

SESSION 5. NUTRITION

5:1

EFFECT OF COOKING ON FAT CONTENT OF BEEF AND PORK

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Dietary recommendations to the general public in Sweden include the reduction of dietary fat intake. This requires knowledge of the fat content of foods and dishes and of what people actually consume. So far, calculations of fat consumption originating from meat have been based only on data concerning raw products.

The purpose of the present study was to provide general information on the fat losses in different retail cuts of beef and pork during cooking. Data on the fat content of cooked meat, from which visible fat has been trimmed off, was also studied. The samples ($n = 65$), having a fat content in raw tissue ranging from 2 to 40%, were chosen on the basis of fatty tissue distribution: (1) intramuscular fat (boneless top loin of pork without any external fat), (2) depot fat as subcutaneous fat (boneless top loin of pork with backfat), (3) intermuscular fat as small depots (boneless rib steak of beef), (4) intermuscular fat as layers of fat (fresh side pork).

All retail cuts were cooked in three different ways: (a) pan-broiling (without any frying fat added) of 1.5 cm thick steaks, for 3 min on each side at 165°C, (b) roasting in oven of cuts of about 1 kg, at 175°C to a final internal temperature of 85°C, (c) boiling in water of roasts of about 1 kg to a final internal temperature of 85°C.

5:2

EFFECT OF FREEZING AND FRYING ON MINERAL CONTENT OF SIX EGYPTIAN BUFFALO ORGANS

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This investigation was carried out to study freezing frying effect on the mineral content of six buffalo organs, namely: Liver, Heart, Kidney, Spleen, Tongue and Brain.

These organs were obtained immediately after slaughtering from Assiut slaughter house. The average age of the animals was the normal commercial age. These ages rated between 2-2.5 years. Samples of organs were transferred without delay to the Food Technology Laboratory, Assiut University.

Copper, Zinc, Iron, Manganese, Calcium, Magnesium, Sodium, Potassium and Phosphorus contents in the aforementioned organs were evaluated as follows:

Sodium and potassium contents were determined by a Carl-Zeiss Jena flame photometer. The stock electrolyte solution of dry ashing was assessed.

Phosphorus was determined colorimetrically by the ammonium molybdate method. While the versine titration method was used for calcium determination. Copper, Iron, Zinc, Manganese and Magnesium were determined using Unicam SP 1900 atomic absorption spectrophotometer. The results revealed that:

1. Liver, heart and spleen of buffalo contained higher levels of copper, iron, manganese, magnesium, potassium and phosphorus than the other organs, except brain which contained relatively higher levels of

Results show that there was a linear relationship between the amount of fat (expressed in g/100 g raw meat) in cooked meat (y) and the amount of fat in raw meat (x). The equations were: for pan-broiling $y = 0.295 + 0.859x$ ($r = 0.991$), for roasting $y = -0.188 + 0.841x$ ($r = 0.976$) and for boiling $y = 0.435 + 0.859x$ ($r = 0.993$). Only small differences in fat loss between the different cooking methods were obtained, although the total weight loss differed considerably. Consequently an overall equation, $y = 0.197 + 0.854x$ ($r = 0.986$), may be used to calculate the fat content after cooking, irrespective of the cooking method. The fat losses were found to be the same for both beef and pork. Only a minor part of fat (about 15%) was thus lost during cooking. A special study was performed on fresh side pork, fat content about 39%, of different thicknesses (3, 6, 10 and 15 mm). The slices of pork were pan-broiled (without added fat) for 3 min on each side at 165°C. Fat losses were found to be directly proportional to thickness. For bacon (3 mm thick) fat losses of 60% were obtained.

The major part (85%) of the fat content was retained in the meat after cooking. However, most fat could be trimmed off as visible fat before eating in all the retail cuts. The trimmed meat had a fat content of only 2-3 g/100 g raw meat, irrespective of the original fat content.

It was concluded that a general figure of 15% for fat loss during cooking of whole meat could be used (thickness of slices ≥ 1.5 cm). All cooked retail cuts of pork and beef could be trimmed to a fat content of 2-3 g fat/100 g raw meat. The data could generally be applied to retail cuts of beef and pork such as steaks and roasts.

magnesium, potassium and phosphorus than tongue and kidney.

