss in weight and penetrometer values were determined at 6, while water activity was determined at 12 hours intervals, TBA values were determined at the beginning and at the end of the drying period. Sensory properties of the products were also evaluated by the Scoring method. All the experiments were applied as three replicates and the results were evaluated statistically.

The results of the chemical, physical and sensory evaluations indicated that the most appropriate relative humidity during fermentation and drying was 85%. In this group decrease in pH, increase in total acidity, weight loss and hardness were observed faster than the other groups and lower water activity values were obtained. TBA values were detected similar in all the groups. In sensory evaluation, the sucuk which was ripened at 85% RH got the highest score in evaluating the odour, taste and general acceptance of cooked samples. There were no any statistically significant differences between the groups in relation to other sensory properties.

Effect of sulphamethazine on the ripening of Italian "salame casareccio"

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2 Sulphamethazine is widely used in pig husbandry. Residues of this compound have been detected in swine muscle and processed meat products. This experiment was designed to evaluate whether and how sulphamethazine affects the yield and the quality of ripened Italian salamis.

Five groups of salamis were manufactured and ripened following the typical processing method for Italian "salame casareccio". A sulphamethazine/NaOH solution was added to three groups at different concentrations (0.5 ppm, 0.1 ppm and 0.05 ppm). The fourth group was used as control, while NaOH was added to the fifth group and used as a second control. Protein content, moisture, pH and A_w were measured and the sensorial quality of the products was estimated at given times. Total aerobic microbial count, Enterobacteriaceae, Lactobacillaceae and Micrococcaceae were also evaluated according to current methods.

No relevant differences in the quality nor in the pH-values, A_w -values, protein content and moisture were detected among the products of the five different groups at any stage of the ripening period and only slight differences in the number of Enterobacteriaceae and Micrococcaceae were recorded in comparison with the controls. Therefore the presence of sulphamethazine residues at the concentrations used in this experiment does not seem to greatly affect the ripening and the final quality of the Italian "salame casareccio" which is one of the most appreciated processed meat products in central Italy.

Horse Flesh and Its Subproducts in Meat Foods Production

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Organoleptic combination, chemical structure and cost of horse flesh and its subproducts as well as milk protein and butter were studied. On the basis of the data taken, low cost recipes and technology for increased protein value sausages, pastes and food mass production have been developed. Such food mass has high protein content (over 20 per cent) and low fat content (10-12 per cent). Being low cost, such food mass contains optimum amount of essential amino acids, B complex vitamins, principal elements - calcium, phosphorus, and vital microelements. New sort cooked sausages contain increased amount of protein - from 14,8-16,6 and only from 8,7-8,9 per cent of fat. Fat and protein proportion is 1:2; calcium and phosphorus proportion is 1:3. Sausages are balanced against 6-7 essential amino acids. Paste produced from horse flesh and milk products has increased protein content - 18 per cent and low fat content - 12,4 per cent. Fat and protein proportion makes 1 to 1,5; that of calcium and phosphorus is 1:2. The paste is balanced against three essential amino acids - tryptophan, lysine, methionine and contains the optimum amount of microelements (cobalt, manganese, zinc, etc.).

Bacterial Starter in Horseflesh Sausages Production

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Volatile fatty acids, volatile carbonyl compounds as well as ethers and sulphides prove to be aroma and flavor producing in cooked, cooked-smoked and half-smoked sausages. However the dynamics of accumulation and utilization of these substances in the body as well as aroma producing importance of each group of the substances in horseflesh sausages have not been studied. To solve the problem methods of obtaining volatile aroma producing substances from the above sausage products have been developed. The experiments have shown that pure cultures *L. plantarum* and *Str. diacetylactics* produce volatile carbonyl compounds, their content growth being observed in the process of frying, cooking, and smoking the six sorts of sausages tested. But the total amount of volatile carbonyl compounds and especially their separate components quantitative proportion depend upon sausage sort. Isobutyric, butyric, crotonic, butylacetic aldehydes, diacetyl, acetone, diethylcetone were prevailing in finished cooked-smoked sausages. Formic, acetic, valeric, and butylacetic acids were predominating in all sorts of sausages involved.

Horseflesh Fresh Sausages Food and Biological Value

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The aim of the study is to develop fresh sausage production technology preserving biologically active compounds.

Soft dry sausage is ready-to-eat in 25 days and hard dry sausage - in 40 days. Hard dry sausages have darker appearance than soft dry ones. Cut color, aroma and flavor are up to the standard. Food and biological value researches testify to the fact that sausages have a high content of polyeicosanic acids, vitamins, minerals, microelements and a number of other compounds which make up biochemical compounds. These compounds are essential in formation of active complexes and contribute to the improvement of body metabolism. The technology spoken of makes it possible to preserve biologically active compounds in the product.

