

Meat preservation,
processing
And
Value addition technologies

Effect of Phosphate Addition and cooking on Mutton Lipids.

Sanjay Singh Rathore

M.V. Sc. Thesis, July-1991

Dr. B. N. Kowale

Chairman

The present investigation was planned to study the effect of phosphate addition, cooking and storage period on mutton lipids at refrigerated temperature. Mutton samples treated with tetra sodium pyrophosphate had significantly higher pH value as compared to control samples. Cooking also raised the pH of mutton samples by 0.2-0.3 units. There was significant increase in the pH values during refrigerated storage.

TBA values of phosphate treated mutton samples (raw as well as cooked) was significantly lower than the respective controls (raw and cooked). Cooking also resulted in an increase in TBA values. A significant increase in TBA values of all mutton samples was observed during refrigerated storage. Carbonyl compounds are the principal products of lipid oxidation. Phosphate addition had no significant effect on the total carbonyl contents of mutton, however, total carbonyl content of cooked mutton samples (with and without phosphate) was numerically higher when compared to their respective controls.

Total lipid content of raw mutton sample was 10.29 mg/g of meat. The phosphate treated mutton samples revealed lower extractability of total lipids when compared to control samples (without phosphate). The phospholipid content of raw mutton sample was recorded as 3.92 mg/g of meat. The phospholipid content of phosphate treated samples was lower as compared to corresponding controls. There was significant increase in total lipid and phospholipid and content of mutton on cooking but refrigerated storage had no significant effect on the total phospholipid content. Principal fatty acids recorded in mutton lipids are oleic, palmitic, stearic, linoleic and linolenic. Oleic acid (C18;1) accounted for 35-38% of total, with total unsaturates being 50-55%. Palmitic acids was the major saturated fatty acid followed by stearic acid.

Addition of pyrophosphate in mutton improved the functional properties and sensory qualities. Significant antioxidant effect of pyrophosphate was evident from the lower TBA values obtained in phosphate treated mutton samples. Lower extractability of total lipids and phospholipids in phosphate blended samples might explain the antioxidant property of polyphosphates since phospholipids are more susceptible to oxidation. However, these findings can be confirmed by future research.

Effect of Processing and Storage on Development of Cholesterol Oxidation Products in Meat of Different Species.

N. Pedda Babu

M. V. Sc. Thesis, Nov.-1992

Dr. B. N. Kowale

Chairman

Although, in causing coronary heart diseases. Cholesterol gets oxidized when it is exposed to air, elevated temperature, free cholesterol is a minor component of animal tissue, it has attained greater importance because of its role radical initiators, light or combination of these resulting in the formation of cholesterol oxidation products which are provenatherogenic, mutagenic and even carcinogenic agents. The present investigation was initiated to study the effect of processing and storage on the development of oxysterols or cholesterol oxides in different meats viz. buffalo meat, chicken, mutton, pork and rabbit meat.

Minced meat was subjected to broiling and pressure cooked samples of all the meat were packed and stored under refrigerated and frozen storage for a period of 0 to 6 days and 0 to 90 days, respectively. The meat samples were analysed for pH, moisture, TBA value, lipid composition and development of oxysterols at regular intervals of 0,3 and 6 days for refrigerated samples and 0, 30, 60 and 90 days for refrigerated samples. The pH of all the meats increased significantly due to broiling or pressure cooking. Total lipids, total phospholipids, total cholesterol and free fatty acid contents and TBA values significantly increased during heat processing in all the meat. Broiling always showed a higher value compared to pressure cooking. A significant increase in the TBA values of all the meats was observed during storage and the changes were more pronounced during refrigerated storage.

Cholesterol oxidation products separated by TLC from all the meats were cholestanetriol, 7 α hydroxycholesterol, 7-ketocholesterol, cholesterol α -oxide and β -epoxide and the unidentified fractions. The present content of all the cholesterol oxides except the cholesterol β -epoxide and unidentified fractions increased on heat processing in all the meats. The unidentified fractions decreased significantly in cooked samples compared to raw, while cholesterol β -epoxide was apparently unaffected. A significant increase in all the oxysterols except unidentified fraction decreased significantly during both the storages.

From the results of the present study it was obvious that cooking invariably increased the present concentration of various cholesterol oxidation products and the changes were more pronounced on broiling. Refrigerated and even frozen storage could not check the development of various cholesterol oxidation products. Hence it is concluded that cooked meat stored either under refrigeration or frozen condition may be consumed with reservation.

Effect of Cooking and Storage on the Development of Biogenic Amines In Buffalo Meat.

K. Murli Mohan

Dr. B. N. Kowale

M. V. Sc. Thesis, Feb.- 1998

Chairman

Biogenic amines in foods are produced by the breakdown of amino acids by the action of microbial decarboxylase. The main biogenic amines occurring in meat are histamine, serotonin, tryptamine, β -phenylethylamine and putrescine. They play an important role in higher levels. In view of their involvement in various disorders and poisoning episodes, it is necessary to evaluate the quality of muscle foods during storage. Biogenic amines have also been recommended. Biogenic amines of buffalo meat were fractionated by TLC and quantified by spectrophotometry. Heat processing significantly reduced serotonin, tyramine, tryptamine and β -phenylethylamine contents. However, histamine could not be detected on broiling. All these amines increased during refrigerated storage of 20 days. However, the increase was more pronounced for histamine and tyramine in pressure cooked meats, for histamine and tryptamine and putrescine in raw meat samples. pH did not change from 0-10 days but increased after 15 days of storage. TBA values significantly increased on heat processing but were more pronounced on broiling and steady increase in TBA values was observed during storage. Free amino acid (FAA) content and tyrosine values decreased on heat processing and reduction was more as spoilage indicators in meat and meat products. Hence, the present study was envisaged to study the effect of heat processing (broiling and pressure cooking) and storage on biogenic amine contents of buffalo meat and its relationship with microbial counts.

Pronounced in pressure cooked meat. FAA content increased in all samples during storage. However, tyrosine values did not change significantly in cooked samples but increased significantly during storage. The day of spoilage was observed to be 10th day for raw and 15th day for cooked meats. To detect freshness/spoilage for raw and heat processed buffalo meat samples during 0-20 days of refrigerated storage, the following biogenic amines may be considered as good indicators viz. histamine, β -phenylethylamine, tyramine and putrescine for raw; β -phenylethylamine, tryptamine and putrescine for broiled and β -phenylethylamine, tryptamine and histamine for pressure cooked meats

Effect of Salt Polyphosphate on the Quality of Ground Buffalo Meat.
A. S. R. Anjaneyulu
Ph.D. Thesis, May, 1988

Dr.Nagendra Sharma
Chairman

Development of value added convenience processed meat products is considered a potential solution for the utilization of vast quantity of buffalo meat available from old and unproductive animals. Ground meat offers a way for better utilization of tough meat, low value cuts and trimmings from spent animals. Use of food grade polyphosphates in the formulations of meat products offer several benefits. The present study was conducted to improve the functional properties meat by addition of polyphosphate or their blends particularly for production of emulsion type of meat products. A series of experiments were conducted to study the effects of different polyphosphates at 0.3, 0.5 and 0.7% level along with 2% salt on the physico-chemical and properties.

Sodium pyrophosphate (SPP), sodium tripolyphosphates (STPP) and blends of polyphosphates significantly improved the physico-chemical properties of buffalo meat as well as quality of patties. A phosphate blend consisting of 65% SPP + 17.5% STPP+ 17.5% sodium acid pyrophosphate (SAPP) was found to be equally effective to improve functionally of meat as that of sodium pyrophosphate in hot, chilled and frozen conditions of meat handling which had the advantage of considerably low sodium content (3%). The improved functional properties of meat were due to increase in pH as well as specific effect of polyphosphate over and above the pH effect in meat system. Green ginger rhizome (0.5%) alone or in combination with onions and garlic caused undesirable soft texture to the patties and hence affected palatability of emulsion type of patties. Hence, dried ginger should be added for its flavor and possible antioxidant effect. Incorporation of buffalo fat in the formulation containing buffalo fat to achieve better acceptability of the product. Pre-blending of meat with salt and development of oxidative rancidity. Phosphate extended the flavour stability of precooked patties for 18 days at 2-3⁰C.

Effect of Processing and Storage on Buffalo Meat Lipids.

V. Kesava Rao

Ph.D. Thesis, 1988

Dr.B. N. Kowale

Chairman

The quality of raw or cooked meat depends essentially on the composition and stability of the constituent lipids. The aim of the study was to find the effect of processing and storage on the compositional changes in various lipid fractions of buffalo meat from different locations.

Broiling and pressure cooking significantly increased dry matter content of buffalo meat. Heat processing significantly increased the TBA values in all the muscles. The changes in TBA values of heat processed buffalo meat were markedly higher in refrigerated than in frozen storage. Muscles L. dorsi, T. brachii and B. femoris differed significantly in their total lipid and total phospholipid content. Heat processing significantly increased the content of total phospholipids in all the three buffalo muscles. Total phospholipid content remained unchanged during refrigerated and frozen storage. Muscles did not differ significantly in their cholesterol contents. Buffalo meat contained higher percent of esterified cholesterol as compared to beef. There was significant increase in the percentage of free cholesterol on broiling and pressure cooking, whereas the esterified cholesterol content decreased.

All the three muscles viz., TB, LD and BF differed significantly in their total glyceride contents. Influence of anatomical locations in the fatty acid composition of total lipids from buffalo meat was observed. The palmitic, stearic, oleic and linoleic acids were the four predominant fatty acids in the phospholipid fraction of buffalo meat. The lower content of PUFA observed in buffalo meat may be attributed to poor plane of nutrition in Indian buffaloes. There was no extensive lipid deterioration due to storage as indicated by pH, TBA value and FFA. However, deteriorative changes in heat processed meat were more pronounced during refrigerated storage than frozen storage.

Effect of Washing on Quality of Ground Buffalo Meat.

V.V.

Kulkarni

DR. B.N. Kowale

Ph.D. Thesis, 1989

Chairman

Studies were conducted to be find the effect of washing of buffalo meat with water and EDTA solution on the functional properties and keeping quality at refrigerated temperature. Buffalo meat washed with water and EDTA solution had significantly reduced the water soluble proteins (WSP). The significantly lower value of total pigment and myoglobin.

Water holding capacity (WHC) of raw meat samples was higher than washed meat samples. EDTA washed meat showed significantly higher EC than water washed and raw meat samples. TBA values of washed meat samples were lower than of raw meat samples.

Washed meat than raw meat. Washing of meat did not affect the total lipid content in spite of visible losses of fat during washing. Lipid analysis revealed that total cholesterol and free fatty acids content of water washed meat samples. However, total phospholipids content of water washed meat was significantly higher than that of raw meat, and EDTA washed meat were non-significantly higher than raw meat.

Patties prepared from water washed meat were comparable to those made from raw meat and addition of raw meat in water washed meat did not bring significant changes in these patties. However, patties prepared from raw meat were superior in binding, texture, flavour and juiciness than those prepared from EDTA washed meat.

A Serological Approach to Identification of Meat Species.

S. V. S. Malik

Dr. H. B. Joshi

Ph.D. Thesis, Jan., 1991

Chairman

Fraudulent mixing of superior quality meat with inferior one or cheaper non-meat substitutes is a major malpractice which is frequently encountered in the society. Growth of international trade in meat has increased the number of falsifications. Studied the feasibility of differentiating the raw meats of closely related species by counter immunoelectrophoresis (CIE) using commercially available rabbit antisera against serum proteins of these species. It was observed that cross-reactivity between two groups of closely related animals i.e. bovine (bullock and Buffalo) and capricovine (sheep and goat) was eliminated when 1:2 dilutions of anti-bullock and anti-buffalo sera were used. It was interesting to note that cross-reactivity within the bovine group was used against bovine group antigens. But cross-reactivity between sheep and goat, even by using their respective antisera, could not be eliminated at any dilution. Studied the possibility of finding out the levels of adulterant that can be detected in the raw flesh of a particular species by (CIE) using commercially available antisera. The minimum detection limits for homologous antigen in meat mixtures, as determined by CIE, were noticed >5 percent level for bullock (BL), buffalo (BF), goat (G), pig (P) and chicken (c) meat antigens using 1:4 anti-BL and anti-BF sera, and undiluted anti-G, anti-P and anti-C sera, respectively. However, sheep meat as an adulterant could be detected >50% level by using 1:8 anti-S serum. In general, higher the dilution of antiserum, poorer was the resolution of precipitin bands.

Also explored the feasibility of salt fractionation, agarose gel electrophoresis for the identification and characterization of specific-specific thermo-stable muscle antigens (TMAs). In general, specific-specific pattern could not be noticed in all the species studied as whole TMAs and their fractions yielded almost identical patterns. It was concluded that raw bullock meat could be successfully differentiated from buffalo, sheep, goat, pig and chicken meats by using 1:4 dilution of anti-bullock rabbit serum in discontinuous CIE. Moreover, bovine group could be distinguished from rest of the species by using 1:4 dilution of anti-buffalo serum. Depending upon the dilution of antiserum, meat adulteration with that of either bullock, buffalo, goat, pig and chicken 5% level in raw meat mixtures could be detected by CIE. Analysis of band patterns obtained by SDS-PAGE of whole TMAs and their ammonium sulphate precipitated fractions may not prove useful in drawing any inference sufficient for species differentiation of cooked meats.

Present Status of Salvaging Male Buffalo Calves for Meat Production: Field study.

Dr. V. Lakshmanan
Ph.D. Thesis, Sept.-1992

Dr. H. B. Joshi
Chairman

A field study was conducted to assess the current status of care and management of buffalo calves in rural and urban sectors with special reference to male buffalo calves (MBCs), to find out the perception of rural farmers and urban dairy entrepreneurs (UCD) on "rearing MBCs for meat production", to evaluate the meat production characteristics of market slaughter MBCs and to make preliminary studies on markets and marketing of MBCs, buffalo veal and by-products.

In all, 101 rural farmers and 87 dairy entrepreneurs were interviewed as respondents under a structured interview schedule specially designed and developed for the study. Live animal evaluation, slaughter and carcass parameters were recorded on 1712, 256 and 66 MBCs respectively. Market information was gathered by keen observation of trade practices and diligent interaction with traders. Age distribution of BCs was also higher than MBCs (47 vs. 25%). Farmers disposed 31% of their MBCs whereas the annual disposal rate of FBCs was lower at 3%. These data corroborated amply with the existing notion on rearing MBCs in rural areas- "farmers generally regarded MBCs as liabilities and FBCs as assets resulting in poor growth of MBCs and distress sale at young age" Farmers showed an overwhelming response to the idea of salvaging BCs from city dairies for meat production. Dairy entrepreneurs highly agreed with the statement – "birth of MBCs, an economic loss to the statement – "dairy neglect rearing MBCs". Dairy entrepreneurs were highly favourable to the project.

The response of dairy entrepreneurs to participate in the project was encouraging with 80% agreeing to supply calves, Murrah and Murrah type formed 87% of the MBCs slaughtered at Delhi slaughter-house. About 10.9% calves were nondescripts. Average slaughter weight of MBCs was about 84 Kg which was much less than the weight attained when the calves were well fed. In general, yields of all the components increased with increase in live weight group from small to extra large.

In order to achieve increased meat production potential from MBCs, it is necessary to rear MBCs to attain higher slaughter weights than at present by improving nutritional status to achieve better confirmation grade.

Effect of Pre-blending and Vacuum Packaging on the Quality of Ground Buffalo Meat.

J. Sahoo *
Ph.D. Thesis, Oct, 1995

Dr. A. S. R. Anjaneyulu
Chairman

Buffalo meat from aged animal could be profitably utilized by processing into value added comminuted products. Ground meat is molded into products of consumer choice. However, grinding accelerates the shelf life of meat. Hence present study is proposed to minimize the oxidation problems by preblending the ground meat with natural antioxidants for improving the colour and odour stability and shelf life of ground meat products along with vacuum packing during refrigerated and frozen storage.

Ground buffalo meat preblended with 0,300, 400, 500 and 600ppm of sodium ascorbate (SA) and 0,5 , 7.5, and 10 and 12.5ppm of alpha-tocopherol acetate (TA) during refrigerated storage ($4\pm 1^{\circ}\text{C}$) indicated that preblended meat with 500ppm ascorbate and 10ppm tocopherol had significantly higher colour and odour scores; lower metmyoglobin and TBARS number and of extended shelf life from 4 to 8days. The effectiveness of 500ppm ascorbate, 10ppm tocopherol and 0.5% sodium-tripolyphosphate when used alone or in combination to improve the functional properties, to reduce pigment and lipid oxidation of preblended meat were in order of SA+TA+STPP>STPPTA+STPP>SA, showed considerable synergistic effect and extended the acceptability from 4 to 8 days. Metmyoglobin content was highly correlated with TBARS number.

Aerobic and vacuum packed preblended meat with 500ppm ascorbate+ 10ppm tocopherol + 0.5% tripolyphosphate had significantly better quality and extended shelf life from 5 to 15 days under refrigerated storage and 45 to 90 days under frozen storage (-18°C). Buffalo meat nuggets incorporated with above antioxidants, aerobic and vacuum packed had significantly better physico-chemical and organoleptic quality than control aerobic packed products. Quality of nuggets decreased and microbial counts increased with processing period of storage. Treatments not only improved the product yield and quality but also extended the shelf life of nuggets from 10 to 30 days under refrigeration and 30 to 60 days under frozen storage.

*Recipient of Jawaharlal Nehru Award (1986) for outstanding P.G. Agricultural Research.

Detection and Quantitation of some Pesticide Residues in Market Meats

Sarfaraz Ahmed Wani

Dr. B. N. Kowale

Ph.D. Thesis, 1996

Chairman

The study was undertaken to evaluate the general profile of pesticide residues occurring in adipose tissue, meat, liver and kidney of buffaloes, goats and spent hens and to study the effect of cooking on pesticide residues in buffalo, goat and spent hen meats. Modified procedure was developed for extraction and clean up of pesticide residues from animal tissues. Organo chlorine pesticides were detected by thin layer chromatography using bisolvent system and quantitated using spectrophotometric method. Recovery of standards in buffalo muscle ranged between 81-95% for all compounds, except dieldrin which was up-to 6.3%. Forty buffaloes, goats and spent hens were screened for pesticide residues level. Most abundant organochlorine residues were DDT, HCH and their metabolites /isomers. Aldrin was not detected in any sample. Dieldrin was detected in spent hen and buffalo tissues only. Results showed that meat (buffalo and goat) had residue levels well below FAO/WHO maximum permissible residual (MPR) limit. However, spent hen tissue had residue level equal to MPR limits recommended by FAO/WHO. Comparatively, higher contamination of organochlorine pesticides residues were seen in spent hens, followed by buffalo and goat. Among the tissue showed highest concentration of pesticide residues followed by liver, kidney and meat.

Study showed relationship of pesticide residue and lipid content. It was concluded that meat marketed in and around Bareilly (U.P) is quite safe for human consumption from pesticide residue in meats of spent hen, buffalo and goat. There was a significant reduction in the organochlorine pesticides residues of DDT/HCH, their metabolites/isomers and dieldrin with concomitant increase in DDT levels. Residues in low concentrations were readily destroyed than those in higher concentration. Broiling, pressure-cooking and microwave cooking were equally effective in reducing pesticide residue level, however, broiling was more effective than above methods.

Quality Changes in Buffalo Meat to Freeze-Thaw Cycles during Storage

A. R.Sen

Ph.D. Thesis, 1996

Dr. N. Sharma

Chairman

After slaughtering buffalo meats are deboned, frozen in plate freezer and then transported to the docks for export. Studies were conducted to find the physico-chemical, microbial and sensory changes during transportation of buffalo meat and freeze-thaw cycling as well as to establish a method for differentiating fresh and frozen thawed meat. Transportation conditions were simulated in the laboratory by keeping buffalo meat in ice pack, refrigerated temperature and dry ice (solid CO₂) pack. Different parameters studied were pH, TBA, Tyrosine value, count, Coliform, enterobacteriaceae and sensory evaluation (colour and odour). Fresh buffalo meat, chicken, chevon and pork were frozen at -18⁰ C for 7, 15 30, 60 and 90 days. Frozen meat was thawed for 24 hrs at refrigerated temperature (4±1⁰C) and 6 hrs at room temperature (25⁰C) and refrozen.

Salient findings were; Icepack method only suitable for the short route transportation. Refrigerated and dry ice pack storage exhibited better temperature control and can be used for long term transportation without noticeable microbial and sensory changes. The estimation of Acid phosphate is of limited value for detection of frozen-thawed and refrozen meat with the onset of spoilage. To some extent it can be used before spoilage starts. Glutamate oxaloacetate transaminase, lipoamide dehydrogenase can be safely used as marker for detection of fresh and frozen-thawed meat. Meat and liver can be safely used without any health hazards upto fourth freeze-thaw cycles. Vacuum packaging in laminates found to be superior to polyethylene packaging in protecting all the quality parameters of buffalo meat. Drip oozes during repeated freezing and thawing contains high quality nutrients. Structural damages due to repeated freeze-thaw cycles is dependent on the frozen time-temperature and the repetition of cycles.

Studies on Development and Keeping Quality of Pork Pickle

Vijendra Kumar
M. V. Sc. Thesis, Aug.-1987

Dr.V.N.Bachhil
Chairman

Pickling is one of the oldest methods of preservation of meats, fruits and vegetables. In the present study, 3 recipes were tried to standardize the procedure for preparing pork pickle with different levels of salt, vinegar and citric acid. Recipe no. 1 was found to be better than recipe no. 2 and 3 on the basis of sensory evaluation and maturation. Hence recipe no. 1 was taken as standard (control) recipe for further studies.

Standard recipe selected for its highest acceptability and overall superiority in previous trails was further used for assessing the keeping quality, physic-chemical changes sensory properties and microbial incidence. In addition, sodium benzoate (0.1% or 0.2%) and sodium nitrite (200ppm) were also added in control recipe to study the effect of these preservatives in extending the shelf stability and enhancing keeping quality of the product. The recipe containing 200ppm sodium nitrite had highest flavor score of 6.16 on 120th day. The initial total viable counts, halophiles and yeasts and moulds in fresh meats were $5.63 \times 10^5/g$, $3.84 \times 10^4/g$, $7.7 \times 10^3/g$ respectively. Pickling reduced the total viable counts by 99.47%, halophiles by 94.10% and yeasts and moulds by 78.86%. Reduced microbial load, reduced water activity and antimicrobial effect of preservatives helped in enhancing the shelf stability of the product. Sodium nitrite did not yield any extra benefit.

Studies on Rabbit Meat Patties

Altaf Hussain Malik

Dr. R. C. Keshri

M. V. Sc. Thesis, Sept-1988

Chairman

Studies were undertaken to investigate the processing procedure of rabbit meat patties, effect of different binders, levels of vegetable and animal fat and refrigerated storage on physico-chemical, sensory and keeping qualities of rabbit patties besides the carcass characteristics and physico-chemical properties of meat of old New Zealand White rabbits of both sexes.

The mean eviscerated hot carcass weights in male and female of two years old New Zealand White rabbits were 922.3 and 913.5gms respectively. The mean value of dressing percentage in male and female were 55.5 and 54.3 respectively. The mean values of meat and bone yield were 710.0 and 195.0gms respectively in male whereas the corresponding values in female were 691.5 and 199.2gms. The meat bone ratio in male and female were 3.6 and 3.4 respectively.

Procedure for preparation of patties with a schedule of mincing meat once through 8 mm plate once again, added with suitable amounts of salt, spices and condiments and with a cooking schedule of broiling in a preheated oven at temperature between 170-190°C for 20 minutes was standardized. The patties with egg albumen as binder had overall best acceptable sensory scores than the other two treatments. The egg albumen improved cooking yields. The yield (79.2%) and overall sensory scores of rabbit meat patties added with 8% Hydrogenated Vegetable Oil were superior than patties with 10 and 16% HVO and control. The patty yield (81.6%) and sensory scores of rabbit meat patties with 5% added rabbit fat were superior to control and patties with 10%RF.

New Zealand White rabbits of both sexes have good carcass yields and desirable meat characteristics to be used in meat patties. Patties with a very good acceptability and high nutritive value can be prepared from rabbit meat incorporating egg albumen and 5% vegetable fat/ rabbit fat. Further, the broiled meat patties can be safely stored up-to 8th day in refrigerator (4±1°C) without any appreciable loss of acceptability and microbiological quality.

Studies on Effect of Phosphate and Some Technologies on the Quality of Kababs from Different Meats

Mir Salahuddin

Dr.N. Kondaiah

M. V. Sc. Thesis, Nov.-1988

Chairman

With the establishment of fast food chains in India, many of the traditional meat based convenience products like Kababs have been exploited in this direction. Hence, the present work was undertaken in order to study the effect of phosphate on the quality of kababs from sheep, goat chicken and buffalo meat under hot, chilled and frozen conditions of handling. Tetrasodium pyrophosphate (0.5) has a beneficial effect on physic-chemical properties, yield and organoleptic quality of kababs from sheep, goat, chicken and buffalo meat under different conditions of handling. Application of emulsion technology resulted in higher yield of kababs without any detrimental effect on the consumer acceptability as compared to hand mix.

Comparatively better yield and acceptability of kababs was observed on charbroiling than oven roasting. But due to its convenience oven roasting may be more suitable for commercial production of kababs. In view of the preference for broiled type of kababs, oven broiling would prove more beneficial. Chicken fat could be used in combination with goat fat for production of better quality kababs from goat meat. Chicken fat alone could also be used, without much disadvantage, in kabab formulation from goat meat. Extending mutton and chicken resulted in kababs of good quality and acceptability. Chicken kababs proved to be better quality and consumer acceptance than mutton kababs. Incorporation of spent hen meat and by-products in mutton kabab formulation resulted in a product with greater yield and better consumer preference as compared to mutton kababs.

Pre-cooked (charbroiled) kababs from mutton, chicken and combination of two could be stored at $5\pm 1^{\circ}\text{C}$ for a period of 10 days without any appreciable loss of quality and consumer acceptability. Production of chicken kababs from spent hens utilizing the by-products through emulsion technology will benefit the industry and provide a variety to the consumer.

Processing and Preservation of Goshtaba and Rista
(Kashmiri Meat Products)

Asgar Hassan Samoon

Dr.N. Sharma

M. V. Sc. Thesis, Dec.-1988

Chairman

The present investigation was conducted on processing and preservation of Goshtaba and Rista which are popular indigenous meat products of Kashmir. Processing schedules and recipes were standardised for Goshtaba and Rista.

Incorporation of mutton-fat 20% level was found to be optimum for processing of these products. Cooking yields were found to be in the range of 87.67-110.67% and 93.23-113.80% for Goshtaba and Rista balls respectively. Yields of their gravies were in the range of 59.11-70.18% and 51.64-59.03% respectively. In general, the yields were higher in hot-processed, traditionally-minced and phosphate-treated groups in comparison to cold-processed, machine-minced and salt-treated groups of Goshtaba and Rista samples respectively

Addition of sodium tripolyphosphate retarded oxidative rancidity in the treated samples, during refrigerated ($4\pm 1^{\circ}\text{C}$) storage. In general, hot-processed, traditionally-minced and phosphate-treated samples of Goshtaba and Rista were more acceptable as compared to cold-processed, machine-minced and products treated with salt alone. The organoleptic acceptability of fresh products was within moderately to highly acceptable range but it decreased due to onset of oxidative rancidity, limiting the shelf-life to 7 days for Goshtaba and Rista samples, during refrigerated storage

Studies on Incorporation of Whole Egg Liquid in Mutton and Mutton+ Chicken Combination Meat Sausages.

Mukesh Gupta

Dr.N. Kondaiah

M. V. Sc. Thesis, Aug.-1990

Chairman

Combination meats for production of sausages may complement one another and results in a product of higher acceptability. Hard fats such as mutton fat was reported to pose dispersion problem in emulsion products and results in unacceptable mouth-coating. Eggs were reported to have unique functional properties and high nutritive value. The objective of present study was to incorporate whole egg liquid (WEL) in mutton and mutton + chicken combination meat sausages and study keeping quality of WEL incorporated sausages under refrigerated storage.

Mutton was obtained from spent ewes and chicken from White Leghorn spent hens. In experiment 1, WEL was incorporated at 0, 15, 20 and 25% levels in mutton sausages replacing the lean meat in experiment 2, WEL levels as that of experiment 1 were used in mutton + chicken in 50:50 proportion. Chicken included deboned meat and by products in natural proportion. In experiment 3, keeping quality of sausages containing mutton+0% WEL, mutton+20%WEL, mutton+ chicken +0% WEL, mutton + chicken 20% WEL was evaluated at 5⁰C. The formulations with WEL were selected from experiment 1 and 2 based on their preference. Formulations with 0% WEL served as control for comparison.

A significant decrease in shear-force value was observed with increasing level of WEL due to the soft texture contributed by egg incorporation and also due to the decreased lean meat content and higher cooking yield Mutton + chicken sausages containing WEL were rated significantly higher for sensory scores compared to control. When mutton and mutton + chicken sausages incorporated with 20% WEL were compared with their corresponding controls (Experiment 3), incorporation of WEL significantly improved ES and resulted in increased cooking yield.

In general, significantly higher sensory scores were observed in WEL incorporated formulations. Mutton + chicken combination meat sausages received higher scores than their corresponding mutton sausages. Overall palatability scores were good in all the formulations throughout storage period suggesting a keeping quality of 10 days at 5⁰C.

Effect of Method of Buffalo fat incorporation on the Quality of Buffalo Meat Patties

Prasad Kumar Patti
M. V. Sc. Thesis, Oct-1990

Dr. A. S. R. Anjaneyulu
Chairman

Incorporation of buffalo fat in the product formulations caused mouth coating and/or after taste problems thus lowering the palatability of processed buffalo meat products. Mouth coating significantly reduces the acceptability of the products. The present study was conducted to overcome the above problems of products containing buffalo fat so as to increase their palatability.

The patties made with chilled buffalo fat had significantly lesser mouth coating and higher overall acceptability compared to the patties prepared with frozen buffalo fat. Addition of fat premix instead of fat to the formulation significantly improved the overall acceptability of the patties. Incorporation of fat premix with different levels of whole egg liquid (WEL) to the formulation had significantly lowered the mouth coating and increased the palatability of the products. The patties containing equal proportion of meat, fat and WEL was found to be better for reducing mouth coating and improving overall acceptability than other fat premixes.

Incorporation of WEL is desirable as functional agent in the formulation containing buffalo fat to achieve higher acceptability of the product. The precooked patties packaged in low density polyethylene bags were well acceptable at (4-7⁰C) for 15 days. This study clearly indicated that problem of mouth-coating contributed by highly saturated animal fats to the products would be significantly reduced by incorporation of fat premix in place of fat for its better dispersion and emulsification which results in significantly increased acceptability and palatability of the products.

Studies on Processing of Fermented Sausages

Rana Mukhopadhyay

Dr.N. Sharma

M. V. Sc. Thesis, July-1991

Chairman

Fermented meat products especially dry and semidry sausages are excellent shelf-stable products with unique flavor and taste characteristics. Low pH and the presence of lactic acid bacteria prevent the products from microbial spoilage. So, the present study was undertaken to find out how far the dairy starter strains are effective as starter culture for processing of fermented pork sausages. For this study three strains of bacteria, namely Lactobacillus acidophilus, Lactobacillus plantarum and Streptococcus Lactis and their suitable combinations were used. Pork and its fat had been chosen as basic raw material.

Standardization process was conducted using only Lactobacillus plantarum as it is the widely used starter culture for meat fermentation. Results of the pH of the end product and the sensory scores were found satisfactory when the recipe contained 1% dextrose and starter concentration of 10^8 micro-organism per gram of meat mixture. For the experiment the new recipe was followed where 1% dextrose was used and all the starter strains and their combinations were added to the recipe at a concentration of approximately $1-2 \times 10^8$ micro-organisms per gram mixed batter.

General appearance, texture, sourness and overall acceptability were significantly affected by the type of starter culture. The mixed cultures of L. acidophilus + L. plantarum + S. Lactis, had been found to be the best starter culture for the processing of fermented sausage. L. acidophilus alone or mixed with S. Lactis could also produce acceptable sausage and could be used as starter culture for fermented sausage production.

Studies on Incorporation of Texturized Soy Proteins and Proteins and Fat levels on the Quality of Mutton Patties.

Jayantha Chowdhary

Dr.Sushil Kumar

M. V. Sc. Thesis, Oct.-1992

Chairman

Production of meat patty-like comminuted meat products from sheep meat has immense scope. However, the ever rising cost of mutton and meat products has necessitated the introduction of nutritious but cheap extender like soy proteins in meat products. Hence the present study was undertaken to evaluate the effect of texturized soy proteins (TSP) and fat levels on the quality of mutton patties during refrigerated storage.