2. Zinc levels in all organs were found to be much higher than other minerals.

3. Spleen and liver were of relatively higher iron content.

4. In general, all studied buffalo organs may be considered as rich sources of iron, phosphorus, zinc, manganese, potassium and copper, while they may be considered as good sources of sodium and magnesium in human diet. Meanwhile they are reckoned as poor sources of calcium.

5. Phosphorus levels were generally higher in liver, brain and spleen.

6. The rate of decrement in sodium and potassium were relatively lower in fried organs. Meanwhile, the other mineral contents in all studied organs were higher in fried organs.

7. The rate of decrement of sodium, potassium and phosphorus was higher than that in other minerals during freeze storage in all studied organs.

5:3

LIPID AND PUFA CONTENTS OF MUSCLE AND SKIN OF CHICKEN. INFLUENCE OF ANATOMICAL LOCATION

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Four broilers of different grades were purchased from a local market, in order to have a broad range in meat quality. Breast, thigh and drumstick were dissected out from both sides of the carcass. Meat and skin were separated from each cut. Lipids were extracted from sample (4-5g) of the following tissues : breast muscle, thigh muscle, drumstick muscle, breast skin and leg (thigh + drumstick) skin. Then, total lipid extracts were fractionated into neutral and polar lipids on a silicic acid column. The polyunsaturated fatty acid (PUFA) content of the total lipid extracts was determined by gas chromatography using a fused silica capillary column.

The results showed :

- 1) Whatever the tissue, samples dissected out from left and right sides of the carcass exhibited no difference in lipid and fatty acid compositions.
- 2) Lipid content of muscle differed largely according to the anatomical location. Thus, breast meat contained less lipid than drumstick meat (1.1 g/100g, 3.3 g/100g respectively) ; thigh meat exhibited the highest amount of lipids (4.1 g/100g).
- 3) Polar lipid content of thigh muscle was close to drumstick muscle ones (0.8 g/100g), but breast meat contained a smaller proportion (0.5 g/100g).

5:4

TRANSITION OF SOME HEAVY METAL ELEMENTS (Cd, Cu, Hg, Pb, Zn) FROM PIGLET FEEDING ROOT SOIL (FERKELWUEHLERDE) INTO PORK LIVER AND KIDNEY. TEST SERIES II

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In the solid waste treatment station "Mura" located in the city of Biel-Bienne, a part of solid waste is transformed into a root soil for piglets (Ferkelwuehlerde). Another study was made concerning transition of heavy metals from root soil into piglets and pork livers and kidneys comparing an O series and a T series of 40 piglets/hogs each. Testing dispositives and analytical methods are the same as reported in test series I (32nd European Meeting of M.R.W., vol. I, 401-402 (1986). As in the year before, no significant differences between Series O and T were found. A preliminary study of heavy metal contents in muscle tissue showed extremely low concentrations in both series.

4) Skin presented a high proportion of lipids (33-36g/100g) weakly dependant of anatomical location.

5) Chicken meat lipids contained a high level of PUFA. P/S ratio exceeded 0.7 in all the muscles studied. The PUFA were mainly N-6 fatty acids (2/3 as linoleic and 1/6 as arachidonic acids), however N-3 fatty acids with 22 carbon backbone accounted for 5 to 8% of the PUFA.

6) Skin lipids showed a low proportion of PUFA as compared to muscles. PUFA contained up to 90% of linoleic acid and almost no long chain PUFA (20 or 22 carbons).

5:5

EFFECT OF DESINEWING AND PROCESSING ON THE AMINO ACID CONTENT OF BEEF SHANK

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Shank meat acquires its toughness properties as well as lower biological value from the high content of connective tissues. In this work six cattle male (of about 18 months age) shanks were used. Meat from 3 shanks was ground as it is, whereas that from the other 3 shanks was mechanically desinewed after grinding. Both were cured by addition of 130 ppm sodium nitrite plus 3% sodium chloride. Parts from either sinewed or desinewed meat were stuffed in natural casings and cooked. The amino acid content was determined using paper chromatography.