Microorganism Topography In Raw-Dried Sausages

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The internal and external factors of the fermentation process and microorganism selection for starter cultures, their biochemical and microbiological properties were intensively studied. It was established that the natural flora and added starter cultures are not evenly distributed in the fermented sausages, but they are immobilized in cavities "nests" in the sausage mix. The microorganisms can not be released from these nests and the sausage aging may be viewed as a solid state fermentation. Therefore, the more evenly inoculation of the sausage mix with identical starter cultures is significant to the fermentation process and quality of the fermented sausages.

In the present study the purpose is to investigate the microorganism topography in raw-dried sausages, produced by starter culture addition. On the base of the received information we oriented to the studies of the possibilities for aging acceleration in raw-dried sausages by the improvement of the starter culture inoculation when they are added to the sausage mixture.

In order to perform the stated purposes we carried out microstructure and physicochemical investigations of parallel batches of raw-dried sausages with and without addition of lyophilized cultures from *Lactobacillus plantarium* and *Micrococcus varians*. In order to improve the microorganism inoculation we sprayed on the sausage mix the lyophilized cultures, which are dissolved in distilled water.

Besides with the microstructural investigations of microorganism topography in the sausages, we monitored the change of water content and pH at definite moments of the aging of control and tested batches, which are placed at equal conditions.

The results are illustrated by microphotos and tables. When starter cultures are added on the 4th day of aging it is examined clearly expressed "nest" clustering of the microorganisms in small but densely located colonies. Their location is predominantly in the connective-tissue spaces, along to the muscle fibres, but it is observed also single colonies among the fat cells.

It was established that when starter cultures are sprayed, it is observed more densely and evenly distribution of the microbial nests and faster lowering of pH and water content of the sausages.

It may be concluded that together with the biochemical properties of the starter cultures, the microorganism inoculation is significant for the fermentation process in the sausages. When the starter cultures are sprayed on the meat mix, they are distributed more evenly, which determine the smaller distances among the bacterial colonies in the sausage. Therefore, the microorganism usage of the substratum is improved. The equal distribution create conditions for more evenly penetrating of their metabolic products in the sausages.

Effect of lactose and of drying temperature on the quality of Italian salami.

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The temperature of ripening and the sugar content of the mince are two major variables in raw sausage technology.

Both factors are known to influence the fermentation pattern thus affecting the final taste of the product.

With the aim to progress in the knowledge of the fermentation chemistry a number of chemical compounds, i.e. organic acids, soluble nitrogen and elemental components were followed in Italian salami produced with or without lactose and with differing temperatures of drying (two levels).

Data, analyzed by one-way and two-way ANOVA, showed a general increase in organic acids as result of higher drying temperatures and of the presence of lactose. In an experiment (temperatures = 8 or 18°C, lactose = absent or present) a statistically significant increase was found for acetic and oxalic acid, but not for lactic acid, which was anyhow higher with lactose and with temperature employed at the upper level. No differences were found for the overall acidity (by titration) and for the index of proteolysis (by treatment with TCA). In contrast, an unusually high index of acidity found in samples treated at 30°C seemed to be due to increased fat hydrolysis. In this experiment, lactic and acetic acid were significantly lower at lower temperature (18°C) while fumaric acid was higher.

In all cases, the generalized presence of mono-, bi- and tricarboxylic acids suggests that homo- as well as heterofermentative processes were involved at all levels of both factors.

Relationship between a failed sausage fermentation process and the properties of the starter culture

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In spite of the use of a commercial starter culture (here called CSC), process failure repeatedly occurred at a processing plant - the pH did not decrease as expected.

An investigation was initiated in order to determine: 1. how the ability of CSC to decrease pH was affected by the bacteriological quality of the raw meat, the concentration of CSC and the sodium chloride concentration; 2. whether the CSC contained any phages; 3. whether the CSC had changed since it was commercially introduced.

The change of pH was measured during the incubation of meat mixtures containing meat, fat, sodium nitrite, sodium chloride, glucose and starter culture. The raw meat used was 1) fresh, 2) stored or 3) salted and stored. The presence of phages in CSC was studied using mitomycin induction. Salt-tolerance was compared for CSC produced in 1989 and the starter culture strain maintained at the Swedish Meat Research Institute Culture Collection.

The CSC's ability to decrease the pH was not affected by the bacteriological quality of the raw meat. The ability to decrease the pH was affected by the concentration of CSC added and the concentration of NaCl used. The CSC did not contain any phages. CSC produced in 1989 was less salt-tolerant than the starter culture strain maintained at the Swedish Meat Research Institute Culture Collection.

The salt-tolerance of CSC had, during the 8 years of commercial production, decreased and the CSC was incapable of functioning during the processing of fermented sausages.