Patties were prepared incorporating TSP (at 0, 10, 20, and 30% levels) and fat (at 5, 10 and 15% levels) and were evaluated for their physico-chemical and sensory quality. Keeping quality of mutton patties containing mutton +0% TSP and mutton + 10% TSP was evaluated at $4\pm 1^{\circ}\text{C}$. Different parameters considered were cooking yield, shrinkage in diameter, gain in height, emulsion stability, shear force values, pH of raw patties and sensory attributes. Keeping quality of mutton patties during refrigeration storage was evaluated on the basis of TPC, TBA value, pH and sensory attributes of cooked patties. The cooking yield increased significantly ($P<0.01$) up-to 20% TSP level, but it decreased significantly ($P<0.01$) at 30% TSP level. Whereas it increased significantly ($P<0.01$) with the increase in fat levels up-to 15%.

The mutton patties of good physico-chemical quality and overall acceptability could be prepared using TSP and fat (HVO) at a level of 10%. Patties were equally acceptable for control and 10% TSP. All patties were moderately desirable up-to 20% level and slightly desirable at 30% TSP level. The keeping quality of mutton patties containing 10% TSP was comparable to those of all mutton patties during refrigeration storage and could be stored up-to 15 days at $4\pm 1^{\circ}\text{C}$ with acceptable overall quality.

Studies on Processing of Cured and Smoked Buffalo Meat Chunks.

Mathew Thomas

Dr. A. S. R. Anjaneyulu

M. V. Sc. Thesis, Aug.-1992

Chairman

The objective was to evolve the technical knowhow that will facilitate production of well acceptable, attractive, ready-to-eat, convenience cured and smoked meat products from the buffalo meat available in the Indian market. Studies on different levels of nitrite indicated that the control product (0ppm nitrite) was unattractive and less acceptable. 150ppm ingoing nitrite level could ensure a well acceptable, attractive product. Various physic- chemical parameters also indicated that 150ppm sodium nitrite in curing brine would ensure a good quality product. 200ppm sodium nitrite added advantage and at the same time 100ppm level was insufficient for a better acceptability.

In the present study 0.5% sodium tripoyphosphate addition markedly improved (3.8%) the cooked yield as well as sensory characters. This amply demonstrate the beneficial effects of phosphate to improve the quality of cured smoked buffalo meat by smouldering hard wood saw dust drastically improved the colour, flavor and overall acceptability compared to cured product. Curing buffalo meat in the pre-chill (hot) condition was found to have improved the cooked yield than post-chill cured meat. Both were equally well acceptable for various sensory traits

The cured and smoked buffalo meat chunks were stable and acceptable up-to 20 days of refrigerated storage. Smoked product was well acceptable on 20th day also. Throughout the storage period, the sensory traits were better in order of smoked, cured and control products. The product could successfully be launched as a new addition to cater the needs of fast growing meat-based food industry.

Studies on the Quality of Mutton Sausages and Rabbit meat + Mutton combination Sausages.

Sanjeev Kumar Roy

Dr. Sushil Kumar

M. V. Sc. Thesis, Aug.-1994

Chairman

Rabbit is emerging as a potential source for augmenting meat production in our country. Development of processed meat products solely based on rabbit meat or in association with conventional meat such as mutton and their sensory evaluation may facilitate in enhancing consumption of rabbit meat by acquainting with its palatability characteristics. Sausages are one of the highly popular processed convenience meat products.

The objectives of the present study were to investigate the effects of incorporation of rabbit meat and phosphates at different levels on the quality of mutton sausages and to assess the keeping quality of all mutton sausages and rabbit meat + mutton combination (50:50) sausages treated with tetra sodium pyrophosphates packed in LDPE bags with and without Vacuum, Under refrigerated storage. Rabbit meat incorporation had significantly increased cooking yield of mutton sausages as a consequence of significant improvement in emulsion stability with increasing level of rabbit meat incorporation as compared to control.

Sensory scores for texture and overall palatability were significantly higher for combination meat sausages containing 50% rabbit meat. Though there was decrease in appearance, flavour and juiciness scores it did not seem to affect the overall palatability of these sausages. pH values of all mutton sausages increased significantly from 0 day (6.491) to 14th day (6.633) of refrigerated storage. The values for combination meat sausages were 6.556 on 0 day and 6.701 on 14th day of storage. Vacuum packaging significantly slowed down pH changes during storage at 4±1°C.

Mutton sausages of better quality and acceptability could be produced incorporating rabbit meat at 50% level. Addition of TSPP at 0.4% level improved the functional and sensory quality of sausages solely based on mutton as well as rabbit meat + mutton combination (50:50) sausages. Non-vacuum LDPE packed all mutton and combination meat (50:50) sausages could be safely stored up-to 14 days at 4±1°C with good acceptability. Application of vacuum packaging the improved the keeping quality of both type of sausages and were of better quality than non-vacuum packed sausages.

Effect of Whey-Protein Concentrates, Sodium Caseinate and Skim Milk Powder on the Quality of Buffalo Meat Smoked Sausages.

P. Deenathayalan

Dr. P. L. Yadav

M. V. Sc. Thesis, Aug.-1997

Chairman

Buffalo meat from aged animals could be profitably utilized by processing in comm.-united meat products by incorporating non-meat proteins to improve yield and functional properties. Among non-meat proteins, milk proteins such as whey protein concentrates (WPC), sodium caseinate (SC) and skim milk powder (SMP) are being used widely by the processed meat industry in beef and chicken products. Hence, the present study is proposed to utilize these milk proteins in the formulations of buffalo meat sausages and studied their possible beneficial effect on yield, physico-chemical properties and shelf-life of vacuum packed products during refrigerated storage.

Buffalo meat sausages prepared with 0, 1, 2, 3 and 4% of WPC indicated that at 1% level, the products were significantly rated better for appearance and colour, flavor and juiciness, with a marginal increase in the moisture content and yield of the products. Studies under SEM revealed that up-to 2% WPC level the product's structure was improved. On comparison, WPC incorporated smoked sausages had higher yield and improved sensory attributes than that of SC and SMP added products. Incorporation of WPC, SC and SMP in the product formulations did not significantly affect emulsion stability, shear force value and protein content.

Vacuum packed smoked sausages during refrigerated storage at $4\pm 1^{\circ}\text{C}$ had significantly increased the pH, total plate count, psychrotrophic count and tyrosine values without any significant difference among treatments. Residual nitrite level was decreasing and total acidity was increasing significantly during the storage period. No difference was observed in TBARS number between treatments. However, sausages with WPC had slightly lower TBARS number. SMP incorporated sausages had higher psychrotrophic counts than others. No coliform counts and a few yeast and mould counts were noticed. Sensory attributes were significantly decreasing as the storage period, increased. Acceptability of sausages for WPC, Control, SC and SMP added products were 30, 25 and 20 days respectively. The ranking of acceptability was $\text{WPC} > \text{SC} > \text{SMP}$. Utilization of milk proteins, in particular WPC, a by-product of dairy industry in meat products will be beneficial to both the industries.

Effect of Tumbling on the Quality of Restructured Buffalo Meat Blocks

Rama Krishna Keerthi
M. V. Sc. Thesis, April-1998

Dr.N. Sharma
Chairman

Abundant quantity of buffalo meat is available at economical price from the spent animals, which is fairly coarse and tough. Appropriate processing technologies need to be evolved to improve its functional properties and product acceptability. Hence the present study was proposed to standardize and utilize tumbling technique in the production of restructured buffalo meat blocks and also evaluated its possible beneficial effects on yield, physico-chemical properties and shelf-life of tumbling treated products during refrigerated storage.

Restructured buffalo meat blocks prepared from 12, 15 and 18 hrs intermittent tumbling under non-vacuum and vacuum conditions and non-tumbled as control indicated that 18 hr vacuum tumbled restructured meat blocks were better for physico-chemical characteristics, product yield, binding and cohesiveness, colour and appearance, flavor and juiciness, texture and overall acceptability. Studies under SEM revealed that 18 hr tumbling either non-vacuum or vacuum enhanced SSP extraction and improved the textural characteristics of the products. Vacuum tumbled and non-tumbled meat blocks. Tumbling process also significantly enhanced the SSP extraction, product yield, binding and cohesiveness and sensory attributes of the restructured meat products made from trimmings and low value cuts.

During refrigeration at $4\pm 1^{\circ}\text{C}$ significant increase in the pH, aerobic plate count and TBARS numbers were observed with significant difference among treatments and control. Treated meat slices had improved microbial quality. Psychrophiles were detectable only after 25 days of storage. TBARS numbers increased up-to 15 days and 20 days for tumbled and non-tumbled meat slices respectively and were decreased gradually during the remaining storage period. Sensory attributes were significantly decreased as the storage period increased. Acceptability of the tumbling treated and non-tumbled slices were 30 and 15 days respectively. The ranking of acceptability was vacuum-tumbled > non-vacuum-tumbled > non-tumbled. Application of tumbling process in particular under vacuum condition for the production of restructured meat products in the meat industry will be most beneficial.

Studies on Preparation of Restructured pork Rolls using Salt, Phosphate and Alginate calcium gels.

Devatkal Suresh K.

M. V. Sc. Thesis, June-2000

Dr.S. K. Mendiratta

Chairman

Restructuring technology enables to produce value added pork products from low value cuts and trimmings. Traditional restructured meat products are based on thermal set binding of myofibrillar proteins that are extracted by use of salt and STPP. An alginate-calcium binding system has been developed to overcome the disadvantages of using salt and STPP in restructured meat products. Recent investigations have also shown potential use of calcium lactate in alginate-calcium restructured meat products. This study was carried out to develop a method for preparation of restructured pork rolls (RPR) using salt-phosphate and alginate-calcium binding systems and to evaluate the shelf life of restructured pork rolls.

Restructured pork rolls were prepared by mixing low value cuts and trimmings of pork with different ingredients in a Hobart paddle type mixer. The mixed meat was manually stuffed into weasands, equilibrated at $4\pm 1^{\circ}\text{C}$ for 12 hrs and then frozen ($-10\pm 2^{\circ}\text{C}$) for 24 hrs, thawed and cooked in a hot air oven up-to an internal temperature of 85°C . Five types of RPR were prepared with 1.75% salt + 0.3% STPP (SP), with 1.75% salt + 0.3% STPP (SP) + 0.3% lactate (SPL), 0.7% alginate + 0.125% carbonate (AC), 0.7% alginate + 0.3% lactate (AL) and 0.7% alginate + 0.125% carbonate + 0.3% lactate (ACL).

Product yield, cooked binding strength and textural properties were better in salt and phosphate than alginate treated pork rolls, however, raw binding was better in alginate containing pork rolls. The pH, TBARS numbers, metmyoglobin and microbial counts increased significantly ($P < 0.05$) whereas ERV, redness and sensory scores of all products decreased significantly ($P < 0.05$) with increasing storage period. Results of microbial and sensory qualities revealed that all types of rolls can be stored for more than 21 days (cooked rolls) at refrigerated temperature ($4\pm 1^{\circ}\text{C}$). Addition of 0.3% calcium lactate improved binding, textural properties and shelf life RPR.

From the results of study, it can be suggested that when the RPR are to be marketed in raw or refrigerated condition, combination of 0.7% alginate + 0.125% carbonate + 0.3% lactate should be preferred, while when the products are to be marketed in cooked or frozen state, combination of 1.75% salt + 0.3% phosphate + 0.3% phosphate + 0.3% lactate should be used. In this way, low value pork cuts and trimmings can be effectively converted into value added restructured pork rolls.

Development of Buffalo Meat Sausages Incorporating Offal Meat

K. R. Krishnan *

Ph.D. Thesis, April, 1988

Dr. N. Sharma

Chairman

A systematic study was carried out to assess the physic-chemical and functional properties of skeletal meat (SM) and offal meat (rumen meat-RM and heart meat-HM) of buffaloes with a view to develop good quality emulsion-type sausages at cheaper costs.

The SM, RM and HM were significantly different ($P < 0.01$) for all the quality parameters. The lowest cooking losses were observed in 15% oil containing emulsion (10.73%) and sausages (9.93%). The sausages containing 15% oil had highest scores for all the sensory qualities and were adjudged the best under the emulsion-type sausages. The sausages containing 20% pork fat were considered the best. The overall acceptability scores also indicated that the 15% buffalo fat treatment was the best among the coarse-ground-type sausages.

It is inferred that (i) good quality, well acceptable, cheap and ready-to-eat emulsion-type sausages utilizing buffalo skeletal meat and offal meat along with 15% refined groundnut oil or 20% pork fat, and (ii) good quality coarse-ground-type sausages of acceptable nature utilizing skeletal meat with 15% buffalo kidney fat could be developed. The sausages could safely be stored at refrigeration temperature for 7 days and at frozen temperature for 8 weeks when properly packed in polyethylene bags.

*Recipient of Jawaharlal Nehru Award (1989) for outstanding Post-graduate Agricultural Research was presented.

Effect of Preblending Hot and Chilled Pork on the Processing and Storage Quality of Sausages

B. D. Sharma

Ph.D. Thesis, May, 1989

Dr. V. N. Bachhil

Chairman

Preblending is being advocated along with hot boning to harvest maximum processing advantages, especially in comminuted meat products. Hence, this study was proposed to exploit the potential of hot boning and preblending technologies for manufacturing pork sausages from indigenous pigs. Minced pork, derived from hot as well as chilled boning, was subjected to preblending with salt alone and salt plus antioxidant (BHT + citric acid and salt + nitrite). The effects of storing the preblends at 2⁰C for 0,7 and 14 days, on the physic-chemical, microbiological and processing qualities were studied. Sausages were prepared at these storage intervals. Sensory, microbiological and physic-chemical properties of precooked sausages at 0 day and under frozen storage at -1±0⁰C for 30, 60 and 90 days were monitored. Salient findings are summarized below.

The pH, WHC, SSP and EC of hot pork were significantly ($p < 0.05$) higher as compared to chilled pork. Preblending with salt significantly ($p < 0.05$) improved the WHC, SSP extraction EC of both hot and chilled pork as compared to unsalted control. The TBA values of hot and chilled pork preblends with antioxidant or nitrite were far below the threshold value of 1.0. Preblending of pork with salt alone reduced of total aerobic count and psychrophilic count significantly ($P < 0.05$) as compared to control. However, further addition of antioxidant or nitrite did not significantly reduce the counts any more. Preblending treatment of hot and chilled pork with salt significantly improved emulsion stability (decrease in loss) and cooking yield of sausages. All sensory attributes of sausages prepared from hot preblended and 14 days stored pork were found to be significantly ($P < 0.05$) better as compared to those from chilled preblends. Preblending with salt plus nitrite significantly decreased the psychrophilic counts, whereas all preblending treatments had significantly decreasing effect on the coliform counts of sausages. The oxidative rancidity levels of sausages were significantly lower for treatments having antioxidant or nitrite.

Studies on Processing and Quality Evaluation of Fermented Mutton Sausages.

Mir Salahuddin
Ph.D. Thesis, Sept.-1992

Dr. N. Sharma
Chairman

The study was conducted on production of fermented mutton sausages through use of LAB as a natural preservative, to develop ready-to-eat meat products. Pure cultures of *Lactobacillus plantarum* and *Pediococcus cerevisiae* were used as a mixed starter culture in the sausage formulation typically containing ground mutton (90parts) and mutton fat (10parts) and other ingredients viz. salt (0.5%). Three main stages of standardized processing schedule included raw sausage preparation fermentation ($30\pm 2^{\circ}\text{C}$, $90\pm 5\%$ RH, 16 hr) and drying ($10-12^{\circ}\text{C}$, $70\pm 5\%$ RH, 8 days) under controlled conditions.

A quickly ripened low salt low nitrite fermented mutton sausage of good physico-chemical quality, microbial safety and stability and, overall acceptability could be produced. Except for the pH decline and growth of lactic acid bacteria during fermentation, the major changes leading to the typical quality and microbial stability of sausages occurred during the process of drying. Mutton fat, at 10 to 20% level, could be used in the formulation of the sausages without any adverse effect on the sensory quality. However, from the point of view of physico-chemical quality, 10-15% fat would be ideal.

The sausages of fairly good quality could be prepared through the traditional process as well as through starter culture. However, in view of the comparatively shorter processing schedule, better process control and higher acceptability of the sausages in the latter, the starter culture mediated method would be preferable. Textured soy protein at 10% level could be incorporated in the sausages. Beyond 10% level, the sausage quality detracted from the control even though there was no adverse effect on overall acceptability.

The fermented mutton sausages prepared under this study were shelf stable. When packed in low density polypropylene, the sausages could store for 28 days at $27\pm 2^{\circ}\text{C}$ and up-to 105 days at $5\pm 1^{\circ}\text{C}$ without any appreciable loss of quality and acceptability.

Application of Hurdle Technology in the Development of Shelf Stable Buffalo Meat Products

Altaf Hussain Malik
Ph.D. Thesis, Sept-1999

Dr. B. D. Sharma
Chairman

With the growing importance of buffalo meat in India, Various techniques are being attempted to preserve it with refrigeration. This study was taken up to utilize hurdle technology for the development of ready-to-cook and ready-to-eat shelf stable buffalo meat products.

Shelf stable buffalo meat chunks could be prepared by desorbing meat chunks in an infusion solution containing 6% glycerol, 6% sodium chloride and 1%propylene glycol coupled with 0.2% sorbic acid and 100ppm sodium nitrite for 24hrs after pasteurization at 80C for 2.5hr. This treatment could produce a hurdle effect enough to give a product with $\sim 0.91 a_w$ and $\sim 52\%$ moisture. Pressure cooking of these chunks after dehydration for 2 hr in potable water gave a cooked product comparable to fresh cooked meat in sensory attributes. The vacuum packaged product could be successfully stored for 6 weeks at ambient temperature ($30\pm 3^\circ\text{C}$) without any loss of physic-chemical, microbiological and sensory quality. The stored product could also be utilized for the preparation of coarse ground patties using egg and maida as binders with some compromise on texture.

Shelf stable ready-to-eat spiced buffalo meat product could also be prepared by desorbing meat cutlets in an infusion solution containing 3.5% glycerol, 5% sodium chloride and 2% honey coupled with 2.2% mango powder, 1%spices, 0.2% sorbic acid 0.2% phosphate and 150ppm sodium nitrite adjusting pH with 0.1% acetic acid, pressure cooking for 20 minutes followed by frying for 2 minutes in mustard oil and mixing with prefried condiments and spices. The product had very good juiciness, tenderness, desired tanginess and saltiness. It could be stored for 7 weeks in PET jars and nylon barrier film under vacuum without any loss of quality.

Thermal Processing of Shelf Stable Buffalo Meat Blocks In Report Pouches

I. Prince Devadason
Ph.D. Thesis, Aug-2000

A.S.R. Anjaneyulu
Chairman

Buffalo meat contributes 36% of the total red meat produced in our country. Abundant quantity of available low buffalo meat needs to be processed into value cost added convenience meat products of better acceptability for higher returns. Comminuted meat products like sausages, patties, blocks, nugget etc have major constraints in the distribution and marketing, being highly perishable. Thermal processing paved the way for developing shelf stable food products at ambient temperature. Hence the objective of the study was to develop buffalo meat block in retort pouches, stable at room temperature for a considerable period of time.

The thermal death time was determined based on the heat resistance of *C. sporogenes* PA 3679 in PBS and buffalo meat emulsion and the Z-value was determined as 12.30^o C and 11.4^oC respectively. The F value was determined based on the heat resistance of *C. sporogenes* PA.3679 as 6.75 min. Buffalo meat emulsion filled in 3 ply retortable pouches were vacuum sealed and were processed using stock sterilizer, for a targeted F value of 12.13 min (9D of PA.36.79) to provide built in safety to the product. The process time was calculated as 41 min with 8 min come up time, 20 min heating time and 13 min cooling time. The inoculated pack study revealed that the thermal process used was microbiologically safe up-to a period of 135 days.

Quality of the buffalo meat blocks were optimized using four different binders namely cornstarch, wheat flour, tapioca starch, and wheat semolina. The blocks processed using corn starch as binder showed higher emulsion stability, product yield, lower drip loss and frying loss, optimum texture profiles as indicated by instron readings and also significantly greater sensory attributes compared to other binders. The micro structure of buffalo meat blocks containing corn starch also showed dense protein matrix, with uniform size fat globules and less number of vacuoles.

The shelf life of buffalo meat blocks using corn starch, as binder processed to a target F=12.13 min was evaluated at controlled temperature (30±1°C) at 15 days interval for 135 days. The pH, shear force value and residual nitrite content decreased and TBARS numbers, tyrosine value and free amino acids content increased simultaneously as storage period increased. The sensory scores have indicated the well acceptability of product up-to a period of 90 days. This study indicated the buffalo meat blocks processed to a F value of 12.13 min are found to be well acceptable up-to 90 days of storage at (30±1°C) based on the evaluation of physical, chemical, microbiological, textural and sensory characteristics.

Studies on Development of Enrobed Buffalo Cutlets

Eyas Ahmed M

M. V. Sc. Thesis, June-2001

Dr. A. S. R. Anjaneyulu

Chairman

Food industries are shifting their attention towards the development of convenient food-products to cater the needs of consumers due to changing socio-economic conditions. Abundantly available buffalo meat can be used for production of value added convenient products. Cutlets, a potential convenient meat product has the problem of crumbly texture and which loose their shape on packaging. Further enrobing of the meat products is a method of value addition, which enhances their acceptability. The objectives of the proposed study were to standardize the product formulation and processing conditions; to improve the texture of the enrobed buffalo meat cutlets using various binders and to determine the storage stability and the shelf life of developed cutlets with and without enrobing under refrigeration and frozen storage.

Incorporation of meat emulsion as a binder significantly improved moisture content and sensory attributes of cutlets. Addition of emulsion at 20% level was better over the 15% and 25% level in terms of sensory attributes than that of control, while 2% level incorporation has similar scores of cutlets. Refined wheat flour (maida) was found better as the binder at 3.5% level, followed by cornflour, potato starch and tapioca flour. Cutlets with maida and cornflour had higher protein and fat content. However, product yield was higher for corn flour containing cutlets. Further enrobing of the cutlets significantly reduced the shrinkage and had attained a higher core temperature on deep fat frying. All the sensory attributes were significantly improved by enrobing. Significant lowering of pH on the 10th day and marked rise in TBA value on 15th day were noticed in both enrobed and uncoated cutlets. TBARS number and mesophilic count were higher for control samples than that of enrobed. Tyrosine value significantly increased up-to 10th day in both samples. Sensory attributes were better for enrobed cutlets throughout the storage period. Enrobed cutlets were acceptable up-to 15 days, while control cutlets were acceptable up-to 10th day.

A rise in TBA value up-to 45 days and a sharp decline was observed thereafter under frozen storage. No significant variation was observed in pH and tyrosine value during storage. Mesophilic count was increased up-to 45th day and then declined, but not below the initial load in both samples. Enrobed cutlets had better microbiological quality compared to control. All the sensory scores reduced significantly and gradually with increasing days of storage which significantly varied between 0 and 15th day and between 60th and 70th day. Control cutlets were acceptable up-to 60 days and slightly acceptable up-to 90 days while enrobed cutlets were well acceptable up-to 90 days. Thus enrobing had markedly enhanced the sensory attributes and storage stability of cutlets.

Development of Low Fat Buffalo Meat Sausages Using Performed Gel of Hydrocolloid and Whey Protein Concentrates.

Sathu, T.

Dr. A. S. R. Anjaneyulu

M. V. Sc. Thesis, June, 2001

Chairman

Buffalo meat could be effectively utilized in producing low-fat products by incorporating fat replacers. Among fat replacers, whey protein concentrates and hydrocolloids are being extensively used by the processed meat industry. Hence, the present study processed to optimize the level of fat replacers and added fat in the formulations of low fat buffalo meat sausages and to evaluate their physic-chemical properties and shelf life of aerobically packed products during refrigerated storage. Among the 20 combinations of performed gel and added fat evaluated, low fat (<6%) sausages formulation with performed gel of hydrocolloid (0.9%) and WPC (6%) and added fat 5% was found comparable with that of control sausages with respect to physic-chemical properties and sensory attributes.

Low fat sausages processed at a core temperature of 85⁰C had better colour and appearance, flavor, juiciness, texture and overall palatability than the products processed at core temperature of 75 and 80⁰C. Low fat sausages had lower TBA values and higher scores for sensory attributes than the control sausages throughout the refrigerated storage at 4±1⁰C. There was no significant difference between the low fat and control buffalo meat sausages in mesophilic counts during the refrigerated storage. Lactobacillus count was found only in low fat sausages.

TBA values were markedly less in low fat buffalo meat sausages in comparison with control sausages during the storage period. Low fat sausages were well acceptable even on 20th day of refrigerated storage whereas the control sausages were palatable only up-to 15th day of refrigerated storage (4±1⁰C).

Effect of Grind Size and Fat Levels on the Quality of Low-fat Ground Buffalo Meat Patties.

Suman S.P.

M. V. Sc. Thesis, June- 2001

Dr.B. D. Sharma

Chairman

In view of increasing importance of buffalo meat and low-fat meat products, the present study was proposed to optimize the processing conditions and formulations for low-fat ground buffalo meat patties to evaluate the effect of grind size, different low-fat levels and to assess the shelf life of these low fat ground buffalo meat patties in aerobic as well as vacuum packaging during refrigerated storage ($4\pm 1^{\circ}\text{C}$).

Cooking of low-fat ground buffalo meat patties at an internal temperature of 75°C resulted in higher sensory scores. Added water at 12% level was found to be optimum for low-fat ground buffalo meat patties with respect to cooking yield and sensory scores. A combination of hydrocolloid fat substitutes, sodium alginate and carrageenan at 0.1% and 0.75% levels respectively, significantly increased most of the sensory attributes of low-fat ground buffalo meat patties. Preparation of low-fat ground buffalo meat patties using 3 mm grind size, rather than 4 and 6 mm, significantly increased flavor, juiciness, texture and overall acceptability. However, an increase in the grind size significantly increased shear force values. Low-fat ground buffalo meat patties at 10% fat level were rated significantly higher in flavor, juiciness, texture and overall acceptability as compared to low-fat ground buffalo meat patties containing 8 and 6% fat level as well as control. The physico-chemical properties, microbiological quality and sensory attributes during the refrigerated storage studies ($4\pm 1^{\circ}\text{C}$) indicated that they were acceptable, without any incipient spoilage up-to 15 days in aerobic packaging and 42 days in vacuum packaging.

Buffalo meat could be well utilized for the production of low-fat ground patties using suitable combination of added water, sodium alginate, carrageenan, grind size and fat level, without compromising the sensory attributes. Thus, it would reduce the incidence of health hazards related with high fat consumption.

Efficacy of Different Fat Replacers on Processing Quality and Storage Stability of Low-fat Pork Patties.

Manish Kumar Chatli
Ph.D. Thesis, July-2001

Dr. B. D. Sharma
Chairman

In view of the growing need of low-fat meat products, consumers interest and economic importance of pork, present study was envisaged to optimize the processing conditions and to assess the efficacy of various fat replacers for the production of low-fat ground pork patties. Storage stability of such product was also evaluated in aerobic as well as vacuum packaging refrigeration temperature.

The optimum levels of added fat, added water, particle size and internal cooking time-temperature combination for the preparation of low-fat ground pork patties was standardized as 4 percent, 15 percent, 3 mm and 75°C for min, respectively. The optimum levels of carrageenan and sodium alginate as a fat replacer were standardized as 0.5 and 0.1 percent respectively whereas combination of carrageenan and sodium alginate was standardized as 0.75 plus 0.1 percent. Of these, 0.5 percent carrageenan was found to be the best. The optimum level of potato starch and barley flour, separately as well as in combination was standardized as 5,4 and 7.4 percent potato starch plus 4 percent barely flour was found to be best for the preparation of low-fat ground pork patties. The optimum level for both 1:3 and 1:4 hydrated TSP was standardized as 4% of these 4 percent 1:3 hydrated TSP has better cooking yield, dimensional parameters and marginally higher sensory scores.

Lipid profile revealed that total lipids, cholesterol, phospholipids, glycolipids and fatty acids were reduced by 40-50% in low-fat ground pork patties than high-fat control. The calorific value among treated groups was highest in potato starch followed by TSP carrageenan. Instrumental texture profile analysis of product placed carrageenan on top followed by TSP and potato starch in that order. Scanning electron microscopic studies revealed a gel like matrix and interwoven protein fiber matrix in products incorporated with carrageenan and TSP respectively. Mineral profile showed high variability amongst the groups. The low-fat ground pork patties with selected fat replacers could be stored under aerobic packaging safely for 21 days and under vacuum packaging for 35 days at refrigeration temperature without any significant effect on physico-chemical, microbiological and sensory qualities.

The optimum levels of milk proteins as fat replacers were standardized the milk proteins as fat replacers were standardized the milk co-precipitate as 7% ,sodium caseinate 2% and a combination of milk co-precipitate and sodium caseinate as 7 and 2 per cent respectively. Of these, sensory acceptability of 2 percent sodium caseinate was found to be best for the preparation of low-fat ground pork patties. The cost of production of low-fat product was worked out to be Rs. 61.48/ kg with 0.5% carrageenan, Rs. 58.65/Kg with 5% potato starch, Rs.51.95/Kg with 4% TSP and Rs. 56.31/Kg with 2 percent sodium caseinate.

Nutritional Evaluation of Chicken Nuggets Containing Byproducts and Extenders.

A. Konda Reddy
M. V. Sc. Thesis, Feb.-1993

Dr.N. Kondaiah
Chairman

Development of further processed convenience products was considered as a potential solution for disposal of spent hens, wherein not only the tough meat is minced, but other additional ingredients can be added which will improve their palatability . Byproducts like skin; gizzard and hearts from spent hens were incorporated in further processed products both for better utilization and reduce cost of the products.

White leghorn spent hens were used for the studies. Different chicken nugget formulations i.e. prime containing deboned meat and byproducts, economy containing deboned meat, byproducts and extenders, were prepared and compared for their yield and quality and acceptability. Emulsion stability, cooking yield, shear force value, composition of raw emulsions and nuggets and acceptability of nuggets were studied. Cost of different formulations (Rs. /Kg.) based on the cost of ingredients were calculated and compared. Nutritional quality of the three formulations viz. prime, choice, economy prepared in the experiment, were assessed and compared by rat growth studies.

The PER of prime (2.91), choice (2.95), and economy nugget might be due to more balanced amino acid composition and the complimentary and supplementary value of eggs and soya. Net protein utilization of prime, choice and economy did not differ significantly. Economy type had relatively higher NPU followed by prime and choice types. Relative growth rates revealed that, the growth rates of rats on different chicken nugget diets did not differ significantly. Gradual increase in growth rate was observed for different chicken nuggets from beginning day to different weeks of the experiments. A 20% level of byproducts (i.e. skin, gizzards and hearts) in their natural proportions could be considered as optimum in chicken nuggets formulation containing extenders at 20% level. By products level could also be increased up-to 30% level in the formulation without seriously affecting the quality of chicken nuggets of acceptable quality, taste and relatively lower in cost, could be prepared using deboned meat, byproducts and extenders. The cost of the products could be reduced considerably by incorporating byproducts from spent hens for chicken nugget production. Nutritionally good quality products could be prepared using deboned meat, byproduct and extenders in chicken nuggets formulations which will increase the marketability of such products.

Effect of Cooking Methods on the Quality of Chicken Meat Balls

Prabhat kumar Mandal

M. V. Sc. Thesis, June- 1993

Dr. R. C. Keshri

Chairman

In India availability of spent hens has increased many folds in recent years. But utilization and consumption of meat from spent hens have been rather limited, particularly due to toughness. Meat ball is one of the convenient comminuted products. Studies were undertaken to standardize the processing procedure for meat balls and to compare the effects of three cooking methods namely, broiling, steaming and deep fat frying, on physical properties, proximate composition, sensory attributes and storage (4-5°C) stability. White leghorn (WL) spent hens of around 400 days available at the 'Experimental layer farm' of CARI, Izatnagar were utilized.

Several trails were conducted to standardize the recipe to obtain an acceptable product. The recipe contained spent hen meat 71%. Other ingredients included chicken fat, whole egg liquid, mashed potato, bread crumb, seasonings and other usual additives. Meat was minced once through 8 mm plate followed by once through 4mm plate. Then the other ingredients were mixed in a mixer to prepare the dough. Cooking schedule of broiling for 45 min at 160°C, steaming for 30 min at 100°C and deep fat frying for 15 min at 130°C were found suitable. Cooking yield was significantly affected by methods of cooking. The mean values of broiled, steamed and fried meat balls were 88.4, 91.7 and 83.6 percent, respectively. Appearance scores were rated as 'very good' for frying and 'good' for steaming and broiling. Flavour, texture and overall palatability scores were higher for fried meat balls whereas juiciness and mouth coating scores were almost similar.

Storage (4-5°C) studies indicated significant effect of cooking methods on appearance score. Appearance score was highest for frying. Flavour, juiciness, texture and overall palatability scores differed significantly between cooking methods as well as storage days. Overall palatability scores for meat balls were higher in case of frying, intermediate for broiling and lower for steaming during storage and all were well acceptable up-to 10 days. The scores decreased gradually from 0 to 10 day s but remained 'very good' to 'good'. Microbiological studies revealed significant effects of cooking methods and storage days on aerobic plate count (APC) of meat balls.