Desinewing increased the tryptophane, methionine, arginine, lysine, glutamic and aspartic acids. On the contrary, hydroxyproline, proline, glycine and alanine were decreased. Cooking as well as curing showed no marked effect on the amino acid content.

5:6

PORK QUALITY AND BACKFAT COMPOSITION OF CUBAN PIGS FATTENED WITH A RESTRICTED DIET BASED ON SWILL AND HIGH-TEST MOLASSES

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OBJECTIVE

The aim of this study was to determine the effect of sex (entire males, barrows and gilts) and age at slaughter (214 and 252 days) on pork quality and backfat composition of pigs fattened on an experimental diet.

EXPERIMENTAL

Ninety-six CC21 pigs were allotted into groups of eight per boxer per sex since 100 days of age (ca. 36 kg live weight).

The feed consisted of a restricted diet based on swill and high-test sugar cane molasses (60:40 % on dry basis) supplemented with 0.8 kg of cereal concentrate per pig, which is the diet used for commercial swine production in Cuba.

After slaughter (109 kg average live weight), samples of *Longissimus dorsi* muscle and subcutaneous fat were taken near the last rib to determine pH, WHC (%), hydro-soluble protein (%) and sensory assessment of color, marbling and flavor for pork, and indexes of iodine (%), peroxide (mEq/100 g), saponification (mg KOH/g) and acidity (mg KOH/g), total cholesterol (mg/100 g) and fatty acid composition for subcutaneous fat.

A linear model in which the effects considered were sex, age at slaughter and their interaction was applied to analyze the data.

RESULTS AND CONCLUSIONS

There was no significant interaction either for pork quality or backfat composition. Pork quality was slightly but significantly ($p < 0.05$) lower (WHC=68.1%) for entire males and ranked lower ($p < 0.01$) in extractable fat (7.0%, dry basis) as compared to barrows (WHC: 72.5%; fat: 9.1%), regardless of age at slaughter.

Tasters found no boar taint either in pork or cracklings from entire males. Pork flavor was graded lower ($p < 0.05$) and crackling flavor higher ($p < 0.001$) for younger pigs.

Both pH₁ and pH_u of the *L. dorsi* decreased significantly ($p < 0.001$ and $p < 0.01$, respectively) with increasing age at slaughter: mean pH₁ was 6.3 and 6.1 for animals slaughtered at 214 and 252 days, respectively, whereas mean pH_u for the same was 5.4 and 5.4.

Sex did not influence subcutaneous fat composition, but fat from older pigs had less ($p < 0.05$) oleic (48.3%) and more ($p < 0.05$) palmitic and stearic acids (21.0 and 12.0%) than that from younger pigs (56.4; 15.4 and 6.8%, respectively).

5:7

CHOLESTEROL CONTENT IN DIFFERENT PORK TISSUES
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The aim of the work was to study comparatively the cholesterol content in different pork tissues. The investigation was performed on muscle and fatty tissue, liver, brain and spinal cord of hogs of Large White race.

Total lipids were extracted according to Folch. After saponification, the unsaponifiable part was tested by gas chromatography. Also total lipids were separated by column chromatography after the Johnston method into neutral lipids, phospholipids and glycolipids, and then the neutral lipids were separated by column chromatography into: hydrocarbons, cholesterol esters, triglycerides, cholesterol, diglycerides, monoglycerides and free fatty acids. The weight percentages of all fractions were evaluated.

The results show high differences among tested tissues in the contents of total lipids (2.47 to 87.48%), neutral lipids and polar ones.

The percentage of neutral lipids in total ranged from 29.67 (in brain) to 99.64 (in fatty

tissue); phospholipids were 0.27% (in fatty tissue) to 64.16% (in liver; similar to it also to brain and spinal cord). The participation of glycolipids was low ranging 0.09-9.54%. There were high differences in quantities of above mentioned neutral lipid fractions in different tissues.