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Chinese Silk Bound Rabbit (chansi tu 缠丝兔) is a traditionally flavored, special local food in Sichuan. The earliest known reference to Chinese Silk Bound Rabbit was dated from last years of the Qing Dynasty, with a fame of over a hundred years.

Technology of Chinese Silk Bound Rabbit is a special and another. Our laboratory has produced Chinese Silk Bound Rabbits with traditional way and has studied their physico-chemical and microbiological properties. Chinese Silk Bound Rabbit is made of choice rabbit and preserved in a special traditional way with many precious chinese herbed medicines such as cinnamon, cardamon, clove etc. It has a beautifully shaped and a clear red brown color. It's delicate flavour with aftertaste. The microbial stability of Chinese Silk Bound Rabbit depends primarily on the hurdle Aw, i.e. water activity, and not on pH. A quick reduction of Aw 0.85 is achieved within 24 hours due to the added humectants (salt 2.5-3%, sugar 1-2%) and intensive drying at higher temperature (50-60 °C) and low moisture (RH 65-70%). However here the pH remains quite high (pH 6.6-6.8) because the number of lactic acid bacteria increases rather slowly in this product. Chinese Silk Bound Rabbit is a raw but non-fermented product. It's simple to prepare, nutritious, safe and storable without refrigeration. It's also a traditional Intermediate Moisture Food.

Research and Manufacture of New-type Yunnan Ham

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This paper reports the finding of studies to determine the best method to overcome the shortcomings of salt hard quality, fat and big size of the famous Yunnan Ham of China while maintaining its traditional color, flavor and savor.

(1) In the first study local pigs were cross-bred with several varieties of lean pigs and raised under controlled conditions and then slaughtered when reaching a desired age and weight. The study was performed 2 times with 6 to 12 fresh pig legs in each of 4 replications the first time and 18 to 33 the second time. The meat was cured according to traditional methods. Similar results were obtained each time the study was performed. There were no significant differences in color, savor and flavor of hams from pigs bred from the different lean varieties compared to local pigs. However, bred pigs had an increase in curability of 18.93% and a reduction in ham size of 16.09%.

(2) In the second study one variety of cross-bred lean pigs and local pigs were raised under the same conditions. Pigs were slaughtered and each group was divided into 3 replications containing 24 legs. Curing treatments consisted of sodium salt, low salt and sweetened. The test was repeated a second time. Results indicated that new-type Yunnan Ham (from bred pigs) contained low salt and were of softer quality. The sense organ appraisal was above 94. All hams met the Chinese national standards for hams.

The Yunnan ham with low salt was generally considered superior to medium salt while sweetened hams were considered inferior.

Research on Improving the Quality of Jinhua Pork Ham

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We write this paper with the intention that the meat scientists and technologists of the world should understand the famous traditional meat products of China.

Jinhua Pork Ham was first made about 1,000 years ago. It is one of the famous, special and excellent traditional meat products of China and gains fame all round the world and thus it is welcomed by both domestic and foreign consumers.

The paper expounds Jinhua Pork Ham's historical course of development, production and marketing, technological process, etc. It also emphatically explains how scientific and technological researchers and managerial personnel have carried out a series of studies in order to improve the quality of the products, since the foundation of P.R. China. On the basis of traditional technology analysis, we have formulated integrative quality standards of products and operating technology rules, have trained processing technicians, have improved fresh keeping and edible methods of finished products, etc. Because of the scientific research and technological innovations underway have gained good effects, the product quality is enhanced further.

Preservation of the Nan-An Pressed Salt Duck with the Technique of Oxygen Scavenger and Seal

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Nan-an pressed salt ducks are renowned at home and abroad as a traditional export commodity. The pressed salt ducks, especially the early product, would decay easily. In order to prolong the preservation and expand the export, the test was designed. Oxygen scavenger was used in this test for Nan-an pressed salt duck's preservation. It was observed from the sensory test that the pressed salt duck's normal efficiency was 97.3 %, and had their own specific flavour and colorness, but 100 Percent of the pressed salted ducks had decayed after 30 days in the control group. It was also found from the result of bacteria and chemical determination that there was a marked difference between the treatment group and the control. In the treatment group, the bacteria counts was 3.6 times 10^5 /g; TVB-N, 9.74 mg/100g; moisture, 41.75 %; peridoxie value, 0.24 %; and acid value, 1.21 %. In the control group, the bacteria counts were 819 times 10^5 /g; TVB-H, 22.67 %; moisture, 30.97 %, peridoxie value, 0.43 %; and acid value, 3.73 %. In the repeat test, it was also proved that the sensory indexes and physicochemical indexes in the treatment group corresponded to the National Health Standard.

In this test, the oxygen scavenger could also prevent the weight losses and the nutrient basic content changes of the pressed salted ducks. This study proved that the oxygen scavenger was a good method for Nan-an pressed salted ducks preservation. It has great significance and economic social benefit.