Meat balls with very good acceptability and nutritive value can be prepared from spent hens by employing either broiling, steaming or deep fat frying method of cooking. From the view points of cooking yield, dimensional changes and ease of processing, steaming was found as a method of choice and storage stability point of view, deep fat frying was a method of choice. Meat balls prepared by three different methods of cooking can be considered as a good quality convenient meat product with a shelf-life of 10 days 4-5°C.

Effect of some Extenders on Physico-Chemical and Sensory Attributes of Chicken Loaf

A. R. Sen
M. V. Sc. Thesis, July-1993

Dr. B. D. Sharma
Chairman

The ever rising cost of chicken meat and meat products has necessitated the introduction of cheap as well as nutritious extenders like milk co-precipitate, potato and Bengal gram in meat products. Hence, the present study was undertaken to evaluate these important extenders on the quality of chicken loaf and to determine the keeping quality of chicken loaf during refrigerated storage.

Five experiments were conducted. Minced lean was replaced by different levels of milk co-precipitate (MCP), cooked mashed potato and Bengal gram paste. Keeping quality of chicken loaves containing either 15% MCP or 10% potato or 5% Bengal gram packed in HDPE and aluminium foil was evaluated at $4\pm 1^{\circ}\text{C}$ up-to 10 days. Different parameters considered were emulsion pH, emulsion stability, shear force value, cooking yield, sensory attributes and proximate composition of chicken loaves in experiment-1, 2, 3, and 5. Keeping quality of chicken loaf during refrigerated storage was evaluated on the basis of pH, TPC, Psychrotropic Count, TBA value and sensory attributes.

Chicken loaves of very good acceptability and nutritive value could be prepared by the incorporation of low-cost extenders viz. milk co-precipitate, mashed potato and Bengal gram substituting lean at the levels of 20 , 20 and 15% respectively. Extender combination-1 (10% milk co-precipitate + 5% potato + 5% Bengal gram) or extender combination-2 (5% milk co-precipitate + 10% potato + 5% Bengal gram) could substitute lean from the basic (control) formulation of chicken loaf while enhancing the quality attributes and reducing the production cost at the same time. Chicken loaves could be conveniently packed in HDPE or aluminium foil and stored safely for a period of 10 days under refrigeration ($4\pm 1^{\circ}\text{C}$) without any appreciable loss of microbial and sensory quality.

Effect of Certain Extenders on the Quality Attributes of Chicken Nuggets

Somnath Nag
M. V. Sc. Thesis, June 1994

Dr.B. D. Sharma
Chairman

The ever rising cost of chicken meat and meat products has necessitated the introduction of cheap as well as nutritious extenders like a pea flour in meat products. Hence, the present study was undertaken to evaluate these important extenders on the quality of chicken nuggets during refrigerated storage. Minced lean was replaced by pea flour and rice flour (hydrated 1:1) at 0, 5, 10, and 15% levels in separate experiments. Economics and keeping quality of chicken nuggets containing either 10% pea flour or 10% rice flour packed in LDPE or laminate (Under vacuum) were evaluated at $4\pm 1^{\circ}\text{C}$ up to 14 days and 30 days respectively.

Quality of chicken nuggets were evaluated based on emulsion stability, cooking yield, shear force value, sensory attributes and proximate composition. Keeping quality of products during refrigerated storage was determined on the basis of pH, TPC, Psychrotrophic Count, TBA value and sensory attributes.

Chicken nuggets of very good acceptability and nutritive value could be prepared by the incorporation of low-cost extenders viz., pea flour and rice flour substituting lean chicken meat at 10% level. Chicken nuggets could be conveniently packed in LDPE for a period of 14 days and in aluminum foil/LDPE laminate under vacuum for a period of 30 days in refrigerated ($4\pm 1^{\circ}\text{C}$) condition without any appreciable loss of microbial and sensory quality. The production cost of 1 kg chicken was, control (all Meat) recipe = Rs. 79.99, recipe with 10% pea flour = Rs. 70.52 and recipe with 10% rice flour incorporation = Rs. 69.36. The economics of substituting lean chicken meat with 10% pea flour (hydrated 1:1) and 10% rice flour (hydrated 1:1) was worked out to be Rs. 9.47 and Rs. 10.63 per Kg. of chicken nuggets respectively.

Studies on Incorporation of Dried Eggs on the Quality of Patties from Spent Hen Meat and By-Products.

A. Kalaikannan

M. V. Sc. Thesis, July-1998

Dr.A. S. R. Anjaneyulu

Chairman

Chicken patties formulation were made with the aim of efficient utilization of byproducts, skin gizzard and heart, in the meat products. As the byproducts are poor in functional properties than the skeletal meat, dried eggs and its components were tried to improve the quality of the patties. The objectives of the proposed study were to find the optimum level of egg powder-whole egg (WEP), albumen (DA), yolk (DY) for incorporation in the formulations of chicken patties and to assess their optimum level of addition on the quality and refrigerated ($4\pm 1^{\circ}\text{C}$) storage stability of products.

Incorporation of WEP at 1% level significantly improved the sensory attributes of patties. The difference in improvement of quality between patties with 1% and 2% were not significantly different. Incorporation of dried albumen, at 1% level significantly improved emulsion stability (ES), product yield and overall palatability of patties. While markedly improved shear force and lowered product shrinkage. Addition of dried yolk at 1% level markedly enhanced the ES, the product yield and sensory attributes. But 2% and 3% levels of incorporation had adverse effect. At their optimum level of incorporation (1% each) and liquid egg (LE) (3.7%) increased the ES, product yield, as well as shear force and sensory attributes. The improvement was in the order of WEP>LE>DA>DY.

The TBARS number, aerobic plate count (APC) as well as psychrophilic counts linearly increased the sores for sensory attributes consistently decreased for all patties during refrigerated storage. Incorporation of DA and DY significantly reduced the production of TBARS and APC. The growth of psychrophiles also significantly hindered by DA, DY and WEP. The patties were well acceptable for all the treatments up-to 20 days, whereas in case of control only 15 days. The stability of patties during refrigerated storage was in order of DA>WEP>LE>DY. Thus, incorporation of dried egg as well as its components has beneficial effect on the qualities and storage stability of patties.

Studies of Tenderization of Spent-Hen Meat by Application of Calcium Chloride and Lactic Acid.

K. Kanimozhi

M. V. SC. Thesis, July-1998

Dr. S. K. Mendiratta

Chairman

With the increase in broiler and egg production, the disposal of layers at the end of their economic productive life (spent hen) is becoming more and more difficult due to inherent quality difference between broiler and spent hen meat. The present study was conducted to develop an effective method for improving the overall qualities of spent hen meat by application of calcium chloride (CaCl_2), lactic acid (LA) and combination of CaCl_2 +LA with or without tumbling and to study its utilization for the preparation of fried product.

Spent hen cuts were marinated within half an hour of slaughter or after chilling for 20 h in solutions containing 0.3M CaCl_2 and 0.5% LA. Combination of CaCl_2 +LA was tried with/without tumbling. Treated and control cuts were evaluated after 4 h or 24h. In general, treatments caused significant decrease in pH, water holding capacity, shear force and microbial qualities, where as moisture, ash and calcium content of treated chicken cuts were found to be significantly higher than control. Scanning electron microscopic studies also revealed alteration in the meat structure of treated cuts. The treatments of chilled cuts brought about significant improvement in texture and overall palatability. Among all the treatments, marination of chilled cuts in combination of 0.3M CaCl_2 and 0.5 LA was found most effective. Tumbling of marinated cuts, further enhanced the tenderness, palatability and other attributes in comparison to marination alone. Enrobing and frying improved the sensory characteristics and microbial qualities of all the samples. However, no significant difference was observed between sensory attributes of control (spent hen) and treated samples. This indicates that simple enrobing and frying can be effective alternative method for utilization of spent hen meat.

From these experiments, it can be concluded that the sensory and microbial qualities of spent hen meat can be improved by marinating and/or tumbling the chilled cuts in 0.3M CaCl_2 and 0.5% LA. This can ensure effective utilization of spent hen and benefit both poultry farmers and consumer.

Studies on Preparation and Shelf-life of Chicken-Whey Soup.

Chidanandaiah

Dr. M. K. Sayal

M. V. Sc. Thesis, June-1999

Chairman

Spent hens and whey, the major by-products of poultry and dairy industry respectively are not used properly in food products in India, mainly due to lack of suitable technologies and other constraints. A study was, therefore, undertaken to standardize the manufacturing technique for chicken-whey soup by separately utilizing neck, back and wings (NBW), shanks and heads of broiler spent hens in whey along with other necessary ingredients, compare chicken-whey soup with chicken soup made from the above spent hen cuts and water and determine the shelf life of chicken-whey soup during storage at refrigeration temperature.

The method of preparation of chicken-whey soup and chicken soup essentially consisted of pressure cooking separately at 15 psi (121°C) for 30 min of NBW, shanks and water respectively along with other ingredients followed by filtration to obtain respective soup. Chicken-whey soup prepared separately by utilizing 20% of NBW, shanks and heads in whey also scored higher for colour and appearance, flavour, consistency and overall palatability, contained more fat, protein, lactose, ash and total solids as compared to the respective chicken soup made separately with 20% of NBW, shanks or heads and water. Use of shanks and heads made the resultant products slightly blackish in colour, intensity blackish in colour, intensity of which was more in case of heads than shanks and chicken soup then chicken-whey soup.

Storage studies revealed that the shelf life of chicken-whey soup and chicken soup made by utilizing 20% NBW in whey and water respectively and packaged aerobically in laminated pouches (Polyethylene/aluminium foil) was 6 days during storage at 4±1°C. There was decrease in thiobarbituric acid value, titratable acidity, total plate count, enterobacteriaceae count and yeast and mould count in both the products during storage. Average scores for colour and appearance, flavour, consistency, meat flavor intensity and overall palatability of the products also decreased during storage. Utilization of NBW, shanks and heads from spent hens and whey for making chicken-whey soup would improve the profitability of poultry and dairy industry.

Studies on Ginger Extract as a Tenderizing Agent and its use for Production of Cured and Smoked Product from Spent Hen Meat

B. M. Naveena
M. V. Sc. Thesis, June-1999

Dr. S. K Mendiratta
Chairman

Tremendous growth of poultry industry has been achieved in our country in the last two decades. This has parent stock and thus the disposal of these spent hens is becoming more and more difficult due to inherent quality differences between broiler and spent hen meat. The present study was conducted to develop overall qualities of meat and smoked product produced from spent hen meat by utilizing ginger extract.

Deboned spent hen muscle pieces (chunks) were marinated within half an hour of slaughter (pre-chilled) or after chilling 24hrs (post-chilled) in distilled water (control) or 3% ginger extract (treatment). Samples were evaluated after 4 and 24 hrs of holding at 41C. In general, ginger extract treatment increased the pH, moisture, cooking yield, total pigments, water holding capacity, collagen solubility, protein extractability, muscle fiber diameter and decreased the shear force values. Electrophoretic pattern of muscle proteins revealed extensive proteolysis and reduction number of bands in ginger extract treated samples. There was significant improvement in all sensory attributes of 'boti kabab' prepared from spent hen meat treated with ginger extracts both at pre-chilled and post-chilled stage. However, sensory scores were significantly ($P < 0.05$) higher in samples treated at post-chilled stage than pre-chilled.

Incorporation of 2.5% ginger extract in the standard curing solution significantly Smoked product and also there was significant reduction in shear force values. Control samples (samples cured in standard curing solution) were spoiled on 5th day of room temperature storage and 30th day of refrigerated storage while treated samples (samples cured in standard curing solution +2.5% ginger extract) remained acceptable on the corresponding days of storage. Increase in shelf life of ginger treated sample was clearly indicated by comparatively lower TBA numbers and microbial counts than control. From these experiments it can be concluded that ginger extract can be effectively used as a tenderizing, antimicrobial and antioxidant agent for improving the tenderness and other qualities of spent hen meat and its products. Thus, this natural spice can prove to be a boon to the poultry farmers, meat traders and consumers if exploited at industrial level.

Quality of Chicken patties Incorporated with Different Milk Proteins.

Girish Patil S.

M. V. Sc. Thesis, June-2000

Dr. M. K. Sanyal

Chairman

Spent hen meat is tougher, less tender and less juicy compared to broiler meat. Need for preparing products utilizing such meat has been highlighted by various workers. Attempts were, therefore, made to develop a good quality chicken patties from spent hen meat and its byproducts like skin, gizzard, heart and fat with the separate incorporation of sodium caseinate (SC), whey protein concentrates (WPC), skim milk powder (SMP) and milk co-precipitates (MCP) and also to study their storage characteristics. Based on physico-chemical and sensory properties, chicken patties prepared separately by incorporating 2% SC, 2% WPC, 3% SMP and 15% MCP were adjusted better than those prepared with other levels of corresponding milk proteins and control.

A comparison of the chicken patties prepared with the preselected levels of different milk proteins (as mentioned earlier) revealed that the chicken patties incorporated with 2% WPC proved best among all the products. Cost of 1000g of chicken patties separately incorporated with 2% SC, 2% WPC, 3% SMP, 15% MCP, 15% MCP and control was RS.62.73, 61.98, 63.62, 62.17 and 64.97 respectively. All the products prepared separately by incorporating different milk proteins at preselected level kept well for 20 days when packaged aerobically on LDPE pouches and stored at $4\pm 1^{\circ}\text{C}$. In general, there was decrease in the contents of moisture, ether extract, protein and ash as well as in the scores for all the sensory attributes but increase in product pH, TBARS value, total plate count, enterobacteriaceae count and yeast and mould count of the products during storage.

SDS-PAGE revealed that proteins having molecular weights (MW) of more than 43Kda present in the fresh chicken patties incorporated separately with different milk proteins at preselected levels broke down into smaller fragments having less than 35Kda MW after 25 days of storage at $4\pm 1^{\circ}\text{C}$ packaged aerobically in LDPE pouches. NEED for up gradation of the technology developed for making good quality chicken patties from spent hen meat and its by-products for commercial scale production has been emphasized.

Studies on Development and Storage Characteristics of Chicken Snack.

V. P. Singh

M. V. Sc Thesis, July- 1999

Dr. P.C.Dubey

Chairman

Meat from spent hens, a major by-product of poultry industry, does not find adequate use in food products as it is tougher, less juicy, less tender, poorer in functional properties and contain higher fat than broiler meat. Several workers have emphasized the need to develop technologies to use such meat in the preparation of nutritious and palatable food items. A study was, therefore, undertaken to prepare chicken snacks using spent hen meat and investigate its storage characteristics. The method of preparation of chicken snack essentially consisted of mincing of spent hen meat, chopping of minced meat at different stages along with starch, milk protein, common salt, spices, condiments, phosphates, chilled water and baking powder for different durations followed by extrusion of emulsion into chip shaped strips and cooking in microwave oven of the emulsion strips.

Chicken snacks prepared separately by utilizing spent hen meat at 50% level along with non-fat dried milk (NFDM) and rice starch (A), NFDM and corn starch (C), and sodium caseinate (SC) and rice starch (C) and SC and corn starch (D) were liked most by the judges as compared to the level of 0, 40 and 60% of spent hen meat in each category of product. Product C scored highest for all the sensory attributes when compared with A, B and D. Storage studies of C packaged aerobically as well as under vacuum in laminated pouches (polyethylene/aluminium foil) and stored for 3 months at $30\pm 2^{\circ}\text{C}$ indicated not much changes in the contents of different chemical constituents, physical attributes, microbiological and sensory profile of the snacks up-to 30 days. However, changes in chicken snacks packages under vacuum was less during storage of 30 days at $30\pm 2^{\circ}\text{C}$ than that snacks packaged aerobically. All the chicken snacks were highly acceptable throughout the storage at $30\pm 2^{\circ}\text{C}$ for days.

The technology developed for making chicken snacks using spent hen meat would provide a nutritious and palatable convenient meat product to the consumers, remunerative price to the poultry farmers for their produce and improve profitability of poultry industry as a whole. However, before commercial exploitation, up-gradation of the developed technology is needed.

Effect of Storage and Cooking on Lipid in Poultry

N. Sharma

Thesis, *, 1980

Dr. H. B. Joshi

Ph.D.

Chairman

Lipid is an important constituent of composition of the lipid and of the changes which are associated with storage and cooking was made in thigh and breast muscles, skin and adipose tissues of broiler and quail. Raw and cooked samples were stored at 4C and 10C for a period of 9 days and 90 days respectively. Lipid extracted from thigh, breast, adipose and skin tissue of broiler and quail separated into various fractions. Lipid content in broiler and quail was highest in adipose tissue which was followed by skin, thigh and breast muscle. Cholesterol content was more in quail meat than in broiler. Lipid from thigh muscle contained more Cholesterol than from the breast muscle of broiler whereas a reverse trend was observed in quail.

Phospholipid content in broiler and quails was maximum in breast muscle followed by high, skin and adipose tissue. Increase in free fatty acids due to storage was more in raw stored meat as compared to those in cooked stored meat. Off-flavour developed more rapidly in precooked than in uncooked meat on storage. Phospholipids are more important in determining the quality of precooked stored meat. Poultry meat is very susceptible to the development of off-flavour due to oxidative rancidity. The loss of desirable fresh flavor was evident on heating of precooked stored poultry meat.

* Rohilkhand University, Bareilly.

Quality Characteristics of Pigeon Meat

Dr. R. C. Keshri
*Thesis, *, 1986*

DR. Nagendra Sharma *Ph.D.*
Chairman

Studies on processing procedures, slaughter characteristics, chemical composition, cooking and palatability of 30 days squab and 150 days old adult pigeon (Columbialiviadomestica) of both sexes were carried out. Live weight, dressing and evisceration percentage, cutability characteristics including meat to bone ratio of various cuts, of chilling and freezing on water uptake in meat, proximate composition of breast and thigh meat, muscle protein fractions such as sarcoplasmic, myofibrillar, stroma and non-protein nitrogen and various fractions of lipids from neutral and phospholipids, cholesterol contents, muscle fiber diameter, total heme pigments and processing of some delicious products from pigeon and their sensory acceptability are reported.

It was concluded that squab meat is superior to the meat from any other species of poultry. It has a higher protein content and a wider meat-to-bone ratio. The carcass has yellow attractive skin colour. The squab meat is more tender, juicy and nutritious.

* Rohilkhand University, Bareilly.

Physico-Chemical Changes, Keeping Quality and Consumer Acceptance of Chicken Sausages Manufactured Utilizing Whole Meat from Spent Layer Chicken.

N.Kondaiah

Ph.D. Thesis *, 1986

Dr.B.Panda

Chairman

The study was conducted to develop chicken sausages utilizing all the twin objectives of maximum returns from spent hens and to produce chicken sausages economically. Carcass data was collected from 251 spent hens and 15 different experiments were conducted to develop a suitable chicken sausage formulation. Average yields of spent hen components were: live weight 1561g, dressed weight 1079g, fat 127g, skin 116g, yolk 23g, deboned meat 396g, total meat 727g and total meat and total edible meat 897g. Deboned meat, total meat and total edible meat were 37%, 67.04% and 82.9% of dressed weight respectively. Cooked meat yield from deboned frames was 5.35% of dressed weight and deboned meat: bone ratio was 2.88.

Based on functional properties breast meat was superior to leg meat and wing + back meat; and gizzard was better than heart and skin for use in comminuted products. RIR breed spent hens yielded higher meat yield of better quality than WL. Hot boning of spent hens and freezing the deboned meat before use in products was a better practice than conventional cold boning. Addition of salt and phosphate to hot mined frozen meat has improved functional quality of the meat.

Chicken fat was more acceptable for chicken sausages compared to mutton fat or vegetable fat or a combination of fats. Chicken fat at 15% level produced sausages of better produced from whole meat components from spent hens only when phosphate and spent hen yolk were added. Cooked potato at 13%, black gram at 13% and soy mince at 8% levels could be incorporated in whole meat sausages. A lower fat level of 8 to 12.5% was more desirable in whole meat formulation compared to 15% level in deboned meat formulation. Three different formulations of chicken sausages were developed using deboned meat, whole meat (deboned meat + uncooked components-skin, gizzard and heart and cooked meat) and total meat (deboned meat + skin, gizzard and heart). Overall acceptability scores were better for deboned meat sausages. (5.73) followed by total meat (5.67) and whole meat (5.33) and difference were non-significant. All sausage formulations indicated good keeping quality of 10 days at 5°C and up-to 90 days at -10°C. At spent hen rates of Rs. 17.40/hen production costs (based on raw material cost) (Rs/Kg) were 32.47, 22.44 and 24.45 for the deboned, whole and total meat formulations respectively.

* Rohilkhand University, Bareilly (U.P).

**Standardization and quality evaluation of Harisa – a traditional Kashmiri
meat product**

Principal Investigator: Dr. A.H. Malik

Co-PI: Dr. Mir Salahuddin, Dr. Sarafaraz A. Wani, Dr. M.A. Pal

Duration: 2004-2008

Abstract

The processing procedure of Harissa was standardized. A 50 minute period of pressure cooking followed by 90 minutes of stirring/mixing on low heat was enough to produce an acceptable product. The product was having acceptable physico-chemical characteristics and scored good-very good on sensory evaluation. The product quality remained stable upto 18th day of refrigerated storage under aerobic and vacuum packaging.

Effect of chicken meat on quality characteristics and storage stability of noodles prepared from different flours.

Akhilesh Kumar Verma
M.V.Sc. Thesis 2012

Vikash Pathak
Chairman

Snacks like noodles are fast foods relished by all segments of society due to variety, convenience and capability to satisfy the short term hunger. The consumption of snack foods is increasing day by day due to rapid urbanisation, increase in per capita income and socio-economical changes and finally the changing life style of people. The snack food market is one of the largest markets in the world but most snacks available in the market are cereal based and lack in essential nutrients. So various cereal flours were replaced with different levels of minced chicken meat to enhance the nutritional value for the assessment of suitability and compatibility of chicken meat noodles. Emulsions prepared from various flours replaced with different meat levels were subjected to measure pH and emulsion stability. The results obtained for these parameters revealed decreased pH as well as emulsion stability with the increase in meat level in all the formulations. This might be due to acidic nature and lower binding ability of meat. The physico-chemical analysis of the fresh chicken meat and control noodles revealed increasing trend of moisture in all of the products while ash, protein, fat water absorption index, water solubility index, increased in whole wheat flour, rice flour and refined wheat flour, rice flour and refined wheat flour based chicken meat noodles and increased in soybean chicken meat noodles with increase in the level of meat. However, other parameters such as crude fibres and cooking loss showed overall decrease in the values with increase in meat levels whereas, volume and weight increase parameters decreased on increase of meat levels in all of the products except soybean flour based noodles. The selected products i.e. P1,P2,P3& P4 were stored for 30 days at $30\pm 2^{\circ}\text{C}$ under aerobic packaging and subjected for quality analysis on 0,10,20,&30th day of storage. The data obtained for storage study overall revealed increasing trend in water activity, moisture, free fatty acid, TBA, water absorption index, crispiness, TPC and yeast and mould whereas decreasing pattern in values of protein, crude fibre, fat ash, water solubility index, hardness, work of shear and all sensory attributes over the storage period of 30 days. All the sensory attributes and some physico-chemical parameters decreased non-significantly ($P>0.05$) and were very well within the acceptable limit. TPC and yeast and mould counts increased in all the groups throughout the storage period but within the safe limit. Overall sensory parameters revealed the maximum scores for P2 (refined wheat flour based chicken meat noodles containing 40% minced chicken meat) followed by $P3>P4>P1$. The cost of production of this product was also under the medium range (Rs 38.72 per 80 gm chicken meat noodles including cost of 8 gm of taste maker) as compared to other selected chicken meat noodles i.e P1, P3 & P4 (43.52, 50.72 &34.72 per 80 g chicken meat noodles including cost of 8g of taste maker for P1 ,P3 & P4 respectively).

Studies on development on quality characteristics of self stable chicken sticks.

Gaurav Kumar
M.V.Sc: Thesis, 2012

Vikash Pathak
Chairman

Chicken meat sticks three different flours (gram flour, rice flour and refined wheat flour) were taken separately in four different batches i.e. G1, G2, G3 and G4; R1, R2, R3 and R4; and W1, W2, W3 and W4 respectively replaced with different levels of minced chicken meat (0, 50, 60 and 70%) for each flour. The freshly prepared sticks were subjected to physico-chemical, sensory and proximate analysis for final selection of meat level in each flour. Values for pH of emulsion and sticks both decreased high significantly ($p < 0.01$) with increased level of minced chicken meat in all three flours in liner way while emulsion stability of dough showed an increasing trend in gram flour based meat sticks and decreasing trend in rice flour and refined wheat flour based meat sticks in highly significant ($P < 0.01$) manner with increased level of meat incorporation. A highly significant decrease ($P < 0.01$) was noticed in cooking yield for all treatments with increased in minced chicken meat due to higher moisture content in meat (70-75%) as compared to flours used in study. Moisture and ash was significantly ($P < 0.01$) higher in all treatments replaced with increased levels of minced chicken meat sticks as compared to control of respective flour. Protein and fat decreased high significantly ($p < 0.01$) in gram flour based chicken sticks with increase in chicken meat level but increased high significantly ($P < 0.01$) in meat sticks prepared by replacement of rice and refined wheat flour with different levels of chicken meat. The overall mean scores sensory parameters like appearance and colour, texture, flavour, mouth coating, meat flavour intensity and overall acceptability were observed highest in G4, R3 and W4 for gram flour. Saltiness had no significant ($P > 0.05$) difference between treatments for any flour. Meat sticks prepared with different flours, G4 containing 70%, R3 containing 60% and W4 with 70% of minced chicken meat replaced with gram flour, rice flour and refined wheat flour respectively, were finally selected to study quality characteristics of shelf stable chicken sticks on 0, 10, 20, & 30th day of storage. TBA, FFA and water activity decreased high significantly ($P < 0.01$) with the advancement of storage period and was highest in G4. Moisture, protein, fat and ash contents were highest in G4. Moisture increased high significantly ($P > 0.05$) in all treatments throughout the storage period. The values of hardness and work were observed highest in R3.W4>G4 but crispiness values for G4>R3>W4. There was no significant ($P > 0.05$) difference in mean TPC, yeast and mould count in between treatments on 0, 10, 20 and 30th day during storage of chicken sticks. *Staphylococcus*, coliforms and *Salmonella* were not detected during whole storage period in any treatments due to high processing temperature and hygienic handling and packaging of product. The scores for all sensory parameters including overall acceptability were highest in G4 and decreased significantly ($P < 0.05$) in all treatments except saltiness.

Technology development and quality assessment of chicken meat biscuits

Raj Kumar Jaiswal
M.V.SC: Thesis, 2012

VikasPatha
Chairman

Keeping in view of demand of biscuits and intervention of nutrition in them present investigation was carried out to study the technology development and quality assessment of chicken meat biscuits by replacement of refined wheat flour with different levels (0%, 40%, 50% and 60%) of chicken meat powder prepared by mincing and dehydration of chicken meat which were abbreviated as A,B,C and D respectively. Various physico-chemical properties, proximate estimation, microbiology, texture analysis and sensory evaluation were carried out on 0, 10th, 20th, and 30th days of storage at ambient temperature in aerobic and vacuum packaging, where as emulsion stability of raw dough and cooking yield of freshly prepared chicken biscuits were evaluated on 0 day only. There was significant difference ($P<0.05$) found for emulsion stability of dough between treatments, but no significant difference was found between A, B and C. Cooking yield decreased significantly ($P<0.05$) with increase in meat incorporation and found to be highest in A, followed by $B>C>D$. A linear decrease was found significantly ($P<0.05$) in pH with replacement of refined wheat flour with increasing level of chicken meat powder, due to acidic nature of meat in both packaging conditions. TBA and FFA values for chicken meat biscuits were found to be significantly ($P<0.05$) increased with increased level of meat incorporation due to higher fat in meat as compared to refined wheat flour. Fat, moisture and ash content increased significantly ($P<0.05$), but protein content increased highly significantly ($P<0.01$) with increase in chicken meat powder level. Work of shearing and shear force values decreased in linear way $A>B>C>D$ due to higher moisture level in meat powder as compared to refined wheat flour. No significant ($P>0.05$) difference was observed in between the treatments for TPC and yeast and mould count in all four days of storage but increased high significantly ($P<0.01$) in aerobic and significantly ($P<0.05$) in vacuum packaging over storage period. The vacuum packaged chicken meat biscuits showed almost negligible microorganism growth due to absence of air. The total absence of Staphylococcus, Coliform count and Salmonella count was reported during whole storage period in both packaging conditions. The colour and appearance and texture scores decreased with increase in meat powder incorporation, but all the variants were well accepted by all sensory panellists. Meat flavour, meat flavour intensity, mouth coating and salting scores increased with increased chicken meat powder level. This semi trained sensory panellists accepted all formulation of meat biscuits, but the highest overall acceptability scores were awarded to C among all the treatments. On the Basis of result obtained, chicken meat biscuits containing 50% of chicken meat powder (C) can be selected as the best treatment in both packaging conditions.

Studies on quality evaluation of some important edible by-products of Barbari goats (*Caprahircus*)

Pramila Umaraw
M. V. Sc: Thesis, 2013

Vikas Pathak
Chairman

The of edible by-products is concomitant with meat production. The present utilization of edible organs is much lower than its potential. Edible by-products of Barbari kids constitute about 3% of the live weight of an animal of which liver contributed maximum (1.47%). This could increase the saleable cost of animal by 6.94%. Physicochemical, proximate, mineral, fatty acid profile, texture, colour and microbiological analysis was conducted taking *Longissimusdorsi* muscle as reference. Physicochemical properties revealed a higher pH values in all organs. Maximum cooking loss was observed in kidneys (34.67%). Proximate analysis of each organ was conducted to find out the nutritive value. The moisture, protein, fat ash, carbohydrate and energy values differed significantly. Except liver all organs evinced higher moisture values than muscle. Protein content of offals was significantly ($P<0.05$) lower than muscle. Liver and heart exhibited high protein content in comparison to other organs (19.66% and 16.08%). Fat content was found to be highest in brain followed by heart (8.49%). Ash content was significantly ($P<0.05$) highest in spleen (3.30%) whereas carbohydrate value was highest for liver (1.76%) and brain (1.85%). Percent energy value was significantly ($P<0.05$) different among all organs studied. Liver had the highest energy value (133.8%). Mineral profile analysis revealed significant difference between muscle and organs and even differed significantly among them. Kidney had highest sodium content (202.39mg/100g), potassium content was highest in testicles (362.61mg/100g). Copper, iron and zinc were found to be highest in liver (6.97 mg/100g), spleen (31.1661mg/100g) and muscle (4.1561mg/100g). Fatty acid contents displayed significant difference among organs and muscles. Each organ had its characteristic fatty acid content. Saturated fatty acid content differed significantly and spleen evinced the highest value (54.95%) although monounsaturated fatty acid content was highest in muscle (40.36%). Polyunsaturated fatty acids were maximum in liver (22.54%). PUFA/SFA ratio of liver (0.49) was similar to the recommended level. Spleen, brain and testicles showed favourable n6/n3 ratio. All edible by-products exhibited characteristic textural and colour parameters. Liver required the maximum shear force and work of shear (121.48 and 32.19 kg-sec). The total viable count (TVC), Coliform count showed slight differences for all organs studied. The *Staphylococcus* counts were low with little differences among organs.

Development and quality assessment of meat momos.

Tanuja

M. V. Sc: Thesis, 2013

Vikas Pathak

Chairman

The present study was conducted for the development and quality assessment of health oriented meat Momos. The meat level and cooking time were optimized on the basis of physico-chemical parameters, colour and textural profile and sensory attributes. The 50% meat level with 30 minutes cooking time was selected with significant ($P < 0.05$) difference in cooking yield, moisture content, protein content, and non-significant difference in colour and textural profile. The optimized product was improved with the incorporation of three different percent of corn and potato starch (4%, 6% and 8% separately) in the dough during the preparation of chicken momos. The chicken momos containing 6% corn starch in dough was selected as the best treatment on the basis of physico-chemical, colour and textural parameters and sensory attributes. There was significant ($P < 0.05$) difference observed in cooking yield, moisture content, protein content, fat content, carbohydrate and sensory values. The mean L^* , and a^* values were differ significantly ($P < 0.05$) and highest for 6% corn starch but b^* value differ non-significantly and increased with potato starch. The textural parameters i.e. hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness values increased slightly in a non-significant manner with increased level of corn as well as potato starch. The mean appearance, flavour, texture, mouth coating and overall acceptability values were significantly ($P < 0.05$) higher for moms with 6% corn starch. Further study was conducted by replacing the chicken meat with four different variants of fish meat i.e. 25%, 50%, 75% and 100% for enhancing the nutritional value of meat momos. There was significant difference was found in mean pH value, cooking yield, weight gain and water activity but significant difference ($P < 0.05$) was observed in mean moisture content, fat and ash content with increased level of fish. The mean L^* , a^* , and b^* values differ in non-significant manner in which lightness and yellowness slightly increased with fish meat but redness decreased. The hardness, springiness, gumminess and chewiness values decreased but adhesiveness and cohesiveness values increased non-significantly with fish meat incorporation. The mean flavour, texture, meat flavour intensity, mouth coating and overall acceptability values were highest for F3 (75%) in comparison to other treatments. Meat Moms prepared with the incorporation of 75% fish meat were finally selected to study the quality characteristics at 0, 3, 6, 9 and 12 day of storage with control and 100% fish meat level at refrigeration temperature ($4 \pm 1^\circ\text{C}$). The mean pH value was non-significantly higher for $F4 > F3 > S2$. The mean values for TBA and FFA increased in highly significant ($P < 0.01$) manner with the advancement of storage period and found to be highest in F4. The total count, Psychrophillic count and yeast and mould count were significantly ($P < 0.01$) higher but within the safety limits up to 9th day of storage. Coliforms and Salmonella were not detected during whole storage period in any treatment due to steam cooking and hygienic handling during processing and storage. The scores for all sensory parameters including overall acceptability were significantly ($P < 0.05$) higher for F3 as sensory parameters including overall acceptability were significantly ($P < 0.05$) higher for F3 as compared to F4 and S2.