The cholesterol fraction was separated by gas chromatography and quantitatively analysed. Cholesterol contents were: in muscle tissue - 239.7 mg/100 g, in liver - 338.9 mg/100 g, in fatty tissue - 122.9 mg/100 g, in brain - 1912.7 mg/100 g, in spinal cord - 2621.6 mg/100 g tissue. In brain and fatty tissue cholesterol showed to be mainly in the free form while in other tissues and specially in spinal cord the ester form of cholesterol was quite high.

Based on the results of this comparative study it is to be stated that there are high variations of cholesterol contents in different tissues of an animal. More detailed data are expected through GC-MS-C combination of the components of the steroid types, that are valuable for the investigation of oxidative changes of cholesterol and other compounds in raw material processing and storage.

5:8

INFLUENCE OF THE THERMAL PROCESSING ON FISH
SAUSAGE PROTEINS

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The interest in fish sausages production constantly increases, while the investigations in this direction are still limited. In the present study our purpose was to investigate the changes in proteins, which occurred during the thermal processing of freshwater fish sausages - silver carp (*Hypophthalmichthys molitrix*).

Three variants of non-structured and structured fish sausages have been investigated, produced on the basis of *H. molitrix* farce (50 % to 60 %), with the addition of beef and bacon.

The technological scheme for the production of cooked sausages, created by us was the following: production and preparation of *H. molitrix* farce, as well as the preparation of the other meat components, including salting and aging, formation of the filling

mass; filling in sausage skins; roasting, cooking and cooling.

The changes in proteins during the formation of the filling mass and the thermal processing of fish sausages have been investigated - roasting at 95 - 80 °C in the course of 50 - 60 min and cooking at 76 - 78 °C in the course of 30 - 35 min. For the purpose we have studied the changes in the indices, characterising the changes in protein composition: the quantity of water-soluble nitrogen, non-protein nitrogen, insoluble nitrogen, as well as the quantity of myofibrillar proteins and the quantity of sarcoplasmatic proteins.

The respective conclusion in connection with the qualitative changes in proteins during the production of fish sausages have been drawn: the different indices change in different degree but insignificant losses in protein contents have been noticed.

5:9

A STUDY INTO THE INFLUENCE OF MECHANICALLY DEBONED MEAT ON THE DIETETIC QUALITY OF MEAT PRODUCTS

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In many countries all over the world, to rationally utilize meat resources, the meat left on the bones after manual deboning is removed mechanically with various presses.

The specialists think that the basic factors which limit the use of mechanically deboned meat (MDM) in dietetic foods, is the feasibility of heavy metal salts in it, as well as insufficient hygienic substantiation of the rational ways of using MDM based on the results of a biological evaluation of products with MDM added.

The purpose of the present paper is to study the mineral composition of mechanically deboned beef and of the meat products with MDB added, as well as to biologically evaluate such products on growing white rats.

Quantum-plasmic and atomic-absorption spectrometry of MDB and of products containing MDB showed no salts of such metals as manganese, vanadium, chromium, niobium, cesium, nickel, cobalt, zirconium, tungsten, strontium; zinc and arsenic salts were present in

trace amounts in MDB only.

MDB was found to be a good source of minerals in meat products. Its incorporation into meat products (up to 20%) provides a physiologically optimum ratio of calcium salts and phosphorus, fortifies the products with magnesium salts (by 2.5 times), ferric salts (by thrice) and with copper and zinc salts.

The MDB-added dietetic meat product developed by the authors, is of a high biological value, exhibits hypocholesterinemic and alkalizing effects which are very important under the modern living conditions. No negative influence upon carbohydrate metabolism was noticed.

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5:10

THE DEVELOPMENT OF A MATHEMATICAL MODEL OF DIETETIC MEAT PRODUCTS

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The development of dietetic foods requires the choice of such chemical constituents which are determined with individual consumer's physiological state and at the same time meet the requirements of rational nutrition. When substantiating formulations, it is necessary to include the ingredients which supply the needed level of each constituent in the product being developed.