Quality and shelf-life of spent hen meat cubes

Subhash Chandra
Thesis, 2001

P.K. Shukla M.V.SC:
Chairman

A study was undertaken to evaluate the quality and shelf-life of spent hen meat cubes. Spent hen minced meat cubes were evaluated for physico-chemical properties, microbiological quality and organoleptic (sensory) attributes at regular intervals from 0 to 9 days of refrigeration storage ($4\pm 1^\circ\text{C}$). There were four products (1) Control, (2) Tetra sodium pyrophosphate (TSPP) (3) Tocopherol and (4) TSPP with tocopherol. Chicken cubes of very good acceptability and nutritive values could be prepared by the incorporation of TSPP or TSPP with tocopherol. Chicken cubes packed in polyethylene bags for a period of 9 days in refrigeration ($4\pm 1^\circ\text{C}$) condition, remains acceptable for consumption. The efficacy of different food additives used in the preparation of spent hen meat cubes in the present investigation was best for TSPP with tocopherol followed by TSPP and tocopherol. There was an increase in microbial count with increasing storage intervals. However, the various microbial counts were well below the threshold value of log 7.0 in these products. Thus, the products were microbiological safe up to 9 days of refrigeration storage. Incorporation of TSPP or TSPP with tocopherol significantly ($P < 0.01$) improved the quality and ultimately extended shelf-life of product. The overall acceptability of product (cubes) at 9th day of storage remained good. However, the overall acceptability of control and tocopherol containing samples was significantly low as compared to TSPP or TSPP with tocopherol containing samples. Hence, TSPP along tocopherol may be added to improve the quality and shelf-life of spent hen meat cubes.

Preparation of some meat convenient products by value addition

Ajay Tripathi

P.K. Shukla

M. V. Sc: Thesis, 2005

Chairman

The present study was undertaken to evaluate the effect of incorporation of two proteins viz., soy flour and black gram flour at different levels in restricted chicken nuggets. Various attempts were made to standardize the products from the recipe and finally one product was taken as standard which was 10% added water level, 15 minute mixing time and 15 minute cooking time. Restructuring of the product was done by replacing lean meat with soy flour (10%) and Bengal gram flour (10%). Restructured products were evaluated for physico-chemical properties and microbiological quality. There were three products; (1) control, (2) soy product and (3) Bengal gram product. There was a marginal increase in cooking yield and water holding capacity with increase in the level of soy protein and Bengal gram protein. There was a significant increase ($P < 0.01$) in pH with incorporation of soy protein and Bengal gram protein. Moisture content of control, soy and Bengal gram treated nuggets did not differ significantly. The moisture of the product packed in the polythene packing was significantly ($p < 0.01$) higher than the aluminium foil packing. The protein content of control, soy and Bengal gram treated nuggets differed significantly. There was no significant effect on ether extract on treatment, storage as well as in packing. Thio-barbituric acid content increased significantly ($p < 0.01$) with incorporation of soy protein but not because of Bengal gram protein. The total plate count was recorded more in polythene packed product. The effect of storage was highly significantly ($p < 0.01$) as the total plate count was increased rapidly during storage. Psychrohillic count for polythene packing was significantly ($p < 0.01$) higher to that of aluminium foil packaging. Restructuring had a significant ($p < 0.01$) effect on general appearance of the products. The effect on flavour was highly significant with incorporation of soy protein and Bengal gram protein. Overall mean values for polythene packaging are significantly ($p < 0.01$) higher to that of aluminium foil packaging. Texture values for polythene packaging are significantly ($p < 0.01$) different from that of aluminium foil packaging. For polythene packaging overall juiciness values were significantly ($p < 0.01$) different to that of aluminium foil packaging. The effect on flavour was significantly ($p < 0.01$) different to that of aluminium foil packaging. Hence, it may be concluded that restructuring of poultry meat by soy flour and black gram flour may enhance the value of meat and provide better acceptability, nutrition and value addition from low cost raw material. Besides use, the value of chicken meat can be enhanced by using restructured meat technology.

A qualitative study on spent quail meat (bone-in) pickle and their storage stability.

Hari Om Singh

Thesis, 2009

H.N. Singh M.V.SC:

Chairman

In the present study, attempts were made to determine the proximate composition of spent quail meat and to assess the suitability of acetic acid (A), lactic acid and vinegar for preparation of spent quail meat (Bone-in) pickle. The recipe was standardized for optimum cooking time and minimum oil requirements. The standardized products after cooling were packed in two types of rigid packages (glass and PET) and stored at room temperature for further study. These were subjected to storage studies on 0, 30, 60 and 90th day of storage. The meat samples of spent quails analyzed for its pH, percent moisture, percent crude protein, percent ether fat and percent total ash were 5.42, 72.72, 29.35, 3.90 and 1.20 respectively. The standardized recipe of spent quail meat (bone-in) pickle contained 12% oil, 40% cook-out, on meat weight basis, 2.5% each of acetic acid/ lactic acid/ vinegar in cook-out, 4% salt, 20% green curry stuff, 4% dry ice spice mixture and 1000g spent quail (bone-in) meat. It was found that combination of acetic acid in the pickle was found most suitable. In the present study almost negligible changes in the pH values in the product were found suitable for safety and longer shelf life. TBA values were found increased with the increase in storage period and on average it increased 3 folds than fresh product during 90 days storage. Among the package glass jars was evidenced with higher TBA value than PET jars. Moisture content of the products was found decreased with increase in storage period but fat, protein and ash contents were found increased with increasing storage period. Microbial counts were increased with increase in storage period. Almost in all products, treatment of the product was significantly affected by the storage period but no significant effect of package was observed during storage period. In general, microbial counts in all the pickle products were well below threshold value of log 7.0/g. Sensory scores of standardized products for almost all the attributes slightly decreased except sourness with increases in storage period. Among the package no significant variation in the sensory scores of various pickle products were found. However, products stored in PET jars were scored slightly higher sensory scores in almost all attributes. It may be concluded that all the combination of acids used in present study were very well accepted by the sensory panellists but combination with acetic acid was found to be best. The standardized recipe for all these products were found organoleptically better, microbiologically safer and shelf stable at room temperature for 90 days and PET jars was proved durable and convenient for pickle storage.

Processing and Storage Stability of Salted Dried Goat Meat.

Y. Babji

M. V. Sc. Thesis, Aug.-1993

Dr.T. R. K. Murthy

Chairman

The more traditional methods of preservation such as salting and drying of meat could play an important role in developing countries where refrigeration facilities are inadequate. A certain lack of confidence in the quality of these dried meats has grown over the years due to the use of improper raw material and uncontrolled processing procedure leading to such problems as dark colour, hard texture, high microbial counts and off-odours. The present Investigation process treatment of meat with lactic acid or EDTA for reducing bacterial stabilization besides improving the sensory attributes.

Experiments were conducted to prepare dried meat after pretreatment with 1% lactic acid or 1% EDTA dip solution maintained at 60°C for 1 min. The goat meat chunks of ½” thickness were grained for ½ hour and rubbed with 5% salt, 50ppm nitrite, 1% agar and 2% spice mixture. The chunks were oven dried at 50°C with air circulation for 20 hrs and subjected to a heat treatment at 130°C for 30 minutes. The samples were packed in polythene bags and wrapped in aluminum foil and stored at 30°C in an incubator for 60 days. The meat samples were analysed before drying, after drying for 20 hrs, after heat treatment and at different intervals of storage viz. 1, 7, 14, 30, 45 and 60 days for moisture, pH, Aerobic and Psychrotrophic plate counts and counts of Enterobacteriaceae, Coliforms, Staphylococcus aureus, Lactic acid bacteria, Faecal streptococci, Aerobic spore formers and Yeasts and Moulds.

Histological examination showed swelling of collagen when 0.5 and 1% agar was used. The 5% salt with 1% agar dried meat samples was acceptable from textural point of view by overcoming the case hardening. The rehydration ratios were 1.18, 1.24 and 1.3 for the three agar concentrations respectively. During storage, dried meat prepared by EDTA dip treatment showed consistently lower aerobic plate count and staphylococcal and Pseudomonas counts when compared with the control and lactic acid pretreatment.

The use of 50ppm nitrite and heat treatment improved the colour and other sensory attributes of the dried meat. The pink colour of the cut proteins of the dried meat disappeared gradually in control and lactic acid pre-treated meats. The EDTA pre-treatment of meat resulted in the persistence of pink colour throughout the 60 days storage period of dried meat. The use 1% agar in the preparation of dried meat improved textural properties

Studies on the Preparation, Packaging and preservation of Pork Pickle

U. K. Pal

Ph.D. Thesis, Sept, 1990

Dr.V.N.Bachhil

Chairman

Meat pickle is a highly acceptable shelf stable meat product of indigenous origin. The present investigation was undertaken to explore the possibility of reducing oil content and cost of the pickle recipe, and to assess the shelf life, safety and acceptability. Two conventional recipes were taken to select the better one as control. Control recipe was further standardized for minimum oil requirement, quality of acidified cook-out, optimum acetic acid concentration, optimum salt and green curry stuff (GCS). Both the control and the standardized products, with or without BHT, were packaged in two types of flexible packaging materials viz. High Density Polyethylene (HDPE) and one side metallised Polyester/Polyethylene laminate (PET/PE laminate). The products thus packaged were stored at room temperature.

The pH of the products stabilized to 5.07 and 5.03 for recipe No. I and II respectively after 7-8 days of maturation. Flavour, saltiness and overall acceptability of recipe no. II were significantly ($P < 0.05$) higher than those of recipe No. I. So, recipe no. II was selected as control for further standardization. Recipe No.II contained Lean pork, 100g; Salt, 35g; GCS, 50g; Vinegar, 100 ml and mustard oil, 250g.

Standardized recipe contained 12% oil, 40% cook-out on meat weight basis, 2.5% acetic acid in cook-out, 4% salt, 20% GCS, cooking time was standardized to 20 minutes. This combination was organoleptically most suitable. In general, BHT had no significant effect on microbial counts. Standardized products had better shelf life. The pH of control and standardized samples stabilized to 5.05-5.07 and 4.85-4.86 respectively after 7-8 days of maturation. Sensory scores for all the attributes decreased with increase in storage. Control samples packaged in HDPE and laminate were acceptable up-to 60 and 90 days respectively.

Standardized products packaged in laminate, with or without BHT, were acceptable up-to 150 and 120 days respectively. Addition of BHT to the products maintained better flavor and overall acceptability. Regarding packaging materials, laminate was found to be better than HDPE. Cost of production of the standardized and the control pickles were worked out to be Rs. 31.42 and 42.30 per kg respectively. This standardized pork pickle was safer, economical, more acceptable and more shelf stable than the conventional recipe.

2.05 Effect of addition of sodium caseinate, whole egg powder on the quality of chicken Sausage made with poultry by-products.

SUBHASH KUMAR VERMA, KESHAB DAS AND S.BISWS
Department of LPT, CVS&AH, Chhattisgarh Kamdhenu
Vishawavidyalya, Anjora, Durg.

The present study was aimed to prepare an acceptable quality chicken sausage with incorporation of edible poultry by-products (Edible poultry by-products such as skin & fat and heart & gizzard were incorporated by replacing proportionate quantity of chicken meat) and binders. Emulsion prepared from minced and chopped broiler meat with inclusion of different levels of poultry by-products and binder along with spices, condiments used for preparation of chicken sausages. Result revealed that chicken sausage containing 14% skin & fat and 3% heart & gizzard exhibited optimum sensory score as well as emulsion stability and cooking yield comparable to control. The sensory quality and physico-chemical characteristics such as emulsion stability and cooking yield chicken sausage Incorporated with 1.5 % SC and 4 % WEP binders ranked superior over higher levels. It is concluded that Acceptable quality chicken sausage could be prepared with incorporation of 14% skin & fat by replacing proportionate quantity of meat, 3% heart & gizzard was comparable to control sausage, 1.5% sodium caseinate and 4% WEP as binders resulted in significant improvement in sensory quality, cooking yield and emulsion stability of chicken sausage.

2.09 Effect of freezing and thawing methods on physico-chemical characteristics of frozen buffalo meat.

**V. CHANDIRASEKARAN¹, S. SURESHKUMAR²
AND G. THULASI³**

**Department of MS and T, ² Department of AHS & CA, VCRI,
Namakkal ³Department of MS and T, MVC, Chennai, Tamil Nadu
Veterinary and Animal Sciences University, Chennai**

A study to assess the effect of different methods of thawing viz., Room Temperature (RT), Chiller Temperature (CT), Microwave (MW) and Water Bath (WB) on physico- chemical characteristics of frozen buffalo meat was carried out. Results indicated that microwave thawing was the quickest method (10 min.) followed by water bath thawing while room temperature thawing and chiller temperature thawing took longer duration of time. A highly significant difference ($p < 0.01$) in Warner-Bratzler shear force value was observed in samples thawed at RT and WB, RT and MW and CT and MW treatments. A highly significant difference ($p < 0.01$) in munsell chroma and drip loss was also observed between different treatments. The highest drip loss was recorded in WB thawing followed by RT thawing. MW thawing showed a highly significant difference ($p < 0.01$) recording the lowest cooking loss compared to that of RT, CT and WB thawing methods. It was found that microwave thawing was the quickest compared to other methods and had lower cooking loss where as CT had the lowest drip loss amongst the treatments.

2.15 Estimation of keeping quality of buffalo meat available in and around Korutla town by resazurin dye reduction test
KUMAR, E¹ SUPRIYA, R. A.¹ VIJAYA KUMAR, A.¹ AND SHASHIKUMAR, M.²

Department of VPH& E, 2 Department of LPT, College of veterinary Science, Korutla, A.P.

The present study was undertaken with an objective to estimate the keeping quality of fresh buffalo meat available in and around the Korutla town. The fresh beef meat samples were collected aseptically in sterilized sample containers from different retail meat shops and samples were brought to the microbiological laboratory and the keeping quality of meat samples was evaluated by estimation of resazurin dye reduction time and total viable counts. The total viable count of fresh beef meat was 6.08 ± 0.21 log CFU/g with acceptable colour and odour and time taken for complete reduction of resazurin dye was 15.35 ± 0.21 hours. The meat samples were showing the deteriorative changes with slight discolouration and slight off odour at 11 hours of storage at ambient temperature and 4th day at refrigeration storage. Meat samples were completely spoiled with greenish discolouration and complete off odour at the end of 17 hours at ambient temperature and 5th day at refrigeration storage. At the time of spoilage of meat samples, resazurin dye reduction periods were 4.05 ± 0.29 and 3.15 ± 0.21 hours with corresponding total viable counts 8.65 ± 0.52 and 7.75 ± 0.46 log CFU/g at ambient and refrigeration storages, respectively. Overall, there was a positive correlation noticed between the time required for the resazurin dye reduction and total bacterial load as there is an increase in the bacterial population which was associated with decrease in reduction time of resazurin dye, irrespective of storage temperatures of meat samples. Thus, it can be concluded that the resazurin dye reduction test can be used as a tool for prediction of early spoilage of meat.

2.17 Optimizing drying process for acid stabilized chicken soft offal.

**DECHAMMA, K.P., NADEEM FAIROZE AND
KRISHNAMOORTHY¹, U.**

Department of LPT, ¹ Dept. of LPM, Veterinary
College, Bangalore.

A study was undertaken to assess feasibility of stabilizing chicken soft offal by acidification followed by drying to address environmental pressure due to the unscrupulous dumping of protein rich intestines from the chicken wet market. Formic acid, phosphoric acid and a mixture of both acids in equal quantity were evaluated to stabilize the soft offal at room temperature up to 4 days. Intact intestines harvested from local retail outlets were subjected for acidification using formic acid (3 per cent), phosphoric acid (4.5 per cent) and acid mixture (equal proportion of formic and phosphoric acid) and were held in sealed containers for 4 days. Then the acidified offal was sundried, oven dried (at 40⁰C, 60⁰C and 80⁰C) and air dried until there was no further reduction in the moisture content. Sundried product acidified with all the three treatments revealed optimum pH (3 to 4.5), moisture (9-10 per cent) crude protein (34-39 per cent) and ether extract (34-44 per cent) followed by oven dried offal with moisture 10-15 per cent, crude protein of 33-51 per cent and ether extract 26-44 per cent. TBARS (0.5mg malonaldehyde/kg) and tyrosine values (27-34 mg tyrosine/100g) of the resultant dried products were found to be satisfactory. There was total elimination of Salmonella and fecal coliforms following the process. It was concluded that the offal treated with formic acid at 3 per cent (v/w) followed by sun drying or oven drying at 40⁰C to be the best mode of stabilization.

2.18 Effect of ageing on the quality of buffalo meat from young and spent animals

KIRAN, M¹. B. M NAVEENA². K. SUDHAKAR REDDY¹., K.

KONDALREDDY¹ M

¹SHASHIKUMAR³, ²V. RAVI²NDER REDDY³. AND Y. PRAVEEN KUMAR²

College of Veterinary Science, NRC Meat, Hyderabad, ³ CVS, Korutla, Karimnagar

Current investigation was carried out to study the changes in physico-chemical parameters during conditioning/ageing at 4 °C in young and spent buffalo meat. Hot boned buffalo meat from young and spent animals was subjected to ageing for 6 days and evaluated at 0, 2, 4 and 6 days of interval. Overall pH of young buffalo meat was found to be higher (5.55 ± 0.01) in comparison to spent buffalo meat (5.41 ± 0.06) throughout the ageing period. Water holding capacity has decreased ($p < 0.05$) from 31.33 ± 1.76 % and 35.33 ± 2.40 % to 17.00 ± 1.00 % and 17.00 ± 1.20 % during ageing in both young and spent buffalo meat respectively. Protein extractability was significantly ($p < 0.05$) higher in spent buffalo meat compared to young buffalo meat, with no ($p > 0.05$) change in protein extractability in both young and spent buffalo meat throughout the ageing period. Muscle fibre diameter was higher in spent buffalo meat compared to young buffalo meat. Myofibrillar fragmentation Index was significantly ($p < 0.05$) higher at 6 day ageing in both young and spent buffalo meat compared to 0, 2 and 4 day aged meat. The significantly higher cooking yield was observed in spent buffalo meat compared to young buffalo meat. There was significant reduction ($p < 0.05$) in Warner-Bratzler shear force of hot boned and 6 day aged buffalo meat in both young and spent buffalo meat. The SDS PAGE pattern of proteins at different ageing periods showed no change in band pattern of young and spent buffalo meat. This study suggests that with ageing period there is improvement in tenderness of both spent and young buffalo meat.

**2.19 A novel superchilling and vacuum packaging process for
improving the shelf-life of fresh mutton chunks**
B. M. NAVEENA, A. R. SEN, M. MUTHUKUMAR, C.
RAMAKRISHNA, Y. BABJI, AND S. VAITHIYANATHAN
National Research Centre on Meat,
Chengicherla, Hyderabad

Fresh meat is highly perishable and requires well established cold chain for prolonged storage and distribution and to provide safe, wholesome and quality meat to consumers. This invention was carried out with an objective to extend the shelf-life of fresh, boneless mutton chunks using vacuum packaging and superchilling (-1 °C) process without freezing and to compare its efficacy with that of existing chilling (4 °C) and freezing (-18 °C) methods. An innovative blast chilling followed by storage at -1.5 °C was optimized under this experiment. Superchilling resulted in uniform, smaller ice crystals on the surface of meat which insulates the product from minor temperature abuse during storage. The superchilling was efficient in maintaining the freshness of mutton chunks without adversely affecting any physico- chemical, sensory and microbial quality parameters up to 80 days of storage. This novel process may be utilized by the buffalo meat processors and exporters for efficient storage and intercontinental transport of fresh sheep meat as an alternative to freezing technology with less labour, space, energy and premium price for the produce.

2.20 Characterization of buffalo meat proteome using 2-Dimensional gel electrophoresis

KIRAN, M.¹, K. SUDHAKAR REDDY¹. B. M. NAVEENA²., M. SHASHIKUMAR³.AND V RAVINDER REDDY³

1College of Veterinary Science, 2 NRC Meat, Hyderabad, 3 CVS, Korutla, Karimnagar.

Our limited understanding of the biological impact of the proteome profile on meat quality presents an important problem in the improvement of meat quality attributes. As a result, there is a need to identify biomarkers that can determine the meat quality. The realization that tenderness is a product of the proteome profile has important implications. In 2-DE proteins within a complex mixture are resolved first by charge, or isoelectric point (pI) and then by relative molecular mass (M_t). In the current study attempt has been made to unravel proteome profile of Indian buffalo meat to identify protein biomarkers influencing tenderness using 2-DE. The extraction and purification of proteins from *Longissimus dorsi* muscle of spent female buffalo meat was standardized using different treatments like tissue lysis, homogenization, vortexing and centrifugation for total protein purification. The extracted proteins were quantified by 2D Quant Kit. About 800 μ g of proteins diluted in rehydration buffer was loaded onto IPG (Immobilized pH Gradient) strips (11 cm, 3-10 pH range) for overnight to undergo passive rehydration followed by IEF (Isoelectric Focusing) with standardized protocol. Focused strips are equilibrated using equilibration buffer 1 and 2 containing Dithiotheritol (1%) and Iodoacetamide (2.5%) respectively. SDS PAGE (Sodium dodecyl sulphate Polyacrylamide gel electrophoresis) of equilibrated strips was performed at a constant voltage mode of 100 V at 60 mA current until the tracking dye reached the lower end of the gel. After complete running, gel was carefully removed and stained using standard coomassie and silver staining procedures. After thorough destaining the gels were scanned using Labscan 6.0. and were analyzed using Imagemaster 2D platinum 7.0 software. Using 2-DE technique, we have successfully separated about 496 and 415 protein spots in coomassie and silver stained gels respectively. These protein spots will be further characterized using mass spectrometry

Changing consumption pattern and demand for non-vegetarian food of Indian households

SIVARAMANE N.¹, B. M. NAVEENA², D. R.

SINGH³ AND PRAWIN ARYA³

¹NAARM, ²National Research Centre for Meat, Hyderabad, IASRI, New Delhi.

In India, cultural and religious aspects play a great role in the consumption of non-vegetarian produce. A considerably large section of population is vegetarian (lacto-vegetarian) in India. The consumption of beef is considered a taboo for Hindus, while pork is taboo for Muslims. Even the non-vegetarian in this country consume less quantity of non-veg products and avoid consuming meat, fish and eggs on particular days of a week and particular fortnight or months in a year for religious obligation. However, animal products like milk, milk products and honey are generally considered as part of the vegetarian diet. On the other hand, some section of the people considers egg or fish as part of the vegetarian diet.

According to the 2006 Hindu-CNN-IBN State of the Nation Survey, 31 per cent of Indians are vegetarians, while another 9 percent consumes eggs. Among the various communities, vegetarianism was most common among Jain community and then Brahmins at 55 percent and less frequent among Muslims (3 percent) and residents of coastal states. While about two-third of the population in India is non-vegetarian by choice, the actual consumers are close to 58 per cent due to non-availability or affordability constraints. Eateries in India clearly specify vegetarian and non-vegetarian food served and it has become mandatory to label the food products based on the contents of animal products namely, green dot for vegetarian, brown for non-vegetarian (meat/fish) and yellow for egg ingredients. The change in consumption pattern was studied using data available through the quinquennial rounds of National Sample Survey Data based on the nation-wide large sample consumer survey conducted regularly once in five years starting from 1972-73. So far eight quinquennial surveys on household consumption expenditure have been conducted so far during 27th, 32nd, 38th, 43rd, 50th, 55th, 61st and 66th rounds of NSS pertaining to the years 1972-73, 1977-78, 1983, 1987-88, 1993-94, 1999-2000, 2004-05 and 2009-10 respectively. The results showed that there is a huge rise percentage of expenditure on non-veg products including egg, fish and meat from 5.27 percent and 6.20 percent during 1993-94 to 8.31 percent and 8.17 percent during 2009-10 for rural and urban consumers respectively. The annual compound growth rate worked out for non-veg products showed that chicken meat witnessed very high growth of about 12 per cent since 1993-94 and egg also witnessed a high growth rate of about 11 and 9 percent for rural and urban consumers respectively. The average per capita monthly consumption of chicken meat increased from 20 grams and 30 grams during 1993-94 to 123 grams and 180 grams during 2009-10 for rural and urban consumers respectively. Similarly, the consumption of rural and urban households increased from 0.64 and 1.48 eggs per capita per month during 1993-94 to 1.73 and 2.67 eggs per capita per month during 2009-10. On the other hand, beef and buffalo meat consumption has witnessed negative growth during 1993 to 2010. The study also showed that consumers of egg, fish group (fish and prawn types) and chicken form the majority of non-veg population. However, a critical examination revealed that while the proportion of households consuming chicken has increased by leaps from just 7.5 percent and 9.0 percent of rural and urban households during 1993-94 to 16.6 percent and 21.5 percent during 2009-10, the proportion of household consuming fish has considerably come down. The demand for different type of non-veg

products were analyzed using the household survey data pertaining to the period 2009-10 using Linear Approximated Almost Ideal Demand System model. The expenditure elasticity close to 2 indicates that the demand of poultry meat has high potential to increase tremendously in the future given the price level and the rising per capita income of Indian consumers.

2.23 Extraction and purification of myoglobin from cardiac or skeletal muscles of Indian Buffaloes (*Bubalus bubalis*)

B. M. NAVEENA AND K. USHA RANI

National research Centre on Meat, Chengicherla, Hyderabad

The isolation and purification of myoglobin is necessary to study the species-specific auto-oxidation mechanism of myoglobin which is the main factor for meat discoloration. The meat pigment, myoglobin is primarily responsible for meat color and it is a sarcoplasmic, heme protein. In order to understand the reasons for darkness of buffalo meat this study was conducted with an objective to estimate the myoglobin concentration, meat colour and to extract and purify the myoglobin from cardiac or skeletal muscles of Indian buffaloes. The complete procedure was carried out at 4 °C. Fresh cardiac/skeletal muscle was minced and homogenized with homogenization buffer containing 10mM Tris-HCL and 1mM EDTA, pH 8.0 and centrifuged at 5000g for 10 min. The supernatant was brought to 70% ammonium sulfate saturation and centrifuged at 18,000g for 20 min. The resulting supernatant was saturated with 100% ammonium sulfate and centrifuged at 20,000g for 1 hour. The precipitate was resuspended in homogenization buffer and dialyzed against buffer containing 5mM Tris-HCL and 1mM EDTA, pH 8.0 for 24 hours with frequent changes at regular intervals. The dialyzed sample was filtered through 0.45 µm and 0.2 µm syringe filters and loaded on Toyopearl-HW 50F resin for size exclusion chromatography (Column: 2.5 x 100 cm). The 5mM Tris-HCL with 1mM EDTA, pH 8.0 was used as a elution buffer at a flow rate of 60ml/h. The purified myoglobin will be used for further characterization using mass spectrometry.

3.01 Comparison of antioxidant and antimicrobial properties of heated turmeric with nitrite in chicken mince
GOSWAMI MEENA^a, PRABHAKARAN. P.^b AND V.K. TANWAR^c
A Department of LPT, DAVASU, Mathura ^bDivision of LPT,
IVRI, Izatnagar, Bareilly ^cDepartment of LPT, GBPUA&T,
Pantnagar

The nutritional and gastronomic value of cured meat has been adversely affected as nitrite is considered as potential health hazards due to its tendency to get converted into known potent carcinogens like nitrosamines. Lots of efforts have been made to replace the nitrite with other phyto-chemicals from consumer health point of view. In present study also, the antioxidant and antimicrobial properties of heated turmeric 1000ppm (120°C for 15 minutes) (HT) were compared to Turmeric 1000ppm (T) and Nitrite 200ppm (N) on minced chicken stored at 4±1°C. Physico-chemical properties (pH, TBA, PV and FFA) were evaluated on 0, 3, 6 and 9th day of storage. Antimicrobial studies as TVC, *E. coli* count, *Clostridium sporogens* count and *Clostridium perfringenes* count were carried out on 1, 4, 7 and 10th day of storage. Highly significant difference (P<0.01) was noticed between treatments and between storage periods in pH (5.922±0.03-HT as compared to C- 5.898±0.05 and N- 5.899±0.02), TBA(0.559±0.09- HT as compared to C-1.569±0.04 and N- 0.614±0.11), PV(1.566±0.17- HT as compared to C-2.595±0.41 and N-2.03±0.21), FFA(1.176±0.19- HT as compared to C- 2.284±0.40 and N-1.446±0.24 and N- 7.194±0.68), TVC(log CFU/g) (7.588±0.73-HT as compared to C-8.583±0.49 and N-6.446±0.53), *E. coli*(log CFU/g) (6.435±0.54-HT as compared to C-7.658±0.71 and N-6.609±0.61), *Clostridium sporogens* count (log CFU/g) (8.102±0.65-HT as compared to C-8.681±0.74 and N-) and *Clostridium perfringenes* count(log CFU/g) (7.663±0.84 - HT as compared to C- 8.790±0.53 and N-6.864±0.58). Heated turmeric was found to be highly effective than turmeric in terms of antioxidant and antimicrobial properties. Heated turmeric also had excellent potential to replace nitrite as natural antioxidant with other advantages. It was highly effective against *E. coli*. It was found to be effective against *Clostridium perfringenes*, *Clostridium sporogens* and TVC, but not upto the mark as in case of nitrite. Further research can be taken into consideration to replace nitrite with other spices and condiments for the production of safe and wholesome processed meat products.

3.02 Studies on development of Emu (*Dromaius novaehollandiae*) meat sausages

**S. S. ZANZAD, R. D. KOKANE, S. K. MANER, K. A.
PATIL, N. D. DANGE S. G. GONGADE AND Y. P. GADEKAR¹**
Department of LPT, Bombay Veterinary College, Mumbai.

1

Central Sheep and Wool Research Institute, Avikanagar, Rajasthan.

The present study was aimed to find out optimum process for preparation of sausages from Emu meat. The sausages were made by two methods viz., steam cooking (15 psi for 15 min, T₁) and water bath cooking (80⁰C for 30 min, T₂). The emu meat emulsion had an average composition as, protein 20.46 %, fat 8.76 %, ash 2.36 % and moisture 66.44 %. The pH was in the range of 6.0 for Emu meat emulsion. The WHC (%) of the emulsion found to be slightly lower than that of Emu meat 65.43 %. The emulsion stability averaged 95.81 %. The cooking yield was 96 % and 96.62 % in T₁ and T₂ respectively. Proximate composition was comparable. During storage, TBARS values were 0.11 and 0.29 on day 1 and increased to 0.14 and 0.38 on day 15 whereas, tyrosine values were 0.12 and 0.31 on day one and increased to 0.13 and 0.44 on day 15. Similarly, total plate and yeast and mold count were 2.55, 1.77 on day 1 which increased to 2.58, 2.18 cfu/g on day 15 in T₁ and T₂ respectively. However, sensory analysis revealed that steam cooked sausages (T₁) were significantly superior in almost all the sensory attributes over water bath cooked sausages (T₂). This study revealed that the acceptable quality of sausages from Emu meat can be made by steam cooking under pressure.

3.03 Physical, chemical, microbiological and sensory characteristics of chicken curries processed in retort pouches.

**I. PRINCE DEVADASON, A. S. R. ANJANEYULU, Y. BABJI AND
A. R. SEN**

National Research Centre on Meat, Chengicherla, Hyderabad.

Chicken curries filled in transparent flexible pouches were impulse sealed and processed at a F_0 Value of 6.50 with a processing time of 48 min in a water cascading retort sterilizer. The products were kept at ambient temperature and the physico-chemical, sensory and microbiological qualities were analysed in one month interval for a period of 18 months. The initial pH was 6.48 ± 0.03 at 0 day and there were no significant decline of pH at the end of 18 months. However TBARS values and Tyrosine values increased gradually from 0 day to the end of 18th month with the values of 0.18 ± 0.04 and 0.28 ± 0.02 at 0 day to 0.62 ± 0.03 and 0.69 ± 0.01 at the end of 18th month respectively. The sensory studies revealed that products were acceptable up to a period of 12 months with an overall acceptable score of 6.5 ± 0.01 at the end of 12th month. However after 15 months there was decline in the texture characteristics. The microbial studies were conducted for anaerobes, total plate counts and yeasts and moulds. The results showed that there was no growth till the end of 18th month. The study indicated that chicken curries processed at a F_0 Value of 6.50 were acceptable up to a period of 12 months.

3.04 Scanning electron microscopic study in correlation with texture and sensory characteristics of mutton curries processed in transparent retort pouches at different temperatures.

I. PRINCE DEVADASON, A. S. R. ANJANEYULU, Y. BABJI AND A. R. SEN

National Research Centre on Meat, Chengicherla, Hyderabad

In thermally processed foods, due to exposure to high temperature the textural and sensory characteristics of meat get altered. Mutton curries processed at a F_0 value of 6.75 at four different temperatures of 110°C, 115 °C, 118 °C and 121.1 °C. The mutton chunks were examined by scanning electron microscopy, shear force value and sensory characteristics for changes in the quality profiles. It was found that curries processed at 121.1 °C with a total processing time of 47 min showed intact muscle fibers and highly acceptable sensory profiles in the descending order of 118 °C, 115 °C and 110 °C. The study has revealed that high temperature with lesser processing time have better textural and sensory characteristics when compared to products processed at lesser temperature with longer processing time.

3.05 Shelf life quality characteristics of chicken nuggets processed in retort pouches by thermal processing.

I. PRINCE DEVADASON, A. S. R. ANJANEYULU AND A. R. SEN
National Research Centre on Meat, Chengicherla, Hyderabad.

The shelf life of chicken nuggets processed in 3-ply transparent retort pouches at $F_0=6.75$ in a still retort sterilizer were evaluated at 15 days interval for physico-chemical, microbiological and sensory attributes for a period of 12 months. The pH of the product was 6.28 at 0 day and a gradual decline was noticed during storage. Texture of the product as indicated by shear force values had decreased slowly. The residual nitrite content had significantly declined from 82.67 ppm at 0 day to 45.00 ppm on 12th month of storage. The TBARS values were 0.24 and 0.67 mg malonaldehyde /kg, respectively at 0 day and 12th month of storage. Tyrosine value had increased from 0.37 mg/100 g at 0 day to 0.58 mg/100 g at the end of 12 months of storage. The sensory studies indicated that the products were well acceptable up to a period of 12 months. As the storage period increased pH, residual nitrite, sensory attributes declined significantly and TBARS value, tyrosine value and free amino acid content significantly increased. Mesophilic aerobes and anaerobes were found to be absent. The shelf life study indicated that the products were well acceptable up to a period of 12 months based on the assessment of physico-chemical, microbiological and sensory attributes.

3.06 Development of ready to eat (RTE) meat products in retort pouches by thermal Processing.

**I. PRINCE DEAVADSON, Y. BABJI, A.R.SEN AND
V. V. KULKARNI.**

National Research Centre on Meat, Chengicherla, Hyderabad.

Thermal processing paved the way for the development of ready to eat (RTE) meat products. In the earlier days processors were using metal cans as packaging material for thermal processing. In the last four decades retort flexible packages have vastly replaced the dominance of metal cans due to their unique advantages such as cost effectiveness, thin profile, less processing time, more nutrient retention, convenience in use and easy to dispose. All kinds of products can be retort processed. The National Research Centre on Meat, Hyderabad is actively in the development of ready to eat (RTE) meat products in the last four years. Different kinds of meat products such as emulsion products namely sausages, nuggets and patties and many traditional meat products such as curries, kheema, soups, briyanis have been developed and the product's shelf life quality were studied upto a period of 12 to 18 months. NRC Meat, Hyderabad is also giving training to entrepreneurs who are interested to start their own enterprise. Royal Heritage Foods, Srinagar, J&K employees got trained at NRC Meat and are successfully running a retort processing unit processing Kashmere Delicacies called "wazwan". NRC Meat is also offering trainings regularly for entrepreneurs, students from SAUs and researchers from various facets of food industries.

3.07 Development and quality evaluation of protein rich mutton bar
K. JAYATHILAKAN, RAJKUMAR AHIRWAR, P. T.
HARILAL, K.A.SRIHARI, M.C.PANDEY AND
K. RADHAKRISHNA
Department of FD&APT, DFRL Mysore

Demand for high quality foods that are less heavily processed, containing lower levels of preservatives and requiring minimal preparation at the user end had been on the increase world over, including India. Extension of shelf life of perishable foods and maximum retention of desirable qualities in the processed foods are the primary aims of all methods of preservation. Standardization of innovative technologies for the development of convenient shelf stable meat products is a challenging task for meat technologists to meet the demands of domestic and export meat sector. Studies were conducted to optimise the process parameters and ingredients for the development of protein rich mutton bar. Compression conditions were optimised for mutton bar and established its shelf stability by evaluating the physico- chemical, microbiological and sensory attributes. Deboned mutton pieces were marinated and subjected for cooking and mincing. Minced meat was hot air dried at 75 °C for 6 hours to obtain a moisture content of 9.83 g/ 100 g. Microbiological studies were carried out at different stages of processing by incorporating control measures to attain microbial safety. Powdered and mixed with other optimised ingredients and subjected for compression in Carver hydraulic press using 1 ½" mold. The bar was packed in cellophane and paper fold polythene and subjected for storage evaluation at 45 °C, 37 °C and RT (30±2°C). The compression characteristics like pressure, moisture, dwell time etc were optimised to achieve a bulk density of 0.9928 g/cc and a compression ratio of 2.017 using 1 ½ " mould for 25 g bar. The optimised bar is a good source of protein (35.31 ± 0.36), carbohydrates (38.98 ± 0.15) and a moderate source of fat (10.14 ± 0.01) and provide 391 kCal/100 g. The a_w of the product was found to be 0.53. Oxidative and hydrolytic rancidity parameters like TBARS, Non-heme iron and FFA did not vary significantly ($p>0.01$) upto 6 months of storage at RT and 37°C. Textural characteristics revealed a significant increase ($p<0.01$) in firmness in terms of Newton during storage at 45 and 37°C. Hue angle and Chroma values obtained from L^* , a^* and b^* values indicated discoloration of the product stored at 45°C after 3 months. The product exhibited good microbiological safety throughout the storage periods at all temperatures. GLC profile of fatty acids revealed a ratio of 1:0.95:0.35 of SFA: MUFA: PUFA. Unsaturated fatty acids did not vary significantly ($p>0.01$) upto 6 months at RT and 37°C. Mutton bar stored at 45°C exhibited a shelf stability of 3 months in terms physico- chemical and sensory attributes. The product exhibited an overall acceptability score of 7.8±0.31 on a 9-point hedonic scale after 6 months of storage at 37°C. Mineral analysis of the product revealed a good source of zinc (155.2 µg/g) and iron (46.2 µg/g). The Ready-To-Eat product with quality protein and micronutrients developed by this technology can definitely meet the requirements of domestic and export meat products market and will be having lot of potential in civilian and service sectors.

3.08 Shelf life study of duck meat salami under refrigerated storage

**NASHRIN JEBIN, S. K. LASKAR, D. R. NATH, Z.
RAHMAN, D. M. CHAVHANAND D. J. KALITA.
College of Veterinary Science, A.A.U, Khanapara, Guwahati- 22,
Assam**

In the present study duck meat salamis were prepared by incorporating simultaneously glutinous rice flour in the increasing order i.e. 0, 5, 7 and 10 % and duck fat in the decreasing order i.e. 15, 10, 8 and 5 % in the formulations viz. Control, T₁, T₂ and T₃ respectively. These products were packed in food grade polyethylene bags and analyzed for shelf life study at refrigerated storage temperature ($4 \pm 1^{\circ}\text{C}$) with following parameters viz. pH, water holding capacity (WHC), water activity (a_w) and total viable psychotrophic bacterial count (TVPBC). It was observed that there was highly significant ($P < 0.01$) Increase in pH from 1st (5.85) to 15th day (6.13) of storage. Increase in WHC were also found to be highly significant ($P < 0.01$) on 15th day (31.23) as compared to the day 1 (23.98). The correlation studies revealed a marked significant positive correlation between WHC and pH ($r = 0.966^{**}$). Moreover, a_w values revealed a highly significant ($P < 0.01$) decrease from 0.9282 in 1st day to 0.8875 in 15th day of storage. The duck salamis however, revealed a significantly ($P < 0.01$) increasing trend in TVPBC from 5th (1.03) to 15th day (3.47) log₁₀ cfu/g of storage with no TVPBC on the 1st day of storage. The results of correlation studies revealed a significantly negative correlation between a_w and total viable psychotrophic bacterial count (TVPBC) ($r = - 0.988^{**}$). Finally, it could be concluded that low fat duck salamis incorporated glutinous rice four can be prepared with shelf life upto 10th day at refrigerated storage temperature.

3.09 Effect of cowpea (*Vigna unguiculata*) extension on the quality attributes of chicken block.

SUMIT KAUR, PRANEETA SINGH, V. K. TANWAR, Y. V. SINGH AND K. P. SINGH

Department of LPT, CV&AS, G.B.Pant University of Agriculture & Technology, Pantnagar.

Broiler meat industry has been the fastest growing industry for last few decades. The production has increased from 0.9 million tonnes in 2001, to 2.19 million tonnes in the year 2010. Plant proteins when added to meat emulsion, affect the properties of emulsion and its texture and alter the taste, flavor, appearance and nutritional qualities of the final product. Legumes are generally included in the diet of human beings as a source of rich quality protein. Therefore, keeping in view the above facts, the present study was envisaged to study the effect of extension of chicken block with cowpea on the product quality and consumer acceptability. Cowpea seeds were soaked and dehulled. These dehulled seeds were pressure cooked and grounded into paste. This paste was incorporated in the chicken mince at 0%(control), 5% and 10% level in the standard formulation replacing lean meat. The whole mixture was mixed with suitable ingredients and converted into emulsion. This emulsion was steam cooked in a mould to convert it, into a block. The blocks of three formulations were analysed for physico-chemical and sensory characteristics. On increasing the amount of cowpea incorporated in the emulsion, significant ($P<0.05$) decrease in the pH was observed. Water activity also decreased, though the difference was found to be non significant. Addition of cowpea paste showed significantly ($P<0.05$) higher cooking yield and emulsion stability. The values of emulsion stability at 0%, 5% and 10% level were 93.26%, 94.36% & 97.16% and of the cooking yield were 69.07%, 70.8% & 72.58% respectively. Significant ($P<0.05$) difference was observed in the TBA values of control and 10% level. The product produced was also analysed for proximate composition. Analysis revealed that, moisture content decreased significantly ($P<0.05$) on addition of cowpea. There was a significant rise in the protein content on increasing the amount of cowpea in the emulsion i.e., 0, 5 and 10%. It was observed that control product had significantly ($P<0.05$) higher amount of fat than 10%, though, the value decreased non significantly at 5% level. Ash content was not significantly affected with cowpea addition, moisture:protein ratio decreased significantly ($P<0.05$) on addition of cowpea. Sensory analysis, on nine-point hedonic scaling by a panel of 10 members, revealed that, the mean values for all the attributes viz. colour and appearance, flavor, texture, juiciness and over all acceptability were higher for 5% level of cowpea paste addition, though the difference in the treatments was non significant. Therefore, it can be concluded that dehulled and pressure cooked cowpea can be incorporated into chicken block at the rate of 5% to make an economic product of similar texture and good nutritional properties without any adverse effect on the consumer acceptability.

3.10 Comparison of product profile of extended restructured mutton chops incorporated with pre-optimized level of different bind enhancing agents.

HEENA SHARMA, B. D. SHARMA, SUMAN TALUKDER AND GIRIPRASAD R. Division of LPT, IVRI, Izatnagar, Bareilly U.P.

The main problem with restructured meat products is related to binding of meat pieces and extension of the product is generally associated with poor binding and texture of the product. Here, the non-meat ingredients play pivotal role and can improve the appearance, palatability and texture of the finished products. In this study, extended restructured mutton chops were prepared to compare the efficacy of various bind enhancing agents at pre- optimized levels of incorporation viz., tamarind seed powder (1%), flaxseed flour (1%), gum tragacanth (0.1%) and gum acacia (0.5%) by replacing lean meat in pre-standardized restructured mutton chops formulation. The products were subjected to analysis for physico- chemical, sensory attributes, textural properties and colour parameters. The incorporation of tamarind seed powder resulted in highest cooking yield and protein percentage among other bind enhancing agents ($P>0.05$). Flaxseed flour led to increase in fat percentage and resulted in highest shear force value of the product but results were comparable to tamarind seed powder and gum acacia incorporated product. pH of the product was not statistically different among bind enhancing agents. Among the sensory attributes, control product had significantly lower value ($P<0.05$) for all attributes. All the bind enhancing agents were equally efficacious in improving binding and texture of the product, however, best general appearance of the product was obtained with flaxseed flour ($P<0.01$). Springiness, and chewiness of the product were highest for tamarind seed powder product ($P<0.01$), while gumminess was comparable to gum acacia product. The maximum redness in the product was obtained with the incorporation of tamarind seed powder ($P <0.01$). The water activity values of the product incorporated with bind enhancing agents were comparable ($P>0.05$).

3.11 Development and evaluation of extended restructured chicken meat block incorporated with lotus (*Nelumbo nucifera*) root powder.

SUMAN TALUKDER, B. D. SHARMA, S. K. MENDIRATTA, R. R. KUMAR, KANDEEPAN .G, O. P. MALAV, HEENA SHARMA, GOKULAKRISHNAN.P,R.DEVAND P. TALUKDER

Division of LPT, Indian Veterinary Research Institute, Izatnagar, Bareilly.

Restructured meat products are convenient, economic and nutritious. To improve the functionality and acceptability of the product, variety of vegetative extenders can be effectively utilized. The present study was envisaged to incorporate hydrated lotus root powder (HLRP) at three different levels viz., 5, 7.5 and 10% in extended restructured chicken block (ERCB), by replacing lean meat in pre-standardized formulation. The products were subjected to analysis for physico-chemical, sensory, textural properties and the storage quality. Cooking yield, water activity and shear force values of the treatment products increased and pH value decreased significantly ($P<0.05$) with increasing level of HLRP in comparison to control, however, protein and fat percent of the 10% HLRP added products decreased significantly ($P<0.05$). Among the sensory attributes, product with 7.5% HLRP showed significantly higher values ($P<0.05$) for flavor and texture whereas for overall acceptability it was comparable with the control. In treatment products the hardness increased and the adhesiveness decreased significantly ($P<0.05$) in compare to control product. The microbial quality was studied and it was found that product could be safely stored under refrigeration ($4\pm 1^{\circ}\text{C}$) temperature in LDPE pouches for 15 days without marked deterioration in quality. On the basis of sensory, physico-chemical and microbiological quality of the RCMB the optimum incorporation level of HLRP was adjudged as 7.5%.

3.12 Consequences of nitrogen flushing on physical and sensory attributes of mutton Based snacks.

**S. K. MESHARAM, S. K. MENDIRATTA, S. CHAND, B. D. SHARMA
AND P. P. PRABHAKARAN Division of LPT, Indian Veterinary
Research Institute, Izatnagar, Bareilly**

During storage of mutton based microwaved snacks, the moisture % and water activity were increased and pH decreased irrespective of method of packaging. Initially TBA value decreased and thereafter increased throughout storage. Irrespective of packaging method, sensory attributes gradually decreased during the storage, however modified atmosphere packaged snacks (packaged with 100% nitrogen) had higher scores than aerobically packaged snacks on any particular days of storage. In aerobically packaged snacks, redness decreases during the storage, however in modified atmosphere packaged snacks it decreases up to 15th day and thereafter increased. Yellowness also increased significantly irrespective of the packaging. Thus, it can be concluded that technology of modified atmosphere packaging for shelf stable microwaved ready-to-eat mutton based snacks ensure better sensory quality and safety than aerobically packaging.

3.13 Study on effect of storage on rancidity and microbiological quality of tenderized spent hen meat pickle

**M. MURUGAN¹, K. S. JAYASREE, K. NARAYANANKUTTY
AND A. K. K. UNNI**

Department of Poultry Science, CV and AS, Mannuthy, Thrissur

An experiment was carried out to study the influence of ambient temperature storage of 64 days on rancidity and microbiological quality of chicken pickle using tenderized (papain treated) and untenderized boned broiler breeder (New Hampshire) spent hen meat. The 2-thiobarbituric acid (TBA) number of untenderized and tenderized meat pickle were ranged from 0.26 ± 0.01 to 0.89 ± 0.01 and 0.22 ± 0.00 to 0.86 ± 0.00 for zero to 64 days of storage. The TBA values between untenderized and tenderized groups were not differed significantly ($P < 0.01$). The TBA values were increased, as duration of storage increased in both the groups. The TBA number of untenderized and tenderized groups was influenced by storage periods and differences in TBA numbers between zero and any other period of storage was statistically significant ($P < 0.01$). The total bacterial count in untenderized and tenderized group were 2.60 ± 0.04 , 4.43 ± 0.04 and 2.60 ± 0.03 , 4.20 ± 0.06 (log number) at zero and 64 days of storage. However, a trend of significant increase in total plate count was observed both in untenderized and tenderized meat groups with the advancement of period of storage except second and third week of storage. But there is no significant differences existed in counts between untenderized and tenderized groups at all periods of storage. Fairly low counts were observed in untenderized and tenderized groups even at 64 days of storage and this might be due to inhibitory actions of the pickle additives like salt.

Note: Part of thesis submitted for Master of Veterinary Science (Poultry Science) to Kerala Agriculture University, Thrissur, and Kerala

3.14 Study on effect of ambient temperature storage on nutritive value of tenderized chicken meat pickle.

**M. MURUGAN, K. S. JAYASREE, K. NARAYANANKUTTY
AND A. K. K. UNNI**

Department of Poultry Science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur

A study was carried out to examine the feasibility of preparing chicken pickle using tenderized (papain treated) and untenderized broiler breeder spent hen meat and to evaluate its nutritive quality for a period of 64 days storage at ambient temperature. It was observed that period of storage significantly increased the proximate composition viz., per cent crude protein, ether extract, and total ash and decreased the moisture content of the product ($P < 0.01$). The mean percent moisture, protein, fat and total ash of untenderized and tenderized spent chicken meat pickle were 54.31 ± 0.50 , 26.65 ± 0.34 , 14.58 ± 0.27 , 3.66 ± 0.02 and 54.59 ± 0.15 , 24.42 ± 0.29 , 14.46 ± 0.37 and 3.61 ± 0.07 respectively. The proximate composition of untenderized and tenderized meat pickle did not differ significantly between the same periods of storage. But, within the untenderized and tenderized groups, the proximate composition were found to differ significantly ($P < 0.01$) between the periods of storage. In untenderized and tenderized groups, the moisture content on zero day decreased from 64.59 ± 0.49 to 54.31 ± 0.50 and 64.97 ± 0.20 to 54.59 ± 0.15 per cent on 64 days of storage. Storage of pickled meat had caused gradual, but significant ($P < 0.01$) reduction in the moisture of both the groups. Storage of pickled meat caused significant increase in the protein and fat content in control and treatment groups. Reduction in the moisture content of pickled meat during storage contributed the higher levels of protein and fat in pickled meat. In both, untenderized and tenderized groups significant increase in total ash was observed during storage, which was due to the diffusion of salt of the recipe in the pickled meat.

Note: Part of thesis submitted for Master of Veterinary Science (Poultry Science) to Kerala Agriculture University, Thrissur, and Kerala

3.15 Study on processing yields and cooking losses of pure bred New Hampshire broiler breeder spent hen.

**M. MURUGAN, K. S. JAYASREE, K. NARAYANANKUTTY
AND A. K. K. UNNI**

Department of Poultry Science, CV and AS, Mannuthy, Thrissur

New Hampshire is one of the promising breed in broiler industry especially used for developing broiler breeder male lines because of its superior meat type qualities. Spent or culled broiler breeder spent hens are also good source of meat, inspite of its low tenderness. To assessing the processing yields and losses of broiler breeder spent hen, a study was undertaken with six New Hampshire broiler breeder spent hen of 72 weeks old, reared under intensive deep litter management, slaughtered as per the standard methods. The mean live weight of broiler breeder spent hen was 2.10 ± 0.33 kg. The shrinkage after 8 hours feed withdrawal was 3.20 ± 0.12 per cent. Dressing yield was 89.50 ± 0.10 and blood and feather loss were 2.60 ± 0.95 and 7.80 ± 0.80 per cent respectively. Eviscerated yield was 65.40 ± 0.34 and Ready to cook yield (Eviscerated yield plus Giblet) was 70.50 ± 0.34 , and Giblet yield was 5.05 ± 0.09 per cent respectively. The Head and Feet yield were 3.90 ± 0.08 and 4.50 ± 0.05 per cent. The Total loss was 29.50 ± 0.32 of which loss due to inedible offal was 19.10 ± 0.21 per cent. The cooking loss of the broiler breeder spent hen was 25.75 per cent.

3.16 Storage stability of soy protein extended chevon patties at refrigeration temperature
SAKET YADAV, PRANEETA SINGH AND V. K. TANWAR
Department of LPT, CV& AS ,G.B.Pant University of Agriculture & Technology,Pantnagar

Goat meat (chevon) supplies a high quality protein and healthy fat, with minimal risk of cholesterol intake along with these, it's a rich source of number of minerals and vitamins viz., iron, potassium, sodium and thiamine. Thus, it is used in different processed forms like, patties, sausages, nuggets etc. Though, the use of soy protein in muscle food is being practiced for centuries, but nowadays its utilization in food industry is becoming more common, due to it's nutritional as well as functional qualities. Along with these qualities, soy protein is known to possess antioxidant property. Keeping in view the aforementioned facts the, present study was envisaged to assess the storage stability of chevon patties extended with 30% soy protein (soy 30) as compared with control (soy 0) at refrigeration ($4\pm 1^{\circ}\text{C}$) temperature. Chevon patties were prepared as per standard procedure with two sets of product viz., control (soy 0) and treatment (soy 30 i.e., chevon was replaced with soy crumbles @ 30%). These chevon patties were packed aerobically in sterilized LDPE bags and stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$). During storage these were subjected to various physico-chemicals, microbiological and sensory studies at every seven days interval till the product was unacceptable. During storage period the TBA values of control and soy 30 product increased significantly ($P<0.05$) from 0.417 to 1.03 and from 0.392 to 0.776, respectively. There was a significant ($P<0.05$) difference between TBA value of control and treatment group. Free fatty acid content increased significantly ($P<0.05$) in both the groups, but, the difference between the values of FFA content of control and treatment was non significant. The peroxide value showed a highly significant ($P<0.01$) effect of treatment and storage. The over all mean values during storage were 17.59 and 11.52 for control and soy 30, respectively. Which were significantly ($P<0.05$) different. There was a significant ($P<0.05$) increase in pH during storage period, but, difference between two groups was non significant. Microbiological analysis of the product revealed that during storage there was a significant ($P<0.05$) rise in the values of total plate count, coliform count and yeast and mould count from 0 to 14 days. Both coliform and yeast and mould were detected on 7th day. But the counts for control and soy 30 did not differ significantly. The products were also subjected to sensory analysis and it was observed that all the scores of sensory attribute viz. appearance/ color, flavor, texture, juiciness and overall acceptability, showed significant ($P<0.05$) decline during the storage period. But, the mean value for overall acceptability was significantly ($P<0.05$) higher for soy 30 (6.58 ± 0.185) than control (6.17 ± 0.114). Hence, it can be concluded that antioxidant property of soy protein showed a beneficial effect, on the physico-chemical and sensory characteristics of chevon patties, during storage period.

**3.17 Microbial and sensory qualities of pork patties incorporated
with dietary fiber From wheat bran.
RUPU SAHA, S. K. LASKAR AND D. R. NATH
Department of LPT, CVS, Assam Agricultural University, Guwahati**

In this study pork patties enriched with dietary fiber were evaluated for microbial and sensory quality. Wheat bran (WB) was used as the source of dietary fiber. In the treated formulations, the fiber was added at three different levels (2, 3 & 4%). The lean meat was replaced with wheat bran (WB) in the preparation of pork patties. These were evaluated in relation to the control (C_T) one containing no dietary fiber (0%). Emulsion was prepared by mixing the ingredients with minced meat and fat and then patties were cooked in pre heated hot air oven at $185 \pm 5^{\circ}\text{C}$ until the internal temperature reaches to $75 \pm 2^{\circ}\text{C}$. The cooked patties were packed in food grade polyethylene bags and stored at $4 \pm 1^{\circ}\text{C}$ up to 15 days. The Total Viable Psychotropic Bacterial Count (TVPBC) (log cfu/g) recorded in the study were higher ($P < 0.01$) in the C_T products. All the treated products recorded progressive increase bacterial counts ($P < 0.01$) along with the increase storage periods. No colititre values were recorded both in the C_T or treated formulations and also on subsequent storage days. There was significant decreasing trend ($P < 0.01$) in all the sensory qualities i.e. colour, flavour, juiciness, tenderness and overall acceptability scores from the C_T to the treated formulations containing WB at an increasing rate. The scores also decreased along with the increase storage periods, but were within the acceptable limits. It is concluded that pork patties can be prepared by replacing lean pork with dietary fiber from wheat bran up to 4% level, but C_T one showed highest acceptability followed by 2% level.

3.18 Effect of addition of oat bran fiber on the physico-chemical qualities of pork patties

RUPU SAHA, S. K. LASKAR AND D. R. NATH

Department of LPT, CVS, Assam Agricultural University, Guwahati

Pork patties were prepared using oat bran (OB) fiber at three different formulations i.e. OB₁ (2%), OB₂ (3%) & OB₃ (4%) and compared with control (C_T) containing no fiber (0%). Increased level of incorporation of oat bran fiber showed significant ($P < 0.01$) differences ($P < 0.01$) in the emulsion stability between the C_T and treated products. Increased duration of storage resulted in improved Water Holding Capacity (WHC) for both the C_T and treated products. Irrespective of C_T and treated formulations, an increasing trend in pH values along with the increase in storage period was recorded. Water activity (a_w) showed significant differences ($P < 0.01$) between the C_T and treated products, besides increased duration of storage had resulted significant decrease in a_w . The Thiobarbituric Acid (TBA) values increased significantly ($P < 0.01$) on storage from day 1st to 15th in both the control and treated formulations. A significant decreasing trend ($P < 0.01$) in cooking loss from the control to the treated formulations was observed. It is concluded that pork patties can be prepared satisfactorily with the addition of oat bran fiber up to 4% level.

3.19 Organoleptic evaluation and meat traits of pressure cooked and microwave cooked Chicken fillets

V. S. WASKAR¹, P. P. GOSAVI¹ AND A. A. DEVANGARE²
1Department of VPH 2Department of LPT, CVAS, MAFSU, Latur

Advent of technology has entered in our kitchen with man consumers are adopting modern tools in cooking in addition to traditional means. The present study was carried out to compare the effect of traditional cooking with modern cooking methods. Fillets were hygienically separated from breast portion of broilers were marinated using mix of common salt-spices-condiments and divided in two lots. One lot was subjected to traditional pressure cooking while remaining lot was microwave cooked using standard power-time conditions. Moisture, protein and fat values were found to be reduced by 12.34%, 3.31% and 1.02% after pressure cooking, while reduction was 0.86%, 1.17% and 4.29% after microwave cooking. Cooking loss was 16.49% more after pressure cooking than microwave cooking. Organoleptic evaluation by a sensory panel indicated that scores of appearance, colour, odour, juiciness, texture, tenderness, flavour as well as overall acceptability of microwave cooked chicken fillets were proportionately higher than pressure cooked chicken fillets.

3.20 Physico-chemical, sensory and keeping quality of plain and enrobed chicken balls

V. S. WASKAR

Department of Veterinary Public Health, College of Veterinary and Animal Sciences, Udgir, Dist.

Most of the consumers require variety in daily meals and so preference is given for ready to eat or ready to cook meat products. Culinary habits of the people have changed with availability of fast foods at every corner. Meat based preparations are given preference owing to their appearance, satiety and nutritional value. In the present study, chicken balls were prepared by emulsifying boneless minced chicken with permissible binders, extenders, spices and condiments added in appropriate quantities. Chicken balls roughly weighing 50 g were prepared and divided in two batches; one batch of balls was directly deep fried in refined edible oil while another lot was enrobed with thick paste of gram flour in water and deep fried. Both the types of chicken balls were evaluated for the physico-chemical and sensory attributes. For keeping quality studies, the balls were packed in LDPE pouches, stored at room temperature and drawn at three hourly intervals. The results indicated that plain chicken balls without enrobing showed 12.20% higher cooking yield and 8.43% lower cooking loss than the chicken balls enrobed with gram flour. Sensory attributes viz. appearance, colour, flavor, texture, juiciness and overall acceptability were adjudged significantly ($P < 0.05$) low for enrobed chicken balls than plain chicken balls. On the basis of sensory qualities, plain as well as enrobed chicken balls were acceptable up to 9 hours at ambient storage indicating moreover similar shelf life. It can be concluded that consumers tend to have more preference to plain and fried chicken balls than enrobed material.

3.21 Studies on quality attributes of chevon nuggets containing Arabic and guar gum

DIVYA

Avian Nutrition and Feed Technology CARI, Izatnager Bareilly-243122

The present study was conducted to determine the effect on quality of chevon nuggets after incorporation of two types of gum viz. gum Arabic and Guar gum @ 0, 0.5%.1.0% and 1.5%. Physico-chemical attributes such as cooking yield, emulsion stability, proximate composition and colour etc. was recorded in all the formulations. Storage stability of the products was evaluated at 0 oC for 2 months storage period. Cooking yield was significantly ($P<0.05$) higher in nuggets containing 0.5 % gum Arabic. However, there was a slight decrease in yield at the higher level of incorporated gums. Emulsion stability was higher in samples containing Guar gum at the level of 0.5 % and 1.0 % addition than that of gum Arabic at the similar level. No significant difference in moisture content of cooked nuggets Was observed at all levels of gum Arabic incorporation. However, the products added with Guar were having significantly higher ($P<0.05$) moisture content than that of control. Irrespective of levels of addition of both type of the gums, the hardness values decreased significantly ($P<0.5$). However, the decrease in hardness was more pronounced in the products with guar gum than that of gum Arabic. Other texture profiles of nuggets like springiness, cohesiveness, gumminess, adhesiveness and chewiness also decreased after addition of gums. There was no significant difference in colour of nuggets having Guar gum at all levels where as gum Arabic at 0.5% level of addition had significantly ($p<0.5$) higher redness values than other formulations. During storage, aerobic plate counts, coliforms and yeast and mould counts were recorded upto 60 days of storage. The aerobic plate counts were observed in the range of log 2.35 and log 2.65 and were within the acceptable limits. In the present study, no coliforms were detected in nuggets throughout the storage period. It can be concluded from the study that it is possible to reduce the addition of fat level in meat products through incorporation of natural gums without sacrificing the texture profile and sensory attributes of chevon nuggets.

**3.22 Healthy low fat functional chevon nuggets: Design,
development and quality evaluation
ARUN K. VERMA, V. RAJKUMAR, R. BANERJEE¹
AND ARUN K. DAS
CIRG, Makhdoom, 281 122, Mathura, India ¹Department of
LPT, Nagpur, 440006, India**

An approach was made through present investigation to develop healthier low fat Functional chevon nuggets with balanced PUFA/SFA ratio and to evaluate their various physicochemical, colour, textural and sensory properties as well as fatty acids profile against control. Low fat chevon nuggets were prepared with incorporation of goat fat (Control nuggets) and combination of goat fat and refined vegetable oil (Functional nuggets). Functional chevon nuggets had higher ($P<0.05$) emulsion stability, product yield, fat and ash content as compared to control nuggets. Ash content in functional emulsion was lower ($P<0.05$) than control. Hunter colour lightness value was higher ($P<0.05$) for functional chevon nuggets than control. Textural profile analysis revealed lower ($P<0.05$) hardness and work of shear values for functional nuggets as compared to control nuggets. Functional nuggets had lower ($P<0.05$) fatty acids such as (C10:0), (C14:0), (C14:1), (C15:0), (C16:0), (C17:0), (C17:1), (C18:0), (C18:1) and (C18:3) while fatty acids such as (C18:2), (C20:0), (C18:3), (C20:2), (C22:0), (C22:1), (C20:3), (C20:4), (C22:2) and (C24:1) were significantly higher. Medium chain triglycerides (MCT) and saturated fatty acids (SFA) were lower ($P<0.05$) in functional nuggets whereas polyunsaturated fatty acids (PUFA), omega-6 fatty acids, PUFA/SFA ratio (1.06 ± 0.05) and omega-6/omega-3 fatty acids ratio (4.46 ± 0.66) were significantly higher. Sensory evaluation of both the products revealed statistically non-significant differences ($P>0.05$) among all the attributes except flavour which was higher ($P<0.05$) for functional nuggets. Thus, use of combination of goat fat and vegetable oil in chevon nuggets makes them lighter, softer and flavourful as well as functional with balanced PUFA/SFA ratio.