For baby foods a recommended list of the necessary ingredients having the chemical composition which effects favourably the "metabolic block" of the organism, was established. Medico-biological restrictions of the possible use of the ingredients and the chemical composition of the finished product were determined with account for a probable loss of chemical constituents during processing. The optimal formulation of biologically perfect products for children was calculated with a computer by a modified simplex method. Several alternatives were calculated, and the one which provides the maximum of the necessary constituents and determines the quantitative expediency of using indi-

idual ingredients, was chosen. The proximate composition (protein, fat, amino acids, vitamins B₁, B₂, B₆, PP) was adjusted to the level required. Protein-to-fat ratio was 1:0.9. The calculated amino acid score approached 1.0. The experimentally prepared product was organoleptically satisfactory and met chemically the medico-biological requirements and the computer data.

The results obtained support the view that it is possible to use multi-component formulations in the development of special medicinal products. The optimization of the implementation of this task is accelerated due to the application of computers: the time for data processing and for performing extensive experiments is reduced.

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5:11

THE BIOSTIMULATING EFFECT OF FEEDING RATIONS CONTAINING PRODUCTION WASTES OF SOME MEDICINAL PREPARATIONS

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Experimental results are presented on laboratory animals feeding with feather meal containing calculated amounts of some wastes derived from medicinal production, as biostimulating additives. The incorporation of these wastes to the feeding meal was found to significantly increase (by 19.5% as compared to controls) the level of protein, perfect in its amino acid profile, in the finished product. Experiments on male rats with the initial weight of 115±5 g indicated that the addition of 9% of the test and control meals to the standard ration ensured weekly gains of 20.48±0.59 g and 10.83±2.47 g, respectively, within a 4-week feeding period. It was noted that test rats needed 9.06 g of feed per gram gained, as compared to 15.3 g for control animals, this evidencing a higher nutritive value of the suggested feeding additive and its pronounced biostimulating activity. Histological studies of the internal organs and tissues as well as calculations of the integral index of chronic intoxication did not reveal any toxic reaction of the animals to the incorporation of biostimulating additives to the feeding rations.

5:12

DETERMINISTIC APPROACHES TO DESIGNING BIOLOGICAL AND ENERGY VALUES OF MEAT PRODUCTS AND RATIONS CONTAINING THEM

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This report deals with the methodology of designing multi-component food products being characterized by the complex of nutritional value parameters required. Principles and criteria for assessing the rationality of use of protein- and fat-containing raw material, namely its essential amino acids and polyunsaturated fat acids were formulated on the base of formalization of biochemistry, physiology and nutrition hygiene conceptions.

Methodological approaches cited in the report served as a base for developing the technique of grounding proportions of food products or their rations ingredients which satisfy the deterministic complex of requirements concerning biological and energy values and which provide the rational use of essential food substances.

On a wide circle of approaches and questions considered this report serves as a starting one and may be of interest for scientific workers studying problems of food products technology improvement and development of new varieties of food products.

FOOD VALUE OF YOUNG BUFFALOES CHILLED MEAT

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The lack of data about digestion velocity of different young buffaloes chilled meat cuts by some enzymes of gastrointestinal tract, the considerable changes in the chemical, amino acid composition and changes in food value have become the main reasons for this research.

The objective of this research is to define the food value, amino acid composition, the degree and velocity of digestion of young buffaloes meat by some enzymes of gastrointestinal tract.

Chilled eye muscle of loin and chuck meat of a 30 months old young buffalo of the average finish has been tested. The samples packed in film have been stored in the refrigerator at $0^{\circ} + 4^{\circ}\text{C}$ and $\psi - 85-90\%$. The chemical composition has been determined according to general methods, the amino acid composition was tested with the help of amino acid analyser of AAA-881 model (CzSSR), the digestion was determined by the method of Pokrovsky A.A., Artanov I.D. The results of the test show that the chemical composition and food value of different samples differ by the content of proteins, fats and by tryptophan-hydroxyproline correlation. The study of digestion velocity and the degree of

digestion have shown that the quantity of proteolysis products increase considerably under pepsin influence.

So we can draw a conclusion that food value of young buffaloes chilled meat is determined not only by chemical and amino acid composition, but by the degree of digestion in vitro and by the velocity of this process as well.

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