3.23 Evaluation of the efficacy of pumpkin on the physico-chemical and sensory attributes of chicken sausages

FAYAZ AHMAD ZARGAR¹, SUNIL KUMAR², PARVEEZ AHMAD PARA³, WASEEM USSAIN RAJA⁴, PAVAN KUMAR⁵, NISAR AHMAD NISAR⁶, RIZWANA ZARGAR⁷, AND LATEEF AHMAD GANAIE⁸
1, 2,3,4,5 & 8 Division of LPT, Division of VP&T, ⁷Division of VB &P, SKUAST-Jammu 6

Three different levels of pumpkin viz. 6, 12 and 18 percent were used for the replacement of corresponding amount of lean meat in preparation of chicken *sausages*. The proximate composition, physico-chemical and sensory properties of *sausages* were analyzed. Amongst the different physico-chemical and proximate parameters pH, emulsion stability, cooking yield, crude protein and ash content were significantly ($p < 0.05$) lower in treated products as compared to control, where as the moisture content was significantly ($p < 0.05$) higher in treated products. Crude fibre increased significantly ($p < 0.05$) at 12 and 18% level of inclusion. Appearance and colour and flavor scores showed a non significant ($p > 0.05$) effect with different levels of incorporation. The juiciness scores were significantly ($P < 0.05$) higher at 18 percent level, whereas texture and overall acceptability was significantly ($P < 0.05$) lower. However reduction was not significant ($p > 0.05$) between the variants prepared by incorporation of 0 and 6 percent levels of pumpkin. The *sausages* with 12% level of pumpkin incorporation had highest ($P < 0.05$) overall acceptability score. Hence 12% incorporation level of pumpkin was found optimum for preparation of chicken *sausages*.

3.24 Comparative efficacy of optimum levels of kohlrabi, pumpkin and carrot separately in chicken sausages.

FAYAZ AHMAD ZARGAR¹, SUNIL KUMAR², PARVEEZ AHMAD PARA³, WASEEM HUSSAIN RAJA⁴, ARVIND KUMAR⁵, NISAR AHMAD NISAR⁶, RIZWANA ZARGAR⁷, AND MUZAFFER KHAN⁸

1, 2,3,4,5 & 8 Division of LPT, Division of VP & T, ⁷Division of VB & P, SKUAST-Jammu 6

A study was conducted to evaluate various physico-chemical properties and sensory attributes of the chicken sausages incorporated optimum levels of carrot (i.e.12%), pumpkin (i.e.12%) and kohlrabi (i.e.6%) and were compared amongst each other for physico-chemical properties and sensory acceptability. The pH of *sausages* with 6% added kohlrabi was significantly ($P<0.05$) lower as compared to control. Cooking yield in carrot treated *sausages* was significantly ($p<0.05$) lower than control. However it was significantly ($P<0.05$) comparable in the *sausages* with 12% added pumpkin and 6% added kohlrabi in the formulation. The moisture content in carrot and pumpkin containing *sausages* was comparable and significantly ($P<0.05$) higher than moisture content in kohlrabi containing *sausages*. The crude protein content in *sausages* with carrot and pumpkin was significantly ($P<0.05$) lower and comparable with each other, where as it was significantly ($P<0.05$) higher in control and kohlrabi containing chicken *sausages*. Ether extract content in the *sausages* with 12% added carrot was significantly ($P<0.05$) lower than rest of the treatments. The ash content in *sausages* with 12% carrot and 12% pumpkin was ($P<0.05$) significantly lower and comparable than *sausages* with 6% added kohlrabi and control. The crude fibre content was significantly ($p<0.05$) lower in control than the rest of the treatments. The mean overall acceptability score was significantly ($P<0.05$) higher in the products containing 12% pumpkin. Hence 12% incorporation level of pumpkin was found optimum for preparation of chicken *sausages*. Therefore, keeping all objectives in mind, the formulation with 12 percent pumpkin was adjudged as the best for development of fibre enriched chicken *sausages*.

3.25 Assessment of quality of okara incorporated chicken patties
JYOTI POONA, ANITA, ANCHAL PANWAR, V. K. TANWAR
AND S. K. BHARTI
Department of LPT, CVASc, GBPUAT, Pantnagar

A study was carried out to evaluate the quality of chicken patties, incorporated with okara as extender. Okara is a white yellowish soy pulp consisting of insoluble part of soybean and obtained as a soy milk by-product. It contains 24% protein, 8-15% fat and 12-14.5% crude fibre. On the basis of standardization trials, 20% okara added patties were prepared as treatment and simultaneously 20% gram dal added patties were prepared as control. Results revealed that moisture retention and water holding capacity of treatment was 89.52 ± 0.0122 and 55.966 ± 0.1428 respectively, which were significantly ($P > 0.05$) higher than control for which values were 88.323 ± 0.1443 and 54.663 ± 0.1819 . Whereas, cooking losses, pH and shrinkage values showed non-significant differences between treatment and control. Fat and ash content of treatment were 12.660 ± 0.7671 and 3.200 ± 0.9001 respectively which were significantly ($P > 0.05$) higher than control (6.900 ± 0.01513 and 1.7000 ± 0.5131). Crude fibre content of treatment and control were 5.2233 ± 0.1154 and 3.4600 ± 0.1000 respectively and differences between these values were significant ($P > 0.05$). Protein and moisture content showed non-significantly higher values for treatment than control. For the sensory characteristics treatment samples recorded significantly ($P > 0.05$) higher juiciness values i.e. 6.7666 ± 0.0882 for treatment than control i.e. 6.1333 ± 0.0577 . Flavour and texture values were also higher for treatment. However differences were not significant. Overall acceptability score of treatment (7.0333 ± 0.0333) was lower than control (7.3000 ± 0.0666) but differences between these values were not significant. It can be concluded that okara addition in chicken patties improves moisture retention, water holding capacity and sensory characteristics i.e. juiciness of chicken patties. Crude fibre content of product also increases, thus okara can be added as extender in meat products for value addition and as fibre additive.

3.26 Effect of incorporation of potato on quality of chicken cutlets

ANITA, CHETANA PANT, YOGESH KUMAR, V. K. TANWAR AND SUMIT KAUR

Department of LPT, CVASc, GBPUAT, Pantnagar

A study was carried out to assess the effect of addition of different level of potato (0%, 25% and 50%) on quality of chicken cutlets. Chicken cutlets containing 25% and 50% Boiled potatoes were prepared as treatments (T₂₅, T₅₀) and cutlets without adding potato were prepared as control (C) and compared for physicochemical characteristics, proximate Composition and sensory quality. Results of physicochemical analysis indicated that pH Values of both the treatments were higher than control and differences were highly significant ($P>0.01$). Cooking losses of T₂₅ and T₅₀ were 12.7666 ± 0.1666 and 13.2400 ± 0.1258 Respectively; which were significantly ($P>0.05$) lower than that of control (14.5600 ± 0.4313). Highly significant differences ($P>0.01$) were observed in WHC of treatments and control whereas; WHC of T₂₅ and T₅₀ did not differ significantly. Shrinkage of T₂₅ and T₅₀ were significantly ($P<0.05$) lower than that of control whereas; moisture retention of T₂₅ and T₅₀ were significantly higher ($P<0.01$) than that of control. Fat retention was significantly ($P<0.05$) higher for both the treatments than control, however, protein content of T₂₅, T₅₀ and C did not differ significantly. Moisture content of T₂₅ and T₅₀ were significantly ($P>0.05$) higher than C but values did not differ significantly between T₂₅ and T₅₀. However, no significant differences were observed in ash content of all the samples. Sensory evaluation revealed that highest ($P>0.01$) score for colour and appearance, juiciness and overall acceptability were observed for T₂₅. However, no significant differences were observed for texture value of T₂₅ and C; whereas; it was significantly ($P>0.05$) lower for T₅₀. It can be concluded that incorporation of potato for value addition of chicken cutlets at 25% level improves quality of chicken cutlets and also decreases the cost of production.

3.27 Development of shelf stable noodles from spent hen meat

K. A. PATIL, R. D. KOKANE, S. JOSE, S. S. ZANZAD, S. K. MANER, N. D. DANGE, S. G. GONGADE AND ¹Y. P. GADEKAR
Department of LPT, Bombay Veterinary College (BVC) Mumbai,
¹CSWRI, Avikanagar

The study undertaken to develop value added shelf stable noodles from spent hen meat. Spent hen meat emulsion and two flour mixtures (wheat flour and maida) were admixed in 60:40, 50:50 and 40:60 proportions to process dough through single screw cold extruder. Noodles contained 20-25% protein. These noodles after steam cooking were dried in a heat pump drier operated under lower humidity and temperature to retain as much as aroma as possible. The microbial quality of spent hen noodles stored at ambient temperature revealed that the total viable count significantly increased as the storage period advanced. The storage study was restricted up to 30 days due to high microbial load. However, the cost of one kg noodles in the present study varied from Rs. 65.55 to 75.20 per kg depending on the proportions of spent hen meat in the dough formulations. A value added shelf stable flour noodles can be economically extruded with incorporations of spent hen meat emulsions in different proportions.

3.28 Cabbage powder (*Brassica oleracea var. capitata alba*) as a source of antioxidant dietary fibre in goat meat nuggets
RITUPARNA BANERJEE¹ AND ARUN K. VERMA²
1Department of LPT, NVCollege, Nagpur ²GPT Lab, CIRG Makhdoom, Farah, Mathura

In the present study antioxidant potential of cabbage powder (CABP) was explored and further effects of its incorporation in goat meat nuggets as an antioxidant dietary fibre at three different levels i.e. 2% (Treat-I), 3% (Treat-II) and 3% (Treat-III) was evaluated against goat meat nuggets without cabbage powder (Control). Cabbage powder extract in water had 15.33 mgGAE/gm total phenolics while value in acetone water mixture (1:1) extract was 13.12 mgGAE/gm. DPPH radical scavenging activity and ferric reducing antioxidant power assay of both the extracts showed concentration dependent radical scavenging activity (RSA%) and absorption (A700). Cabbage powder contained rich amount of total dietary fibre (37.16%) which is comprised by 21.32% insoluble and 15.84% soluble fractions. Incorporation of CABP in goat meat nuggets improved ($P<0.05$) the moisture content, total phenolics and dietary fibre while ash content was decreased. Products redness value was decreased ($P<0.05$) whereas yellowness value was increased due to added CABP. Texture profile analysis revealed that addition of CABP significantly decreased ($P<0.05$) products hardness, gumminess and chewiness values. Sensorial parameters of the goat meat nuggets were not affected significantly due to added cabbage powder. Storage study of the products showed decreased ($P<0.05$) thiobarbituric acid reactive substance (TBARS) number with higher concentrations of CABP which was maintained throughout the 12 days refrigerated storage ($4\pm 1^{\circ}\text{C}$) period. Thus cabbage powder can be used as an antioxidant dietary fibre in goat meat nuggets to improve its sensory characteristics, functional and health values as well as storage stability.

3.29 Effect of pomegranate ellagic acid on physico-chemical and sensory attributes of chicken nuggets

A. A. SHEWALKAR, R. K. AMBADKAR, R. BANERJEE, K. S. RATHOD, H. P. NARKHEDE AND R. V. WAGH

Department of LPT, Nagpur Veterinary College, Nagpur-440006

An experiment was conducted to assess the physico-chemical and sensory properties of chicken nuggets made with or without incorporation of BHA (100mg/kg) and Pomegranate ellagic acid (PEA) at three different levels viz. 8 (T₁), 10 (T₂) and 12 mg/kg (T₃). Irrespective of treatment, pH, cooking yield and proximate composition showed insignificant effect. The free fatty acid content was found to be significantly (P<0.01) lower in PEA nuggets in comparison to control and BHA. Significant (P<0.01) decrease in peroxide value was observed in the order of control>BHA>T₁≥T₂>T₃. Significant (P<0.01) reduction in TBARS values were observed in PEA nuggets, however, values were not affected significantly irrespective of levels of PEA. Although, appearance was not found to be affected by the addition of PEA, flavour, juiciness, texture and overall palatability increased significantly (P<0.01) in PEA nuggets. The optimum scores for sensory attributes were observed in T₃.

3.30 Effects of addition of grape seed extract and dried holy basil powder as natural antioxidants in chicken nuggets

H. P. NARKHEDE, R. K. AMBADKAR, RITUPARNA BANERJEE, K.S. RATHOD, P. G. KOKARE, P. M. BOKDE AND ANJANA MANJHI

**Department of Livestock Products Technology, Nagpur
Veterinary College, Nagpur-440006**

An experiment was conducted to assess the shelf life of chicken nuggets made with or without incorporation of BHA (100mg/kg), Grape seed extract (9g/kg) (GSE) and Dried holy basil powder (4g/kg) (DHBP) at refrigeration temperature (4±1°C) for 25 days. A significant increase in pH of the treatment products during the refrigerated storage (4±10°C) period has been observed. Thiobarbituric acid (TBA) number (mg MDA/kg), Free Fatty Acid content (FFA) (% Oleic acid) and Peroxide Value (meq/kg fats) showed a similar gradual increasing trend during the storage period. Among the treatments, TBA number was found to be non-significant ($p>0.05$) in GSE, DHBP and BHA nuggets whereas all the samples varied significantly ($p<0.05$) when compared with control product. Peroxide values and FFA were found to be significantly ($p<0.05$) different among all the treatment groups. Of these, GSE treated chicken nuggets had the lowest values followed by DHBP, BHA and control product. Total Plate Count (\log_{10} cfu/g) and the Psychrophilic Count (\log_{10} cfu/g) were observed to follow a gradual significant ($p<0.05$) increase. A quite similar pattern of significant ($p<0.05$) inhibition of microbial spoilage in chicken nuggets was observed in both TPC and PC counts, among which GSE nuggets had the lowest count followed by DHBP, BHA and control product respectively. *E. coli* and *Salmonella* organisms were not detected in any samples throughout storage. Sensory studies revealed that GSE secured significantly ($p<0.05$) highest scores in appearance, juiciness and overall palatability followed by DHBP, BHA and control product. Whereas, DHBP nuggets reported significantly ($p<0.05$) highest scores in flavour and texture followed by GSE, BHA and control. From the above study, it can be concluded that GSE and DHBP can be opted by the meat processing industry in near future over synthetic established antioxidants.

3.31 Standardization of acidity level in hurdle treated chicken croquettes using lactic acid.

S. SHARMA, J. SAHOO, AND M. K. CHATLI
Department of LPT, College of Veterinary science,
GADVASU, Ludhiana.

Study was conducted to standardize the acidity level of hurdle treated chicken croquettes (treated with humectants in combination of 0.5% carrageenan + 5% texturized soya protein) using lactic acid. Three different treated meat batters having pH 6.0(T1), 5.6(T2), 5.2(T3) along with control(C) were prepared using chicken meat along with other ingredients viz. refined soyabean oil, salt, sugar, sodium nitrite, TSPP, skim milk powder, maida, spice mix, condiments in required quantity. The products were examined for different physico-chemical quality, texture & colour profiles and sensory quality. It was revealed that water activity was significantly ($P < 0.05$) lower in T3 than in T2, T1 and C, but is comparable with T1 and T2. Product pH, emulsion stability and cooking yield was significantly ($P < 0.05$) lower in T3 as compare to other treatments and control products. The colour profile showed a significantly ($P < 0.05$) higher L^* value and lower a^* value in T3 as compare to C, T1 and T2. While the texture profile exhibited a significantly ($P < 0.05$) lower value for hardness, cohesiveness, chewiness, gumminess and resilience and non-significant difference in springiness and stringiness in the T3 product as compared to other batches. The evaluation of sensory attributes showed a significantly ($P < 0.05$) higher score for flavour, texture, juiciness and overall acceptability in respect of T2 samples. Hence it was concluded that meat batter having pH 5.6 was the preferred pH for the preparation of chicken meat croquettes.

3.32 Effect of oats Quaker on the quality characteristics of chevon cutlets

SUNIL KUMAR, PRAMOD KUMAR SINGH, PAVAN KUMAR, Z. F. BHAT AND ARVIND KUMAR
Division of LPT, Faculty of Veterinary Sciences and Animal Husbandry, SKUAST- Jammu

A study was conducted to evaluate the effect of oats Quaker on the quality characteristics of chevon cutlets. Three levels of oats Quaker viz. 2%, 4% and 6% were incorporated by replacing the lean meat. The quality of the products developed was assessed for various parameters including proximate parameters, texture profile, colorimetric values, water activity and sensory attributes. The mean moisture values of the cutlets showed a significantly ($p < 0.05$) decreasing trend with increasing levels of incorporation of oats Quaker. The fat content of the cutlets also decreased significantly ($p < 0.05$) with increasing levels of oats Quaker. The addition of the oats Quaker significantly ($p < 0.05$) improved the fibre content of the products besides enhancing the colour and texture. Mean scores of various sensory parameters i.e. flavour, juiciness and overall palatability showed a decreasing trend with increasing levels of incorporation however, no significant ($p > 0.05$) change was observed up to the 4% incorporation level. The mean scores for appearance and color and texture showed an increasing trend with highest scores for the cutlets containing 4% oats Quaker. Almost all the sensory parameters decreased significantly at 6% level of incorporation. Thus, based on various physicochemical and sensory parameters, incorporation of oats Quaker at 4% level was considered as optimum for the development of chevon based cutlets.

3.33 Effect of aloe vera, amla powder and chitosan on the storage quality of modified Atmosphere packaged refrigerated low-salt restructured ham slices

J. SAHOO, M. K. CHATLI, J. SINGH, AND DEEPIKA RANI

Department of LPT, College of Veterinary science, GADVASU, Ludhiana

Four batches of restructured ham slices (RHS) were prepared viz. C (high salt control), T1 (low-salt), T2 (LS + aloe vera + amla powder) and T3 (LS + aloe vera + amla powder + chitosan), modified atmosphere packaged (70% N₂+30%CO₂), stored at a refrigerated temperature of 4±1o C for 42 days and examined for different quality characteristics. It was observed that the low-salt restructured ham slices (T1) had significantly (P<0.05) higher a* value, b* value, springiness and stringiness and significantly lower hardness, chewiness, colour score, flavor, juiciness and acceptability score as compared to high salt control (C) during the storage period. There was a significantly (P<0.05) lower TBARS number, free fatty acids and higher pH in T3 samples as compared to C, T1, T2 batches. The colour profile indicated a significantly lower L* value, b*value and higher a*value in T3 batch when compared to C, T1 and T2 products. The redness (a*value) of product was significantly improved due to the effect of aloe vera and amla powder as evidenced in T2 sample. All the low salt products (T1, T2 and T3) showed a significantly higher a* value as compared to control sample. There was a significant (P<0.05) increase in hardness, stringiness, gumminess and chewiness of T3 samples at the end of storage. In general the hardness of the product increased as the storage period progressed. There was no significant variation between C and T1 in respect of SPC and staphylococci count. However the natural preservatives aloe vera, amla powder and chitosan improved the microbiological quality. The T3 products showed a significantly lower SPC and staphylococci count as compared to C,T1 and T2 batches during refrigerated storage. The coliform count and yeast and mould were not detected in any of the product variants. The sensory attributes in respect of colour, flavor, texture, juiciness and overall acceptability remained significantly(P<0.05) higher in T3 batch as compared to C, T1 and T2 samples. Based on the findings it is concluded that use of aloe vera, amla powder and chitosan as natural preservatives is very useful to improve the quality of MAP low salt restructured ham slices up to 35 days in refrigerated storage.

**3.34 Utilization of aloe vera pulp in the development of designer
chicken nuggets**
**Z. F. BHAT, SUNIL KUMAR, PAVAN KUMAR, ARVIND KUMAR
AND PRAMOD KUMAR**
**Division of LPT , Faculty of Veterinary Sciences and Animal
Husbandry, SKUAST- Jammu**

The study was conducted to explore the utilization of Aloe vera (*Aloe barbadensis*) in the development of designer chicken nuggets. Three levels of Aloe vera pulp (*Aloe barbadensis*) viz. 5, 10 and 15 percent were used in the formulation replacing lean meat. pH of both raw as well as cooked chicken nuggets decreased significantly ($P < 0.05$) with increasing level of incorporation of Aloe vera pulp. Proximate parameters i.e. protein, fat and ash percent decreased significantly ($P < 0.05$) whereas moisture content increased significantly ($P < 0.05$) with the increasing level of incorporation. The sensory parameters decreased significantly ($P < 0.05$) with increase in the level of Aloe vera incorporation however, most of the sensory attributes of the nuggets containing Aloe vera upto 10 percent pulp were comparable with control. The developed chicken nuggets containing optimum level of Aloe vera pulp (10 percent) along with control samples were aerobically packaged in low density polyethylene (LDPE) pouches and were analyzed at a regular interval of 0, 7, 14 and 21 days during refrigerated storage at 4 °C. The mean pH values of the product showed a significantly ($P < 0.05$) increasing trend however, Aloe vera enriched nuggets showed significantly ($P < 0.05$) lower values in comparison to the control samples on all days of storage. The mean scores of all the sensory parameters decreased significantly ($P < 0.05$) with storage. Total plate count and psychrophilic count increased significantly ($P < 0.05$) throughout the period of storage although, the Aloe vera enriched samples showed significantly ($P < 0.05$) lower values than control samples. Coliforms were not detected throughout the period of storage. Free fatty acid (% oleic acid) and thiobarbituric acid reacting substances value (mg malonaldehyde/kg) also increased significantly ($P < 0.05$) with storage period but the Aloe vera enriched samples showed significantly ($P < 0.05$) lower values in comparison to the control samples.

3.35 Evaluation of the comparative efficacy of optimum levels of different flours as enrobing material on the quality characteristics of chicken nuggets containing optimum level of papaya pulp.

PARVEEZ AHMAD PARA¹, SUNIL KUMAR², WASEEM HUSSAIN RAJA³, FAYAZ AHMAD ZARGAR⁴, PAVAN KUMAR⁵, NISAR AHMAD NISAR⁶, RAHEEQA RAZVI⁷, AND

LATEEF AHMAD GANAIE⁸
, 2,3,4,5 & 8Division of LPT, 6Division of VPT, 7Division of VA, SKUAST-Jammu

A study was conducted to evaluate various physico-chemical properties and sensory attributes of the chicken nuggets enrobed with optimum levels of pea flour, black bean flour and green gram flour (25% w/w, 25% w/w and 25% w/w, respectively), containing optimum level (6%) of papaya pulp. The nuggets enrobed with 25% (w/w) green gram flour had significantly ($p < 0.05$) higher pH values whereas the pH of nuggets enrobed with 25% (w/w) pea flour and 25% (w/w) black bean flour showed a non significant ($p > 0.05$) difference with each other. The nuggets enrobed with 25% (w/w) green gram flour and 25% (w/w) black bean flour had significantly higher ($p < 0.05$) cooking yield. The moisture content in nuggets enrobed with 25% (w/w) pea flour and 25% (w/w) black bean flour was comparable and significantly lower than the moisture content in nuggets enrobed with 25% (w/w) green gram flour which had significantly ($p < 0.05$) higher moisture content. The extract content of the nuggets enrobed with 25% (w/w) black bean flour was significantly ($p < 0.05$) higher. However the selected levels of pea flour (25% w/w) black bean flour (25% w/w) and green gram flour (25% w/w) had a non significant effect ($p > 0.05$) on crude protein, ash and crude fiber content. The nuggets enrobed with optimum level of black bean flour in the batter had significantly ($P < 0.05$) higher coating thickness value as compared nuggets enrobed with optimum levels of pea flour and green gram flour in the batter mix. Juiciness and overall acceptability was significantly ($p < 0.05$) higher in the products enrobed with 25% (w/w) green gram flour. So 25% level of incorporation of green gram flour in the batter mix was considered optimum for preparation of enrobed chicken nuggets.

3.36 Effect of high pressure on instrumental colour, texture and microbiological qualities of chicken meat.

SURESH DEVATKAL¹, RAHUL ANURAG¹ AND P. SRINIVASA RAO²

¹Division of ASEC, CIPHET PAU Campus. Ludhiana, ²Department of AFE. IIT Kharagpur

High pressure processing (HPP) is a non-thermal technology used for manufacture of pasteurized meat products with natural taste and flavour. High pressure processing involves an application of elevated pressure (100-900 MPa) at process temperature of less than 45 °C. High pressure modifies only non-covalent bonds and does not affect small molecules such as flavor compounds and vitamins; therefore, leads to less degradation in nutritional and sensory qualities as compared to thermal processed meat products. A preliminary study was conducted to evaluate the instrumental colour, texture and microbial quality of chicken leg and breast meat treated at 300 MPa for 5 min. Vacuum packaged and chilled meat samples were subjected to a pressure of 300 MPa in a high pressure vessel with a dwell time of 5 minutes and depressurized immediately. The highest temperature reached during the pressurization cycle was 40 °C and after depressurization, temperature dropped back to near ambient. Visual observation showed an accumulation of exudates in pressure treated leg meat. Colour studies indicated a significant increase in Lightness (L) (56 to 72) and yellowness (b) (8.3 to 13.6) of pressurized breast and leg meat. Redness (a) value also increased (0.88 to 2.54) in leg meat treated with high pressure. Peak cutting force was 242 N in pressure treated as compared to 110 N in untreated leg meat. Pressure treatment further increased gumminess, springiness and chewiness values in poultry leg meat. Microbiological studies showed a reduction of 3.0-log, 1.6 -log and 1.0-log in total plate counts, *Enterobacteraceae* and *Pseudomonas* counts respectively. Further detailed investigations are being carried out to improve the quality and safety of chicken meat using high pressure processing.

3.37 Studies on shelf life of chicken meat emulsion incorporated with grape (*Vitis vinifera*) seed extract during refrigerated storage (4±1°C)

G. V. BHASKAR REDDY, A. R. SEN¹, K. SUDHAKARA REDDY, K. KONDAL REDDY, T. MADHAVA RAO AND N. KONDAIAH¹
Department of LPT, College of Veterinary Science, ¹NRC on Meat, Hyderabad

In the present investigation, antioxidant and antimicrobial efficacy of grape seed extract (GSE) comparing with synthetic antioxidant i.e Butylated Hydroxy Anisole (BHA) was studied in chicken meat emulsion during refrigerated storage (4±1°C). Grape seed extract (GSE) had significantly (P<0.05) lower 2- thiobarbituric acid reactive substance (2-TBARS) values and free fatty acid (FFA) per cent compared to control (C) and Butylated Hydroxy Anisole (BHA) during refrigerated storage (4±1°C) of aerobic packaged chicken meat emulsion. Addition of GSE significantly (P<0.05) reduced the total plate counts, total psychrophilic counts and coliform counts during 14 days of refrigerated storage (4±1°C). GSE recorded significantly (P<0.05) superior scores of colour, flavour, juiciness and overall palatability than C and BHA. As the progressing of storage period, 2-TBARS values, FFA per cent and microbial counts increased significantly (P<0.05) and sensory scores were decreased significantly (P<0.05) with irrespective of treatments during entire refrigerated storage (4±1°C). But, these quality changes were within limits and not caused any significant quality deterioration during 14 days of aerobic packaged chicken meat emulsion. The results of this study concluding that addition of natural antioxidant i.e grape seed extract @ 0.01% is delayed the rancidity development, actively inhibiting the growth of micro organisms and further increasing the shelf life up to 14 days during refrigerated storage (4±1°C).

3.38 Influence of tumbling and massaging on physico-chemical and textural quality of Restructured mutton slices.

G. V. BHASKAR REDDY, A. R. SEN¹, P. N. NAIR¹, K. SUDHAKAR REDDY, K. KONDAL REDDY AND T.MADHAVA RAO

**Department of LPT, College of Veterinary Science,
¹NRC on Meat, Hyderabad**

The increasing success of restructured meat products has been based on the efficient use of tumbling and massaging of meat with salt and phosphates for extraction of salt-soluble proteins which bind meat chunks in order to produce a texture similar to the more desirable steaks and chops. The present investigation was undertaken to evaluate the physico-chemical, binding and textural quality of restructured mutton slices processed with hand mixing (control), tumbling (1hour), Massaging (1 hour) and Tumbling + Massaging (30 minutes each). Both tumbled and massaged formulation recorded significantly highest ($P<0.05$) cooking yield (90.48%), batter stability (85.52%) and water-holding capacity (57.04%) than slices restructured by hand mixing, tumbling and massaging only. The pH of restructured mutton slices did not significantly ($P>0.05$) influenced by various mechanical processing methods. The total moisture, protein and fat per cent values were slightly highest in restructured mutton slices processed by hand mixing but there is no significant difference ($P>0.05$) were found between control, tumbling, massaging and both tumbled and massaged meat. The highest total protein extractability was recorded in restructured mutton slices processed by both tumbling and massaging (24.69%) which is significantly ($P<0.05$) more than tumbled (17.15%), massaged (14.24%) and hand mixing (06.51%) samples. There is no significant ($P>0.05$) difference was noticed in collagen content of all formulations but collagen solubility was significantly ($P<0.05$) highest in restructured mutton slices processed by both tumbling and massaging. Restructured mutton slices processed with both tumbling and massaging significantly ($P<0.05$) recorded more adhesiveness, chewiness, cohesiveness, springiness and less hardness scores compared to the slices processed by hand mixing, tumbling and massaging only. In sensory scores, appearance/colour, flavour and mouth coating scores were did not significantly ($P>0.05$) influenced by method of restructuring process but chewiness, cohesiveness, juiciness and overall palatability scores were significantly ($P<0.05$) highest in restructured mutton slices processed with both tumbling and massaging. Findings of this investigation revealed that processing of restructuring of mutton slices by both tumbling and massing process is suitable for successful production of restructured mutton slices with good textural integrity and palatability.

3.39 Effect of incorporation of rice flour on the physico-chemical quality of chicken Meat caruncles

SINGH. P, SAHOO. J, CHATLI, M. K AND BISWAS, A. K
Department of Livestock Products Technology, College of Veterinary Science, GADVASU, Ludhiana

The present study was carried out using spent hen meat which is a good source of animal protein and omega-3 fatty acids. Four different batches of chicken meat caruncles (CMC) were prepared from spent hen meat viz. C = 35% Refined wheat flour (RWF), T₁ = 22.75% RWF + 12.25% Rice flour (RF); T₂ = 17.50% RWF + 17.50% RF and T₃ = 12.25% RWF + 22.75% RF and their physico-chemical quality characteristics were examined. There was no significant difference ($P>0.05$) of emulsion stability (%), cooking yield (%) and water solubility index (WSI) among the control and treated CMC. The pH was significantly ($P<0.05$) lower in treated samples than control CMC. The a_w of control sample was significantly ($P<0.05$) lower than the treated sample but it did not significantly vary among T₁, T₂ and T₃ batches. The hydratability significantly ($P<0.05$) decreased in T₁, T₂ and T₃ Samples (0.96-1.27) as compared to control batch (1.63). Water Absorption Index (WAI) was significantly higher ($P<0.05$) in control than T₁ (3.79), T₂ (3.80) and T₃ (3.53) samples. The study showed that incorporation of rice flour improved the physico-chemical quality of chicken meat caruncles.

**Effect of clove powder and modified atmosphere packaging on
the sensory attributes of chicken meat caruncles during ambient
storage ($35\pm 2^{\circ}\text{C}$) conditions**

**SINGH. P, SAHOO. J, CHATLI M. K AND BISWAS A. K
Department of Livestock Products Technology, College of Veterinary
Science, GADVASU, Ludhiana**

Chicken meat caruncles were prepared in different batches i.e. CA (control, aerobic packaging), CMAP (Control, 50:50 CO₂/N₂ modified atmosphere packaging), TA (treated with 0.2% clove powder, aerobic packaging) and TMAP (treated with 0.2% clove powder, 50:50 CO₂/N₂ modified atmosphere packaging) and were stored at $35\pm 2^{\circ}\text{C}$ and 70% R.H. The sensory attributes were judged on an 8-point hedonic scale. Colour / appearance was significantly higher ($P<0.05$) in TA batch than CMAP and TMAP. Flavour score of TA sample was significantly higher ($P<0.05$) than CA. Crispiness of TMAP was significantly higher ($P<0.05$) than TA. The scores of After-taste, Meat flavour intensity and overall acceptability did not vary significantly among themselves. With the advancement of storage period, all the sensory attributes namely colour, flavour, crispiness, after-taste, meat flavour intensity and overall acceptability decreased irrespective of the type of product. The present study proved that treatment with clove powder and MAP could be effective to a great extent in improving the scores of sensory attributes of chicken meat caruncles.

Effect of process variables on texture profile of chicken meat caruncles

**SINGH. P, SAHOO. J, TALWAR. G, CHATLI M. K. AND
BISWAS A. K.**

**Department of Livestock Products Technology, College of Veterinary
Science, GADVASU, Ludhiana**

The effects of processing factors such as spent hen meat level, oil level and cooking time on textural attributes of shelf-stable ready-to-eat chicken meat caruncles were studied using Box-Bhenken design of Response Surface Methodology. The texture profile included Hardness (N), Adhesiveness (mJ), Adhesive force (N) and Stringiness (mm). All the textural parameters followed quadratic relationship with the process variables and having R^2 value $>90\%$. Linearly meat level showed significantly higher ($p<0.05$) effect on adhesiveness; oil level on adhesiveness and stringiness; and cooking time on adhesive force of chicken meat caruncles. Interaction of oil level and cooking time significantly ($p<0.05$) increased hardness, adhesiveness and adhesive force of chicken caruncles. Quadratically the effect of oil level was significantly higher ($p<0.05$) on all the textural attributes. The desirable product quality was achieved by 65% meat level, 5% oil level and a cooking time of 4 minutes where optimized values of hardness, adhesiveness, adhesive force and stringiness were 102N, 76mJ, 9N and 0.3 mm, respectively.

**Traditional meat products of India - Using geographical indications
(GI's) as a tool for enhancing their outreach & markets - A case study on
'Hyderabad Haleem'**

RAVI S¹ AND MUTHU KUMAR M²

**1Registered Geographical Indications Agent / Attorney, 2NRC
on Meat, Hyderabad**

Geographical indication (GI) is a name or sign used on products which possess certain qualities, uniqueness and enjoy a certain reputation due to its geographical origin. There are some very popular meat products in our country with unique characteristics to a given particular area / territory. A well-known example for such product is *Hyderabad Haleem*, the famous meat based product from Hyderabad. In Hyderabad region, it can be observed that the fasting (*roza*) undertaken by Muslims, during the holy month of Ramzan is culminated in the evenings (*iftar*) by having *Haleem*. Considering the uniqueness, special flavour and taste connected with the region of Hyderabad and traditional way of preparation, *Hyderabad Haleem* was identified for protection under Indian GI act and an application was filed for Geographical Indication with Indian Geographical Indication registry. Later, it was discussed with few prominent producer groups who have been involved in the manufacture of the product in the most traditional manner without any compromise whatsoever on the well laid out manufacturing procedures since historic days, for the embarking and initiation on the GI application. An association, Haleem Maker's association, Hyderabad, to represent the best interest of the producers of authentic *Hyderabad Haleem* was formed and registered as per the requisites of the Indian GI Act. The field study was conducted for various parameters for uniqueness and historic details of the product. The various processes and stages involved in the making of *Hyderabad Haleem* right from procurement of goat meat to boiling of meat with potable water in traditional utensils, addition of ingredients, processing, adding of spices at appropriate quantities at the required time, mixing of ingredients using special devices, stirring, mashing of final product for fine texture and final packaging were thoroughly studied and analysed. The Statement of Case (SOC) document which is a key for any GI application was prepared by evolving a standard method of manufacture of the product in its every stage. National Research Centre on Meat, Hyderabad had expressed consent to be one of the main inspection bodies for up keeping of the quality of authentic *Hyderabad Haleem*. Samples were analysed for the specific quality attributes of authentic '*Hyderabad Haleem*' by the institute. In recognition of its cultural significance and popularity, in 2010 '*Hyderabad Haleem*' was granted Geographical Indication status by the Indian GI registry, making it the first processed non-vegetarian food in India to be listed as a registered Geographical Indication of India.

Effect of marinating chicken meat with garlic paste at room temperature on common food borne pathogens

**SUDARSHAN S¹, NADEEM FAIROZE² AND
RENUKAPRASAD C³**

**1Dept of LPT, Vet. College, Bidar; 2Dept of LPT, Vet. Col.,
Bangalore 3VC, KVAFSU, Bidar**

To enhance the flavor addition of spices in food has been practiced from time immemorial. But the role of spices as a biopreservative has been a recent concept. The incidence of pathogens in Chicken meat especially of *Salmonella* and *E.coli* has been reported in India and elsewhere. Among the commonly used spices the role of garlic in different forms as an antibacterial has been well documented. The present study was underpinned with an objective of determining the antibacterial efficacy of garlic paste on common food borne pathogens in Chicken meat by marinating under ambient temperature. Chicken meat was marinated with 1.5 and 2.5 percent of garlic paste (w/w) wrapped in aluminum foil for different durations. Microbial analysis was carried out at 0, 2, 4, and 6 hr interval at room temperature (26 ± 2^0 C). The overall mean \pm SE values (log₁₀ cfu/g) of Total Viable Count, *Staphylococcus*, *E. coli* and *Salmonella* counts of chicken meat as influenced by marinating with 1.5 per cent garlic paste were 5.24 ± 0.07 , 4.34 ± 0.07 , 3.08 ± 0.09 and 3.02 ± 0.03 , respectively, for 2.5 per cent garlic paste were 4.95 ± 0.04 , 4.14 ± 0.17 , 2.94 ± 0.08 and 2.85 ± 0.06 , respectively. Among the different groups of garlic paste concentrations and time combinations, the analysis of the data showed a significant ($P < 0.01$) reduction in colony forming units at 4 hr duration of marinating with 2.5 percent garlic paste for TVC, *Staphylococcus*, *E. coli* and *Salmonella*. This result can be recommended to the regulatory agencies, meat processors as well as the households to produce high quality food items by

Marinating Chicken meat with garlic paste at room temperature to reduce the microbial load.

Acceptability of ready to eat chicken curry from *Krishibro* birds

NAGA MALLIKA. E AND NAGA RAJA KUMARI K¹

Department of LPT, ¹Department of PS, NTR College of Veterinary Science, Gannavaram.

Krishibro is broiler type suitable for backyard rearing. Considering the scope and Utilization of this variety for domestic consumption, an attempt was made to prepare ready to eat chicken curry using krishibro meat and to evaluate its quality in comparison with commercial broiler meat. Fresh chicken pieces washed with clean potable water kept in marinating mixture containing Vinegar as acidulant. The curry was prepared with addition of salt, spices and condiments to suit local taste. The sensory quality of ready to eat chicken curry of both commercial broiler and Krishibro were evaluated using 9 point Hedonic scale. The juiciness, texture and overall acceptability scores of Krishibro were almost consistent with commercial broiler ($P < 0.01$). Significantly higher flavour scores were recorded in the curry prepared with krishibro meat. However colour scores did not show any significant variation ($P < 0.01$). Over all pH of cooked curry was in range of 5.71 to 5.91 in gravy and pieces. Product pH in control commercial broiler and Krishibro did not reveal any significant difference. There was no significant variation in the proximate composition of the samples. Based on these findings it can be concluded that Krishibro meat can be utilized for domestic chicken meat preparations effectively.

**STUDIES ON EFFECT OF FERMENTED BAMBOO SHOOT
EXTRACT ON SHELF-LIFE OF PORK PICKLE**

**CHAVHAN. D. M¹, HAZARIKA. M², BRAHMA. M. L³,
RAHMAN. Z⁴ AND JEBIN. N⁵**

**1Department of VPH, BVC, Mumbai, 2CVS, AAU, Guwahati 3BU,
Assam, 4SV Dispensary, Sonabarighat, Cachar, Assam, 5National
Research Centre on Pig, Rani, Guwahati**

The fermented bamboo shoot extract (FBSE) which possesses strong antibacterial and flavouring properties is used for preservation of animal products since time immemorial in North Eastern Region of India. The tribal people relish the distinctive flavour of FBSE. A chemical preservative (Vinegar) which is normally used for preparation of pickle was substituted by FBSE at the level of 50 and 100% so as to determine its suitability as preservative without affecting the important quality parameters of pork pickle. The shelf life was studied for a period of 90 days at room temperature and was determined on the basis of pH, titrable acidity, thiobabaturic acid (TBA) values and total viable bacterial and mould counts. No significant differences ($P > 0.01$) with respect to mean values of pH, titrable acidity and TBA values of pork products with 50% and 100% replacement of bamboo shoot extract were found when compared to the control products. Pork pickles with 100% FBSE was found to be more stable than the control samples during the 90 days of storage period at ambient temperature. The total viable bacterial counts were found to be significantly ($P > 0.01$) lower in 50 and 100% FBSE incorporated samples however the loads were within the acceptable range in all the products. The yeast and mould counts were almost nil during the entire storage period. Based on the above study, it can be concluded that FBSE can successfully be used as organic natural preservative to replace the conventional chemical preservative (vinegar) even at ambient storage temperature.

Preparation and storage stability of retort processed, Indian traditional type chettinad chicken product

S. RAJAN, V. V. KULKARNI AND V. CHANDIRASEKARAN

Department of Meat Science and Technology, VCRI, Namakkal

Chettinad chicken was prepared using boneless meat derived from spent chicken and boiler breeder packed in retort pouches (250g), and processed in retort at the product temperature of 121.1°C and the corresponding F_0 value of 5.2. The product was stored at ambient temperature (35 ± 2 ° C) up to 180 days. The sensory scores for texture of the Chettinad chicken prepared from spent chicken and broiler breeder meat decreased significantly however the scores were rated very acceptable even on 180th day. The thiobarbituric acid (TBA), tyrosine values and acid value increased gradually during storage but *E. coli*, *Salmonella spp*, *Clostridium spp*, *Staphylococci spp*, *Streptococci spp*, yeast and mould could not be detected during the entire storage period. The cost of production of Chettinad chicken (250 g) prepared from spent chicken meat and broiler breeder meat was Rs.37 and Rs.50, respectively. It was concluded that the retort processed Chettinad chicken prepared from spent chicken and broiler breeder meat can be safely stored up to 180 days at ambient temperature.

**EFFECT OF MODIFIED ATMOSPHERE PACKAGING ON THE
STORAGE QUALITY OF GOAT MEAT WADDI AT AMBIENT
TEMPERATURE (35⁰C)
SAHOO. J, CHATLI. M. K, BISWAS. A. K, SINGH. J AND KAUR. M
DEPARTMENT OF LPT, COLLEGE OF VETERINARY SCIENCE,
GADVASU, LUDHIANA**

Goat meat waddi (GMW) is a shelf stable meat product. It was prepared using different ingredients such as minced goat meat, refined soyabean oil, salt, sugar, STPP, sodium nitrite, spice mix, baking powder, whole egg liquid, maida, carragenan, chilled water in required quantities as per formulation standardized in the laboratory. Four batches of GMW i.e. aerobic packaged (C), MAP 100% CO₂ (T₁), 100% N₂ (T₂), 50% CO₂+50% N₂ (T₃) were prepared, stored at temperature 35±2⁰C for 120 days and the samples were examined at 15 days interval for different physico-chemical, colour and texture profiles, microbiological quality and sensory quality. It was found that the pH of T₁ products was significantly (p<0.05) lower than other products from day 75 onwards. TBARS, FFA, PV followed an increasing trend throughout the storage irrespective of the packaging conditions. However, all the parameters were significantly (p<0.05) higher in aerobically packaged control product than MAP products. ABTS and DPPH value followed a declining trend during storage. However, the decline was significantly (p<0.05) lower in treated products than control. The colour profile (L*, a* and b* values) was comparable in all the treated products and control. The texture profiles i.e. hardness was lower in control product than treated product; however hardness followed an increasing trend during the storage. Springiness was comparable in all the batches irrespective of storage conditions and storage period. Cohesiveness, chewiness did not follow any trend during storage. The microbiological quality parameters including SPC, Yeast and mould and Staphylococci count were comparable in all the treated products; however it was lower than control batch. The sensory evaluation conducted by sensory panel members revealed that the colour and appearance, flavour, texture, juiciness and overall acceptability were better maintained in treated products than control during storage. Among treated products, the product stored under 100% CO₂ (T₁) maintained better appearance and colour and juiciness attributes. It is concluded that quality of GMW can be well maintained up to 120 days at ambient temperature (35⁰C) under different MAP conditions with 100% CO₂ is being preferable.

Extension of shelf life of hurdle treated restructured chicken meat slices using modified atmosphere packaging technology

JIMOMI. U, SAHOO. J, BISWAS. A. K AND CHATLI M. K

**Department of LPT, College of Veterinary Science, GADVASU,
Ludhiana**

Six variants of hurdle treated restructured chicken meat slices (RCMS) viz. aerobic control (T₁), aerobic hurdle treated (T₂), aerobic hurdle treated+chitosan (T₃), MAP control (T₄), MAP hurdle treated (T₅), MAP hurdle treated+chitosan (T₆) were prepared using different ingredients i.e. chicken meat mince plus chunks, refined soybean oil, salt, sugar, TSPP, sodium nitrite, spice mix, condiments, whole egg liquid, skim milk powder, amla powder, aloe vera gel, chitosan, chilled water of required quantity as per product formulation, packaged in LDPE or laminated pouches, stored at a refrigerated temperature of 4±1°C for a period of 35 days examined for different quality characteristics at a storage interval of 5 days. The a_w was found to be significantly (P<0.05) lower in hurdle treated+chitosan samples (T₃ and T₆) and also lower microbial load. T₃ and T₆ samples showed significantly (P<0.05) lower TBARS number and higher values for ABTS, DPPH, SASA (% inhibition) and total phenolic content as compared to T₂, T₅ and control batches both before and after storage indicating antioxidant efficacy of the natural preservatives used. Colour profiles indicated significantly (P<0.05) lower L* and higher a* and b* values in T₃ and T₆ products. Texture profiles indicated that hurdle treatment with incorporation of chitosan in RCMS significantly (P<0.05) improved the hardness character. Sensory attributes scores were significantly (P<0.05) higher in T₃ and T₆ samples during all the storage intervals regardless of the mode of packaging. SPC was significantly (P<0.05) lower in T₆ as compared to T₃ on day 20 and also it was lower in T₆ as compared to T₄ on day 35 indicating superiority of chitosan incorporation and MAP to improve quality of RCMS. Coliform count was not detected in T₃ and T₆ samples throughout the storage period indicating that hurdle treatment along with incorporation of chitosan could effectively check the growth of coliforms in the RCMS. It is concluded that hurdle treatment along with incorporation of chitosan and MAP could extend the shelf life of RCMS up to 30 days against 10 days in aerobic control sample.

Development and quality characteristics of tofu extended chicken meat nuggets

**N. K. NAYAK, V. PATHAK, V. P. SINGH, M. GOSWAMI,
PRAMILA AND TANUJA**

**Department of LPT, U.P. Pt. Deen Dayal Upadhyaya Pashu
Chikitsa Vigyan Vishwavidyalaya Evum Go Anusnadhan Sansthan,
Mathura**

The study was conducted with an aim to reduce the cost of chicken nuggets by replacing part of lean meat with soy paneer (Tofu) and soy flakes. Tofu and water soaked soya flakes at the rate of 20% each were used in the formulation of chicken nuggets. The proximate composition of chicken nuggets revealed that fat and ash content were higher and protein content was significantly ($P < 0.05$) lower in tofu extended chicken nuggets, however there was no significant variation ($P > 0.05$) in moisture content in either of the extended nuggets. Initially TBA value was observed significantly ($P < 0.05$) lower in both extended nuggets but there was no significant ($P > 0.05$) difference in pH. Under refrigeration TBA, pH and TPC subsequently increased upto 12 days of storage however, did not exceed the safer limit throughout the study period. The overall acceptability was highest and cost of formulated products was lowest in tofu extended chicken nuggets.

Studies on quality of emu meat sausages standardized in comparison with broiler

meat and spent hen meat sausages in refrigeration (4±1 c) and freezing (-18±1 c)

**GOVIND. V, PRABHAKAR. K, ESWARA RAO. B,
SRINIVASA RAO. T AND NAGAMALLIKA .E**

**Department of LPT, NTR College of Veterinary
Science, Gannavaram, A.P**

Emu meat available in the market at present is tougher, less juicy and darker in colour. Converting emu meat into emulsion based products like sausages offers better prospects as colour and palatability can be manipulated to enhance acceptability and marketability. Hence this study was undertaken in two phases. In phase I trials were conducted to standardize the recipe with the incorporation of corn flour and oat flour at 3% and 5% levels along with spices and condiments. Recipe with 5% corn flour incorporation was selected based on quality and economic considerations to study certain physico-chemical and organoleptic parameters at both refrigeration storage and frozen storage in comparison to the broiler and spent hen meat sausages of similar composition. Formulation with 5% corn flour had better colour (6.684 ± 0.06), tenderness (7.441 ± 0.077), juiciness (7.647 ± 0.072), flavour (7.723 ± 0.056), and overall organoleptic sensory acceptability (7.279 ± 0.017) along with better emulsion stability (94.189 ± 0.269), lower cooking loss (5.583 ± 0.2) and lower fat percent (6.957 ± 0.134). Storage studies were conducted for this formulation as it is more economical employing refrigeration and freezing in comparison to other two meat sausages. Irrespective of formulations, mean pH, Tyrosine, TBARS values and TVC of all three meat sausages had increased during refrigerated and frozen storage. Emu sausages recorded significantly higher pH (6.206 ± 0.006), Tyrosine value (0.842 ± 0.009) and lower TBARS (0.560 ± 0.023) in comparison to spent hen meat sausages. Total viable counts (4.594 ± 0.020), flavour (7.083 ± 0.027) and Juiciness (7.072 ± 0.028) score of emu meat sausages were significantly ($p < 0.01$) higher in comparison to other formulations. This study indicates that corn flour incorporation at 5% level in emu meat can contribute to significant economic gains, with the advantage of low fat meat formulation can be satisfactorily stored for 3 days in refrigeration and 3 months in frozen storage and equal quality in comparison to broiler meat sausages and better in quality comparison to spent hen meat sausages.

Effect of incorporation of pumpkin on quality characteristics of chicken meat patties.

AKHILESH K. VERMA, V. P. SINGH AND V. PATHAK

Department of LPT, U.P. Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evum Go Anusnadhan Sansthan, Mathura

The reported study was envisaged to reduce the cost of formulation of meat patties by incorporation of pumpkin without compromising on the acceptability. Four different variants were prepared replacing lean meat with pumpkin at the levels of 0, 10, 20 & 30 percent in the formulation. The formulation without pumpkin was taken as control. The analysis performed on the product revealed significant ($P < 0.05$) increase in moisture, ash and moisture: protein ratio while fat and protein content significantly ($P < 0.05$) decreased with enhancement in the level of pumpkin in formulation. Processing characteristics of control chicken patties were also significantly ($P < 0.05$) different with the pumpkin incorporated products. The moisture retention in the products was significantly ($P < 0.05$) increased with the increase in levels of pumpkin in patties. These products were microbiologically safe and counts were very well under the prescribed limits of processed meat products. All variants were very well accepted by the sensory panellists and were stable during 9 days storage period under refrigeration. The formulation containing 20 percent pumpkin was found best on the basis of various estimated parameters.

Application of hurdle concept in development of chicken lollipop

**V. P. SINGH, V. PATHAK, N. K. NAYAK, M. GOSWAMI,
TANUJA AND PRAMILA**

**Department of LPT, U.P. Pt. Deen Dayal Upadhyaya Pashu
Chikitsa Vigyan Vishwavidyalaya Evum Go Anusnadhan Sansthan,
Mathura**

Chicken lollipop is one of most relished chicken meat products throughout the globe. The study was conducted to increase the shelf life of lollipops using combination of hurdles. The chicken wings were collected and shaped into the lollipop. Three different combinations were used i.e. control (lollipop without glycerol), T1 (lollipop with glycerol and corn flour) and T3 (lollipop with glycerol and bread crumbs). The chicken wings shaped in lollipop were then marinated for two hours. After marination lollipop were rolled over the corn flour/bread crumbs followed by cooking in controlled time temperature combination. Developed lollipops were subjected to physico-chemical, microbiological and sensory evaluation. The initial total plate counts did not differ significantly in any variants however significant ($P < 0.05$) differences in TPC were observed between the control and other variants during storage under refrigeration. The product developed using glycerol and bread crumbs were found best in terms of sensory evaluation and microbiological quality.

Effect of different cooking methods on the quality attributes of chicken lollypops

TARUNPAL SINGH, MANISH K. CHATLI AND JHARI SAHOO

Department of LPT, CVS, GADVASU, Ludhiana

Poultry wings are low-value cuts and development of value added products such as chicken lollypops can improve its marketability. The present study was conducted to evaluate the effect of different cooking methods on the processing, sensory and instrumental texture & colour profile of chicken lollypop. Initially wings were marinated (salt, spice mix, condiments, curd, barbeque sauce, STPP) for 2 hours and then dipped in batter and brushed with bread crumbs and thereafter cooked into three batches viz; T-1; oven cooking (175°C, 24 min.), T-2 -deep fat frying (165°C, 6 min.) and T-3; Combination (oven cooking at 175°C, 12 min. & shallow frying at 165°C, 1.5 min.). The products were compared for physico-chemical (pH, cooking yield, water activity, texture and colour profiles) and sensory properties. Results exhibited that cooking yield was significantly higher ($p < 0.05$) in T-1 amongst all the treatments. Water activity recorded highest for T-1, whereas lowest for T-2. Instrumental colour parameters lightness (L^* values) was measured highest for T-1, redness (a^* values) and b^* values were highest in T₂ and T₃ respectively. The textural profile characteristics were comparable in all the treatments. The sensory quality attributes including overall acceptability were significantly ($P < 0.01$) higher in T₂ than T₁ and T₃. Results concluded that the sensory attributes of deep fat fried chicken lollypops were better with improved redness and lower water activity value, however it has lower cooking yield.

Efficacy of Apple (*Malus domestica*) peel extract as an antioxidant in pork emulsion

**MANISH K. CHATLI, GAURI JAIRATH, RAVNEET KAUR
AND JHARI SAHOO**

Department of LPT, CVS, GADVASU, Ludhiana

Lipid oxidation deteriorates the colour and flavour of meat and meat products. Natural antioxidant can be explored to improve the oxidative stability of meat during aerobic refrigeration storage. The present study was conducted with an objective to evaluate the antioxidant potential of apple peel extract (APE) prepared in different solvents viz. acetone (T-1), methanol(T-2) and ethanol(T-3) in comparison to control (C) in raw pork emulsion during refrigerated storage ($4\pm 1^{\circ}\text{C}$) under aerobic packaging conditions. APE was incorporated at 3% concentration level in pork emulsion (lean meat:fat:: 80:20, salt;1.5%). The samples were drawn on 0,2,4 and 6th day and evaluated for various physiochemical (Total phenolics; TP, 2,2-azinobis-3ethylbenthiiazoline-6-sulphonic acid radical scavenging activity; ABTS, pH, titratable acidity, Thiobarbituric acid reactive substances; TBARS, visual colour & odour scores, instrumental colour profile) and microbiological parameters (Standard Plate Count; SPC, Coliforms, *Staphylococcus spp*, yeast & mould count). TP content was extracted highest in T-1 and lowest in T-3. The indicators of oxidative stability of pork emulsion; ABTS and TBARS value were significantly ($p<0.05$) improved in treated products than control. ABTS value was measured highest for T-2 and lowest for T-1 among treated products. TBARS values were comparable in T-1 and T-2 however, it was significantly lower than T-3 and control. TBARS values followed an increasing trend whereas ABTS decreased during storage. The visual and instrumental colour profile was comparable in control and treated products on day 0, however it remained stable in treated products whereas it declined in control throughout storage. pH was significantly ($p<0.05$) higher in control than treated products. SPC, Coliforms, *Staphylococcus* and yeast & mould count were significantly lower in all the treated products than control irrespective of the type of solvent used for the extract preparation. Results concluded that APE prepared with methanol has stronger antioxidant potential with better microbial quality without any deteriorative effect on the odour of the pork emulsion during refrigerated storage under aerobic packaging conditions.

Oxidative stability of pork emulsion incorporated with different Apple (*Malus domestica*) pomace extract

**GAURI JAIRATH, MANISH K. CHATLI, RAVNEET KAUR
AND JHARI SAHOO**

Department of LPT, CVS, GADVASU, Ludhiana

Lipid oxidation-induced quality problems can be minimized with the use of natural antioxidants. Antioxidant potential of apple pomace extract was prepared in acetone (T-1); methanol (T-2) and ethanol (T-3) and was incorporated at 3% level in raw pork emulsion (lean meat: fat - 80:20, salt 1.5%) stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$) under aerobic packaging conditions and was compared with control (C). The pork emulsion was stored for 6 days and the samples were drawn at 2 days interval to evaluate (Total phenolics; TP, 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid radical scavenging activity; ABTS, pH, titratable acidity, Thiobarbituric acid reactive substances; TBARS, visual colour & odour scores, instrumental colour profile) and microbiological parameters (Standard Plate Count; SPC, Coliforms, *Staphylococcus spp.*, yeast & mould count). TP content was measured highest for T-1 whereas ABTS value was highest for T-2 and these followed a declining trend throughout the storage. TP content and ABTS value were significantly ($P < 0.05$) higher in T-2 than all the treatments on last day of storage. TBARS value was comparable in T-1 and T-2 however it was significantly ($p < 0.05$) lower in treated products than control. Visual and odour scores were comparable in treated and control product on day 0, however it decreased with the increase in storage days w.r.t. control. SPC, Coliforms, *Staphylococcus* and yeast and mould count were significantly lower in treated product than control and similar trend followed throughout storage. Our results indicated that apple pomace extract prepared in methanol have better antioxidant potential and can be successfully utilized in raw pork products to minimize lipid oxidation, off-odor development, and surface discoloration.

Comparative evaluation of various Apple (*Malus domestica*) pulp extract as an antioxidant in pork emulsion

RAVNEET KAUR, MANISH K. CHATLI, GAURI JAIRATH AND JHARI SAHOO

Department of LPT, CVS, GADVASU, Ludhiana

Pig meat is rich in unsaturated fatty acids, therefore highly susceptible for oxidation. It can be minimized with the use of natural antioxidants. Therefore present studies was conducted with an objective to evaluate the antioxidant potential of apple pulp extract prepared in different solvents viz. acetone, methanol and ethanol in raw pork emulsion during refrigerated storage ($4\pm 1^{\circ}\text{C}$) under aerobic packaging conditions. The extract was prepared using fresh apple pulp with above mentioned solvents in ratio of 1:9. The extract was incorporated up to 3% in pork emulsion and the samples were drawn at 2 days interval for evaluation of various physiochemical, visual colour and odour scores, instrumental colour profile and microbiological characteristics. TP content extracted highest in pulp-ethanol extract however, ABTS value was higher with pulp-methanol extract. pH was measured lowest with pulp-methanol extract and followed a increasing trend upto day 4 and thereafter decreased on subsequent storage. TBARS value was significantly ($P<0.05$) lower in treated products than control and measured lowest with pulp-acetone extract on day 6th of storage. Visual and instrumental colour profile were comparable in all the treated and control products. SPC, Coliforms, *Staphylococcus* and yeast and mould count was numerically lower with pulp-methanol extract than other treated samples however, it was significantly ($P<0.05$) lower in all the treated products than control. Hence, it can be concluded from the results that the pulp-methanol extract can be effectively used as an antioxidant in pork emulsion without any deteriorative effect on colour and odour of the meat.

Effect of clove oil (0.1%w/w) on the quality characteristics of papaya pulp enriched enrobed chicken nuggets at refrigerated storage (4±1°C).

PARVEEZ AHMAD PARA, SUNIL KUMAR, WASEEM HUSSAIN RAJA, FAYAZ AHMED ZARGAR AND ARVIND KUMAR

Division of LPT, SKUAST-Jammu.

The addition of clove oil in the meat emulsion showed a significant ($P < 0.05$) effect on some physico-chemical properties, microbiological properties and sensory attributes of chicken nuggets. The products were stored under refrigeration temperature ($4 \pm 1^\circ\text{C}$), aerobically packaged in low density polyethylene pouches (LDPE) and were analyzed for physico-chemical, microbiological and sensory parameters till spoilage at 0, 7, 14, 21 days. In the present study, the pH value followed a gradual decreasing trend with the advancement of storage period. However in almost all treatments the pH value was significantly lower on day 21st of the storage. Clove oil treated products had higher acceptability with lower thiobarbituric acid reacting substances value (TBARS), free fatty acid (FFA) values and also lower total plate count (TPC), Psychrophilic count (PC) and yeast and mould (YMC) counts. Sensory scores reduced gradually with increase in the storage days. The sensory ratings remained between fair to very good upto 14 days during the storage period. On the basis of the various sensory scores and microbiological parameters the product was declared spoiled on 21st day of storage period. Thus, clove oil treated products could be stored safely in LDPE pouches for 14 days under refrigeration ($4 \pm 1^\circ\text{C}$) without any marked loss of physico- Chemical, microbial and sensory quality.

Effect of feeding organic iron and zinc on protein and ash content of the japanese quail meat

PRAKASH SANNAMANI, JAYANAİK, D. T. PAL¹, K. VENKATA REDDY AND H. N. N MURTHY

Department of PS, Veterinary College Hebbal, ¹NIANP, Adugodi, Bangalore

An experiment was carried out to evaluate the effects of feeding different levels of organic Fe (Fe-methionine) and Zn (Zn-methionine) on protein and ash content of the Japanese quail meat. A total of 600 day old quail chicks were allotted to five treatment groups (T1 to T5) of 120 chicks each with four replicates consisting of 30 birds per replicate. Birds were housed in battery cages under standard managerial conditions and fed *ad libitum* for a period of six weeks. Control diet (T1) was formulated by incorporating inorganic iron (120 mg/kg) and zinc (25 mg/kg) according to NRC (1994) specifications. The inorganic Fe (FeSO₄) and Zn (ZnSO₄) of the control diet were replaced by organic iron and zinc at recommended level (T2), two (T3), three (T4) and four times (T5) of NRC (1994) specifications. All the five experimental diets were formulated to be isonitrogenous (24% CP) and isocaloric (2900 Kcal/kg ME). The protein content of the meat (%) was highest ($P \leq 0.05$) in T3 group fed with organic Fe (240 mg/kg) and Zn (50 mg/kg) when compared to both higher (T4 and T5) and lower levels (T1 and T2) of iron and zinc fed groups, and it was lowest ($P \leq 0.05$) in inorganic (control) iron (120 mg/kg) and zinc (25 mg/kg) fed group. Ash content of the meat was lowest ($P \leq 0.05$) in inorganic iron and zinc fed control group when compared to organic Fe and Zn fed groups (T2 to T5). However, among organic Fe and Zn fed groups, birds fed with highest level (T5) of Fe (480 mg) and Zn (100 mg) had lowest ($P \leq 0.05$) ash content in meat than other experimental groups (T2 to T4). The study revealed that supplementation of increasing levels of iron and zinc up to 240 and 50 mg/kg, respectively, in organic form have beneficial effect on protein content of the Japanese quail meat.

Study of physico-chemical properties of the vacuum packed guinea fowl meat sausages at refrigeration temperature

**RUMA DEVI, V. K. TANWAR, P. K. SINGH,
PRANEETA SINGH, ANITA, AND P. P. PRABHAKARAN**

**Department of LPT, CVAS, G. B. Pant University of Agriculture
and Technology, Pantnagar**

In the busy world of today, there is a great need of value added ready to eat food products, having increased shelf life because globalization has changed the lifestyle of people to great extent. In this regard sausages are better alternate to other conventional food types. Guinea fowl meat has a unique taste to introduce variety on the dinner table rather than always having chicken, and the taste is similar to pheasant, without the excessive gamey flavour. The Guinea fowls mature at an early age, and are extremely delicate and flavourful being firm and plump, the Guinea fowl is easy to prepare and does not require defatting. In recent years there has been an increased demand for guinea fowl meat because it is lean and rich in essential fatty acids. The muscle is low in calories with only turkey meat having fewer calories than it. The meat is rich in vitamins such as vitamins E, B & B₂ and minerals such as magnesium, calcium and iron. Guinea fowl meat is a good source of iron and protein. The present investigation was envisaged to assess the Physico-Chemical properties of guinea fowl meat sausages under vacuum packaging condition. Guinea fowl meat sausages were subjected to two different types of packaging treatment i.e. aerobic packaging with low density polyethylene bags (control) & vacuum packaging using barrier bags (Treatment) & stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$). Physico-Chemical properties were analysed on 0th, 3th, 7th, 14th, 17th, 21th, & 30th day. pH of the aerobically packaged product was found to be non-significantly higher ($P>0.05$) than vacuum packaged product during storage period. Water activity was found to decreased during the storage period both in vacuum as well as aerobically packaged product, but the values were non-significantly higher ($P>0.05$) for aerobically packaged sample as compared to vacuum packaged product. The vacuum packaged product showed a highly significant ($P>0.01$) lower TBA & FFA value than aerobically packaged product throughout the observation period. Hence it can be concluded that vacuum packaging has a beneficial effect on Physico-Chemical properties of the product better than aerobic packaging.

Studies on processing and quality evaluation of meat surimi products

R. C. KESHRI AND S. K. MENDIRATTA

Division of Livestock Products Technology, IVRI, Izatnagar

Attempts were made to develop suitable processing conditions and formulations of meat surimi products of indigenous nature and the quality of the products were evaluated in fresh and stored conditions. Surimi is a much enjoyed food product in many countries and is available in many shapes, forms and textures. Generally, fish or meat of land animals is used for preparation of surimi products. The separated meat is minced or beaten to form a gelatinous paste. Depending upon the desired texture and flavour of the product, the paste is mixed with differing proportions of additives. This is then processed into surimi products. Meats of aged chicken were tried in the present investigation. The convenience, suitability and performance of surimi products such as meat balls, nuggets and patties were studied. The physicochemical (pH, TBA values and proximate composition) and sensory quality (appearance & colour, flavour, juiciness, texture and overall acceptability) of the standardized products were evaluated. Enhancement of the quality by further addition of preservatives (BHA plus BHT) and storability of the product in refrigeration ($4\pm 1^{\circ}\text{C}$) and frozen ($-18 \pm 2^{\circ}\text{C}$) conditions on the basis of physicochemical, sensory and microbial parameters were carried out. Ready to eat meat products namely patties, meat balls and nuggets of high sensory acceptability could be prepared by mincing the meat and fish flesh once mechanically passing through 8 mm sieve plate of a grinding machine followed by manual beating with wooden hammer to obtain better textural and binding properties in the final products. Meat patties, meat balls and meat nuggets of optimal quality could be prepared from emulsion having combination of fish flesh and chicken meat at 20:80 levels respectively, along with other ingredients, seasonings and condiments. Ready-to-eat products processed from chicken meat plus fish flesh (80:20) was found to contain 56.48 to 68.18 percent moisture, 14.23 to 22.17 percent protein and 8.91 to 11.44 percent ether extracts. The overall sensory acceptability was "Good to Very good". The microbial enumerations (TPC) of these finished products in fresh conditions were 1.71 ± 0.12 , 2.04 ± 0.07 and 1.92 ± 0.09 log cfu /g respectively, for the patties, nuggets and meat balls. The ready to eat products so prepared could be safely stored up to 20 days at refrigeration temperature (4°C) and for 60 days at frozen temperature (-18°C) without any adverse effect on physico-chemical, sensory and microbial qualities. The finished product's cost could, thus, also be reduced to 10 % of the cost of the major meat after incorporating fish in the formulation.

Effect of humectants on the physico-chemical characteristics of buffalo meat sausage

S. SURESHKUMAR, A. KALAIKANNAN AND V. VENKATARAMANUJAM

**VCRI, Tamil Nadu Veterinary and Animal Sciences University
Namakkal,**

A study was conducted to optimize the effect of a_w , antibacterial, antioxidant and vacuum packaging during the development of shelf stable buffalo meat sausage. In the experiment, humectants viz. ISP (3 per cent), sugar (1 per cent) and sodium lactate (2 per cent) were employed for the preparation of sausages to adjust the a_w to 0.90 and 0.88 along with extended cooking time. The effect of a_w on the storage stability of the sausage stored at ambient temperature ($35\pm 2^\circ\text{C}$) was studied. The mean values of physico-chemical characteristics of buffalo meat sausage with added humectants and the analysis of variance recorded. A_w and the product yield of control, treatment 1 (ISP (3%), Sugar (1%)) and treatment 2 (ISP (3%) Sugar (1%) and sodium lactate (2%)) were 0.930 ± 0.001 , 0.902 ± 0.001 , 0.883 ± 0.001 and 90.69 ± 0.27 , 93.00 ± 0.75 , 89.26 ± 0.86 , respectively. The emulsion stability for the control, treatment 1 and treatment 2 were 90.46 ± 1.07 , 95.27 ± 0.29 and 90.86 ± 1.39 , respectively. Among the treatments, treatment 1 recorded the highest emulsion stability. The emulsion and product pH for the control, treatment 1 and treatment 2 were 6.70 ± 0.05 , 6.81 ± 0.05 , 6.52 ± 0.08 and 6.78 ± 0.05 , 6.88 ± 0.05 , 6.64 ± 0.05 , respectively. Shear force value (kg/cm^2) values were 1.53 ± 0.12 , 1.48 ± 0.16 and 1.17 ± 0.02 , respectively for control, treatment 1 and treatment 2. The overall acceptability scores were 7.07 ± 0.24 , 6.00 ± 0.31 and 7.03 ± 0.10 , respectively. On analysis of variance there were highly significant ($P \leq 0.01$) differences between the control and treatments in a_w , product yield, emulsion stability, product pH, texture and overall acceptability scores while a significant ($P \leq 0.05$) difference was noticed between the control and treatments in emulsion pH. There was no significant ($P \geq 0.05$) difference in shear force values, among control and treatment groups. No significant ($P \geq 0.05$) difference was noted in appearance, flavour and juiciness.

Effect of antibacterial and antioxidants on the storage qualities of buffalo meat sausage

S. SURESHKUMAR, A. KALAIKANNAN AND V. VENKATARAMANUJAM

VCRI, Tamil Nadu Veterinary and Animal Sciences University, Namakkal, Tamil Nadu

A study was conducted to optimize the effect of a_w , antibacterial, antioxidant and vacuum packaging during the development of shelf stable buffalo meat sausage. The influence of nisin and BHA combination at different levels on the physico-chemical and sensory qualities of buffalo meat sausage were studied. A_w of control, treatment A (Nisin 100 ppm + BHA 100 ppm), treatment B (Nisin 100 ppm + BHA 50 ppm), treatment C (Nisin 50ppm + BHA 100 ppm) and treatment D (Nisin 50 ppm + BHA 50 ppm) were 0.880 ± 0.000 , 0.879 ± 0.001 , 0.880 ± 0.001 , 0.880 ± 0.001 and 0.879 ± 0.000 , respectively. The mean values of product yield were 89.59 ± 0.66 , 90.93 ± 0.73 , 90.85 ± 0.66 , 89.88 ± 0.71 and 90.21 ± 0.34 for control, treatment A, B, C and D, respectively. The mean values of emulsion stability were 92.82 ± 0.75 , 92.39 ± 0.57 , 92.51 ± 0.66 , 93.34 ± 0.42 and 92.90 ± 0.82 for control, treatment A, B, C and D, respectively. The emulsion pH for the control, treatment A, treatment B, treatment C and treatment D were 6.07 ± 0.01 , 6.09 ± 0.01 , 6.12 ± 0.02 , 6.16 ± 0.02 and 6.03 ± 0.01 , respectively. The product pH of the control, treatment A, treatment B, treatment C and treatment D were 6.15 ± 0.02 , 6.16 ± 0.01 , 6.18 ± 0.02 , 6.21 ± 0.01 and 6.16 ± 0.20 , respectively. Shear force values were 1.13 ± 0.01 , 1.15 ± 0.01 , 1.10 ± 0.02 , 1.15 ± 0.01 and 1.10 ± 0.02 (kg/cm^2), respectively for control, treatment A, treatment B, treatment C and treatment D. Considering the sensory attributes of treatments, the treatment B fetched a high score for texture attribute, while treatment A received a high score for juiciness. The overall acceptability scores for control, treatment A, treatment B, treatment C and treatment D were 7.50 ± 0.14 , 8.67 ± 0.12 , 8.06 ± 0.16 , 8.06 ± 0.16 and 8.45 ± 0.19 , respectively. On analysis of variance highly significant ($P \leq 0.01$) differences was noticed between treatments in emulsion pH, juiciness and overall acceptability scores. Significant ($P \leq 0.05$) differences between the treatments in shear force value and texture scores and no significant ($P \geq 0.05$) differences between the treatments in a_w , product yield, emulsion stability, product pH, appearance and flavour scores of buffalo meat sausages was noticed.

Study of physico-chemical properties of the vacuum packed guinea fowl meat sausages at refrigeration temperature

**RUMA DEVI, V. K. TANWAR, P. K. SINGH,
PRANEETA SINGH, ANITA AND P. P. PRABHAKARAN**

**Department of LPT, CVASG. B. Pant University of Agriculture
and Technology, Pantnagar**

In the busy world of today, there is a great need of value added ready to eat food products, having increased shelf life because globalization has changed the lifestyle of people to great extent. In this regard sausages are better alternate to other conventional food types. Guinea fowl meat has a unique taste to introduce variety on the dinner table rather than always having chicken, and the taste is similar to pheasant, without the excessive gamey flavour. The Guinea fowls mature at an early age, and are extremely delicate and flavourful being firm and plump, the Guinea fowl is easy to prepare and does not require defatting. In recent years there has been an increased demand for guinea fowl meat because it is lean and rich in essential fatty acids. The muscle is low in calories with only turkey meat having fewer calories than it. The meat is rich in vitamins such as vitamins E, B & B₂ and minerals such as magnesium, calcium and iron. Guinea fowl meat is a good source of iron and protein. The present investigation was envisaged to assess the Physico-Chemical properties of guinea fowl meat sausages under vacuum packaging condition. Guinea fowl meat sausages were subjected to two different types of packaging treatment i.e. aerobic packaging with low density polyethylene bags (control) & vacuum packaging using barrier bags (Treatment) & stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$). Physico-Chemical properties were analysed on 0th, 3th, 7th, 14th, 17th, 21th, & 30th day. pH of the aerobically packaged product was found to be non-significantly higher ($P>0.05$) than vacuum packaged product during storage period. Water activity was found to decreased during the storage period both in vacuum as well as aerobically packaged product, but the values were non-significantly higher ($P>0.05$) for aerobically packaged sample as compared to vacuum packaged product. The vacuum packaged product showed a highly significant ($P>0.01$) lower TBA & FFA value than aerobically packaged product throughout the observation period. Hence it can be concluded that vacuum packaging has a beneficial effect on Physico-Chemical properties of the product better than aerobic packaging.

Processing and quality evaluation of pickle prepared from dried yak meat

KANDEEPAN G.¹, SANGMA S. AND RAMESHA K. P.²

**NRCY, Dirang, Division of LPT, IVRI Izatnagar, Bareilly,
²Southern Regional Station, NDRI, Bangalore 1**

Yak is the major source of meat for its rearing community. Yak meat has great demand among the consumers especially during *Lossar*, a major festival of west kameng and tawang districts of Arunachal Pradesh, India. Yak meat is utilized by the local people in various forms and dishes viz. dried meat (*Shia sangbu*), curry (*Shia kamtang*), sausage (*juma*), chutney, *momo* and *thukpa*. Dried meat is available in surplus during the festival season. Local people use them only for the preparation of curry form and none other technology is available in this region to utilize the excess meat in a different form. Meat pickle is good option for utilizing this surplus dried yak meat. Meat pickle is a shelf stable product and can be stored and consumed for a longer period compared to any other meat products. There is hardly any scientific information available on processing and quality evaluation of this meat product. Moreover, this technology would ensure the post harvest losses due to poor shelf life of fresh meat and high contamination by the spoilage microbes. Value addition would also bring about variety to the meat product available in the market. Therefore, a program was designed to develop pickle from yak meat and its quality was evaluated. A standardized processing protocol was utilized for the preparation of yak meat pickle. Dried meat was rehydrated and used in the experiments. The pickle was prepared in both chunk and mince form. The yak meat pickle has pH of 4.65, titratable acidity 0.138%LA, moisture 51.57%, protein 19.04%, fat 27.12% and ash 1.90%. The microbial profile of yak meat pickle comprises standard plate count of 1.54 log cfu/g and yeast and mold count of 1.96 log cfu/g. Yak meat pickle is a shelf stable product which can be stored for around 6 months at ambient temperature. Processing of pickle is the best way to utilize the surplus dried meat in the region where sophisticated meat processing equipments are beyond reach by the poor local people.

A study on packaging and shelf life of duck ham

M. SINHAMAHAPATRA, D. BHATTACHARYYA AND S. BISWAS

**School of Agriculture, Indira Gandhi National Open University,
Maidan Garhi, New Delhi**

A study was conducted to assess the shelf life of duck ham packed in PET/Poly and laminate of metalized PET/Poly with polyethylene pouches under aerobic and vacuum packaging and kept in refrigerator ($4\pm 1^\circ\text{C}$) and freezer ($-18\pm 1^\circ\text{C}$). The samples were analyzed for pH, TBA value, tyrosine value, proximate composition (moisture, protein and fat content), microbiological parameters (TPC, TPSC, TCC and YMC) and sensory qualities (colour, flavour, tenderness and overall acceptability). In case of pH, TBA value, tyrosine value, TPC, TPSC, YMC, protein and fat content, hams showed an increasing trend throughout the storage period in refrigerator and freezer temperatures. Moisture content and the scores of colour, flavour, tenderness and overall acceptability of hams decreased during storage with the advancement of the storage period in both the storage temperatures. While comparing the effect of packaging materials on storage quality of duck ham, laminate resulted in a better edge over that of PET/Poly pouches, though the difference was statistically insignificant. Irrespective of packaging materials, duck hams were acceptable upto 20th and 40th day of refrigerated storage in aerobic and vacuum packaging respectively and upto 3rd month and 5th month of frozen storage in aerobic and vacuum packaging respectively.

Effect of mousambi based natural antioxidant fortification on product characteristics and storage quality of restructured buffalo meat steaks

GIRIPRASAD R., B. D. SHARMA, SUMAN TALUKDER AND S. K. MENDIRATTA

**Division of Livestock Products Technology, Indian Veterinary
Research Institute, Izatnagar, UP**

This study was conducted to explore the possibility of fortification of antioxidant through mousambi (*Citrus limetta* Risso) peel powder in restructured buffalo meat steaks. Three different levels of hydrated (1:5) mousambi peel powder viz. 0.25, 0.5 and 0.75 % were incorporated separately replacing the lean meat in standardized formulation. The steam cooked buffalo meat steaks were assessed for physico-chemical, sensory and storage properties. The cooking yield and moisture percent showed increasing trend with increasing level of mousambi peel powder which was significantly higher ($P<0.05$) at 0.5% and 0.75% levels as compared to control. The decrease in pH of treatments products was relatively small. The total phenolics (μg) content, which is the indicator of antioxidant capacity of mousambi peel powder showed significantly increasing trend ($P<0.05$) with increasing levels of incorporation, with the maximum value (343.11 μg) at 0.75% level. Among the sensory attributes, general appearance, juiciness, texture and binding scores of treatment products showed an increasing trend with increasing levels of mousambi peel powder, whereas increase in flavour and overall acceptability scores was observed only upto 0.5% level. On the basis of physico-chemical and sensory properties, the optimum level for incorporation of mousambi peel powder was adjudged as 0.5%. The texture attributes like hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness of optimized mousambi peel powder added was comparable to control. The optimized product in aerobic packaging was stored at refrigeration temperature ($4\pm 1^\circ\text{C}$) for 20 days and during the period of storage, thiobarbituric acid reactive substances in optimized product remained significantly lower ($P<0.05$) in comparison to control product. The total plate count and coliform count were significantly less ($P<0.05$) than control from 15th day onwards, whereas psychrophilic count was also less at 20th day. These findings indicated that the restructured buffalo meat steaks could be fortified with antioxidant using mousambi peel powder at 0.5% level and can be safely stored for a period of 20 days at refrigeration temperature ($4\pm 1^\circ\text{C}$) with very good overall acceptability.

Effect of whole egg malange incorporation on physico-chemical, sensory and microbiological properties of chicken meat nuggets from spent hen meat

G. GAWDAMAN, V. KESAVA RAO, ROBINSON J. J. ABRAHAM*, S. SANJIVI KUMAR, AND J. SELVAMUTHU

***Department of MS and T, MVC, Chennai, Department of LPT, RAGCVAS, Puducherry**

A study was undertaken to determine the optimum level of incorporation of whole egg malange for the preparation of chicken meat nuggets with 80 per cent deboned spent hen meat and 20 per cent chicken fat which was considered as control, to these three different levels (3, 5, 7%) of whole egg malange were added to replace the lean. The analysis revealed that nuggets with 5% level of whole egg malange was found to be optimum with respect to physico-chemical and sensory properties so which was further subjected to storage studies under refrigerated condition for 10 days. During the refrigerated ($4\pm 1^{\circ}\text{C}$) storage period pH, TBA value, tyrosine value and microbial counts gradually increased but well within the acceptable limit. Based on the finding it is concluded that 5% whole egg malange incorporated nuggets could be stored upto 10 days by aerobic packing in LDPE bag at refrigerated ($4\pm 1^{\circ}\text{C}$) without any appreciable deterioration in the quality and acceptability of the product.

**Comparative study on the shelf life of sun dried and oven dried
chevon meat chunks stored at room temperature**

**G. GAWDAMAN*, S. SANJIVI KUMAR, V. KESAVA RAO,
ROBINSON J. J. ABRAHAM AND U.K. PAL**

***Department of M S and T, MVC, Chennai, Dept. of
LPT,RACVAS, Puducherry**

A study was undertaken with the objective to compare the shelf life determination of sun dried and oven dried meat (chevon) chunks at room temperature storage. Chevon purchased from local market were brought to the lab, excessive fat and connective tissue removed, cut into small chunk and washed with potable water, to this 2.5% salt and pinch of turmeric powder added and subjected to two different drying (sun drying and oven drying) till the moisture level comes to 9-10% packed aerobically and stored at room temperature for 30days. The analysis revealed that there was a gradual increase in pH, TBA value, tyrosine value, total viable count, and staphylococcal count and yeast and mould counts with increase in storage period at ambient. Chunks dried at oven were superior in sensory and microbial quality than the sun dried meat chunks and significantly ($P < 0.01$) differed. Based on the finding it is concluded that sun dried and oven dried chevon meat could be stored upto 20 and 30days by aerobic packing in LDPE bag at room temperature without any appreciable deterioration in the quality and acceptability of the product.

Effect of carbohydrate based extenders on textural properties of chicken meat patties

KALAIKANNAN A, KULKARNI V. V, SANTHI D AND ELANGO. A

**Department of M S and T, Veterinary College and Research Institute,
Namakkal**

The effects of incorporation of fibre rich whole grain wheat flour and oats on the textural properties of the chicken meat patties were studied. The whole grain wheat flour and oats flour were added to the chicken meat patties at 3 percent level each over and above the standard formulation. The emulsion pH and product pH were not altered much. The addition of these fibres improved the emulsion stability significantly ($P \leq 0.05$). The product yield was improved by the addition of these extenders. The texture profiles analyses showed no undesirable changes in the texture. The Warner Bratzler shear force was significantly ($P \leq 0.05$) increased by addition of wheat and oats flour to the chicken meat patties. Hence it is concluded that carbohydrate based extenders can be used to reduce the cost of production of chicken patties.

Development of novel value added emu meat products

B. KARTHIK, ROBINSON J. J. ABRAHAM, V. APPA RAO AND G. GAWDAMAN

Department of Meat Science and Technology, Madras Veterinary College, Chennai-07

A study has been designed to develop novel value added emu meat products (cutlet and tikka) and to assess their shelf life at refrigerated ($4 \pm 1^{\circ}\text{C}$) storage temperature. The parameters studied include physico-chemical properties, sensory characteristics and microbial qualities on 1st, 3rd, 5th and 7th day of storage. Results of the present study on cutlet and tikka from beef, chicken and emu revealed increase in pH, TBA and tyrosine value from '0' to 7th day at refrigerated ($4\pm 1^{\circ}\text{C}$) temperature. Similar findings were observed in microbial qualities count also, but the counts were well within the standard limits and coliforms were absent throughout the storage period. The sensory scores were found to be acceptable. It could be concluded that beef, chicken and emu cutlet can be stored well up to 5th day and tikka can be stored safely upto 7th day at refrigerated ($4\pm 1^{\circ}\text{C}$) temperature storage. The deterioration of cutlet on 7th day was not due to microbial spoilage but due to development of rancidity.

Optimization of oats level for inclusion in chicken nuggets

**D. SANTHI, S. SURESHKUMAR, A. KALAIKANNAN, A.
ELANGO, A. NATARAJAN AND K. SUKUMAR**

**Department of M S and T, Veterinary College and Research Institute,
Namakkal**

The objective of this study was to optimize the inclusion level of oats in chicken nuggets to fortify with dietary fibre. Low-fat chicken nuggets were prepared with addition of oats at levels of 10% and 20% over and above the amount of meat and control without oats. The effect of addition of oats on the sensory properties, texture and proximate composition on the low-fat chicken nuggets was studied. The sensory evaluation showed that there was no significant difference in the overall acceptability between control and 10% addition level and was significantly ($P \leq 0.05$) low in 20% addition level. Texture analysis revealed that the springiness was significantly ($P \leq 0.01$) lower in 20% addition level and there was no significant difference between control and 10% addition level. Cohesiveness was significantly ($P \leq 0.01$) higher in control and decreased with increase in the addition level of oats. Resilience ($P \leq 0.01$) and chewiness ($P \leq 0.05$) significantly decreased with addition of oats. The proximate analysis showed that the moisture level was significantly ($P \leq 0.05$) low in 20% addition level and there was no significant difference between control and 10% addition level. There was significant ($P \leq 0.05$) increase in the crude fibre level in oats added nuggets but there was no significant difference between the two treatments. This study demonstrates that an acceptable low-fat chicken nuggets can be made in which oats can be added up to 10% level over and above the amount of chicken meat.

**Effect of irradiation and antioxidants on quality attributes and shelf
life of chicken emulsion**

**T. RAVI, M. SHASHI KUMAR, M. MUTHUKUMAR, K.
SUDHAKAR REDDY AND N. KRISHNAIAH**

CVVS, Hyderabad, National Research Centre on Meat, Hyderabad

A study was conducted to assess the effect of irradiation on shelf life of chicken meat emulsion stored at refrigerated temperature under vacuum package with addition of natural and chemical antioxidants. The overall mean pH of control (no irradiation and no antioxidant), T1 (irradiated without antioxidant), T2 (irradiated with BHA) and T3 (irradiated with curry leaf extract) groups were 5.38 ± 0.04 , 6.10 ± 0.04 , 6.14 ± 0.04 and 6.08 ± 0.04 , respectively with the control group recording significantly lower pH. There was decrease in pH with increased storage period. The overall mean 2-TBARS of control samples were significantly higher than irradiated samples. The T2 samples recorded significantly lower 2- TBARS among treatments. The storage period showed significant effect on mean 2-TBARS values. The overall mean total plate count (\log_{10} cfu/g) of control, T1, T2 and T3 groups were 7.17 ± 0.06 , 5.19 ± 0.06 , 5.20 ± 0.06 , 5.23 ± 0.06 , respectively and the count increased with storage length. The mean *E.coli* and *Salmonella* counts (cfu/g) showed a gradual increase from day 1 to day 35 in control, while no colonies could be detected in irradiated groups. The overall mean scores for appearance and colour, flavor, juiciness, texture and overall acceptability of control samples were significantly lower than irradiated samples. The overall mean scores were lower on day 35 when compared to other period of storage. Thus, the present study indicated the promising potential of irradiation as a safe and efficient preservation method and curry leaves as source of potent antioxidant to retard oxidative rancidity.

Application of hurdle concept in development of chicken lollipop

**V. P. SINGH, V. PATHAK, N. K. NAYAK, M. GOSWAMI,
TANUJA AND PRAMILA**

**Department of LPT, U.P. Pt. Deen Dayal Upadhyaya Pashu
Chikitsa Vigyan Vishwavidyalaya, Evum Go Anusnadhan Sansthan,
Mathura-281001**

Chicken lollipop is one of most relished chicken meat products throughout the globe. The study was conducted to increase the shelf life of lollipops using combination of hurdles. The chicken wings were collected and shaped into the lollipop. Three different combinations were used i.e. control (lollipop without glycerol), T1 (lollipop with glycerol and corn flour) and T3 (lollipop with glycerol and bread crumbs). The chicken wings shaped in lollipop were then marinated for two hours. After marination lollipop were rolled over the corn flour/bread crumbs followed by cooking in controlled time temperature combination. Developed lollipops were subjected to physico-chemical, microbiological and sensory evaluation. The initial total plate counts did not differ significantly in any variants however significant ($P < 0.05$) differences in TPC were observed between the control and other variants during storage under refrigeration. The product developed using glycerol and bread crumbs were found best in terms of sensory evaluation and microbiological quality.

**Effect of incorporation of pumpkin on quality characteristics of
chicken meat patties.**

AKHILESH K VERMA V. P. SINGH AND V. PATHAK

**Department of LPT, U.P. Pt. Deen Dayal Upadhyaya Pashu
Chikitsa Vigyan Vishwavidyalaya Evum Go Anusnadhan Sansthan,
Mathura-281001**

The reported study was envisaged to reduce the cost of formulation of meat patties by incorporation of pumpkin without compromising on the acceptability. Four different variants were prepared replacing lean meat with pumpkin at the levels of 0, 10, 20 & 30 percent in the formulation. The formulation without pumpkin was taken as control. The analysis performed on the product revealed significant ($P < 0.05$) increase in moisture, ash and moisture: protein ratio while fat and protein content significantly ($P < 0.05$) decreased with enhancement in the level of pumpkin in formulation. Processing characteristics of control chicken patties were also significantly ($P < 0.05$) different with the pumpkin incorporated products. The moisture retention in the products was significantly ($P < 0.05$) increased with the increase in levels of pumpkin in patties. These products were microbiologically safe and counts were very well under the prescribed limits of processed meat products. All variants were very well accepted by the sensory panellists and were stable during 9 days storage period under refrigeration. The formulation containing 20 percent pumpkin was found best on the basis of various estimated parameters

**Efficacy of Leaves (drumstick, mint and curry leaves) Powder
as Natural Preservatives in Restructured Chicken Slices**

**A. P. NAJEEB, P. K. MANDAL, L. A. JUDITH, R. SARAVANAN, U.
K. PAL AND C. D. DAS**

Department of LPT, RGCVAS, Puducherry

The use of natural preservatives to increase the shelf-life of meat products is promising since they have antioxidant and antimicrobial properties. Earlier a highly acceptable restructured chicken slice without addition of extra fat was developed but it was found to have shelf life of only 10 days under refrigeration storage. Hence, the present study was planned to find out the efficacy of certain plant leaves (*drumstick*, mint and *curry* leaves) powder @ 1% level as natural preservatives on the physico-chemical, microbiological and sensory attributes of restructured chicken slices under refrigerated storage. A control product without preservative and a reference product with BHT (200ppm) were also prepared. Incorporation of these leaf powders at 1% level did not show any significant difference for both cooking yield (99.46-99.61%) and proximate composition (moisture 72.17-72.30%, protein 19.21-19.37%, fat 4.23-4.28% and total ash 2.32-2.38%) of restructured chicken slices compared to both reference (BHT) and control product during storage. All the products added with leaf powders showed significantly ($P < 0.01$) lower microbial counts (2.97-3.72 log₁₀ CFU/g) compared to both control and BHT added products. Yeast and mould were not detected in any of the products throughout the storage period. Sensory evaluation scores showed that restructured chicken slices incorporated with leaf powders were equally acceptable as reference product and rated good to very good for appearance, flavour, juiciness and overall palatability. Restructured chicken slices with leaf powders can be stored safely without much loss in its quality even up to 20 days under refrigerated storage.

Development of fermented chevon sausages using LAB cultures and fermented bamboo shoot

**PRIYA VINNARASI. J, DAS C. D., MANDAL P. K., PAL U.
K AND RAO, V. K.**

Department of LPT, RGCVAS, Pondicherry

Fermented sausages are the meat products in which biological acidification are brought about by growth of specific microbial cultures such as lactic acid bacteria (LAB). Fermented bamboo shoot is a naturally available neutraceutical which can be used as source of acidification for sausages. The present study was undertaken to develop fermented chevon sausages using LAB cultures and fermented bamboo shoot powder (FBSP). LAB, namely *Lactobacillus plantarum*, *Pediococcus pentosaceus* and *Micrococcus luteus* as mixed cultures and FBSP were used in fermented chevon sausages. Control was prepared without LAB cultures or FBSP. The sausages were fermented at 28⁰C for 12-14 hrs, dried at 6-8⁰C for 12- 14 hrs and then smoked for 7 hrs at 95-100⁰C. Cooking yield (%) of the fermented sausages was lower than the control sample. Fermented sausages containing LAB cultures had significantly (P<0.01) lower pH compared to control. The titratable acidity of control sausages was significantly (P<0.01) lower than LAB cultures fermented sausages. No significant differences were observed in the proximate composition of the control and LAB cultures fermented sausages. Based on sensory scores, control and LAB cultures fermented chevon sausages were rated as moderately palatable to very palatable. In fermented chevon sausages incorporated with different levels (3 % and 5 %) of FBSP, the cooking yield and ash content of the products increased significantly (P<0.01) with increase in level of FBSP. Although sensory evaluation scores revealed a significant decrease in flavor and overall acceptability of the products with increase in level of FBSP, still the products were well acceptable and rated as moderately palatable to very palatable. Based on the sensory evaluation results, it was observed that 3 % level of FBSP incorporated fermented chevon sausages were better compared to 5% level of incorporation. It was concluded that utilization of FBSP at 3 % level would not only be the biological way of meat product preservation but also quality of FBSP fermented chevon sausages was comparable to traditional LAB cultures fermented chevon sausages.

Efficacy of acetic, citric and lactic acid in improving the quality of marinated chicken

ABIDA JUDITH L., U. K. PAL, P. K. MANDAL, C. D DAS AND VINOTH KUMAR A

Department of LPT, RGCVAS, Pondicherry

A study was planned to find out the most suitable organic acid at an optimum concentration to marinate chicken breast pieces along with salt, dry spice mix, green curry stuff and honey. In all the experiments, marinade of control samples contained all the ingredients except the acid. In experiment-I, three organic acids viz. acetic, citric and lactic acids, were tried individually at different concentrations (0.25%, 0.5% and 0.75%). The control and treated products were tested for pH, moisture, water holding capacity (WHC) and extract release volume (ERV) and also subjected to sensory evaluation. Results revealed that pH and WHC (%) decreased significantly ($P < 0.05$) with increasing concentration of acids. Moisture (%) did not vary significantly ($P < 0.05$) between the three levels of acids but slightly reduced compared to control. Organoleptic scores ranged between 7-8 on 9 point hedonic scale. But the product marinated with 0.25% scored higher when compared to 0.5% and 0.75%. Based on the results, 0.25% was selected as the optimum concentration of acids. Experiment II was conducted using the three acids at 0.25% to select the best acid to be used in the marinade. Products were tested for the above parameters. Results revealed that pH, moisture (%) and WHC (%) of acid marinated chicken did not vary significantly but were reduced slightly compared to control. Organoleptic scores ranged between 7.71-8.28 on 9 point hedonic scale. Product marinated with 0.25% citric acid scored higher compared to 0.25% acetic and lactic acids. In both the experiments, the ERV did not show much variation among acid treated samples but ERV was significantly ($P < 0.05$) higher in all the acid treated samples compared to control samples. It is concluded that 0.25% citric acid can be used to marinate chicken along with salt, dry spice mix, green curry stuff and honey.

Effect of *Garcinia cambogia* extract as a bio-preservative on the keeping quality of pork fry at room temperature

BHUVANA K. S, MANDAL, P. K. AND PAL U. K.

Department of LPT, RGCVAS, Pondicherry

A study was conducted to assess the bio-preservative effect of the aqueous extract of *Garcinia cambogia* (Kachampuli in Coorgi) which was added to the pork fry as an acidulant. The pork cubes of 1cm³ were marinated with salt (1.75%) and selected dry spice mixture (2%), followed by frying for 45 minutes in sunflower oil (10%) along with the green curry stuff (onion, ginger and garlic paste in the ratio 3:1:1). The aqueous extract of *Garcinia cambogia* was added to the treatment 1 and treatment 2 at levels of 1% and 2% respectively. The products were cooled and stored in air tight glass jars and routinely analyzed for physico-chemical properties, microbiological quality and sensory attributes. The results indicated that the pH of the pork fry was lower in the treatment 1 (5.32) compared to the control (5.84). The TBA and tyrosine values of the pork fry in the treatment 1 (1.66 & 5.57) were also lower than that of the control (1.94 & 6.74). The microbiological quality (Standard plate count) remained within safe limits up to 6th day of storage in case of the treatments (log cfu/g 3.84) whereas, the control (log cfu/g 4.92) deteriorated after 48 hours of preparation. Results of sensory evaluation revealed that the flavor, texture, juiciness and overall acceptability were better for the treated pork fry and remained so throughout the study. From the physico-chemical, microbiological and sensory evaluation results, it was found that the use of aqueous extract of *Garcinia cambogia* at 1% level was optimum for the room temperature preservation of the pork fry for almost six days.

Functional starter culture and production of bioactive peptides from meat proteins in fermented and dried probiotic chicken sausage

A. R. SEN, B. M. NAVEENA, M. MUTHUKUMAR, I. PRINCE DEVADASON, P. N. NAIR AND G. VIJAYBHASKAR REDDY

National Research Centre on Meat, Chengicherla, Hyderabad

Studies were conducted to process probiotic chicken sausage with curd/dahi and formation of bioactive peptides during ripening of fermented meat product. Temperature of appropriate fermentation was standardized by measuring the pH, total acidity and enumerating the *Lactobacilli* counts. The smoking time and temperature was also standardized to assess the viability of *Lactobacilli*. In probiotic chicken sausage the water activity dropped from 0.95 at the beginning of fermentation to 0.89 after 15 days of drying. After fermentation, *Lactobacilli* reached from initial 5.02-5.26 log cfu/g to 9.05-9.29 log cfu/g. After fermentation and drying at 10⁰C for 15 days, no *Salmonella* or *Enterobacteriaceae* was detected in all the fermented chicken sausage. After fermentation, *Lactobacillus bulgaricus* was in the range of 5.85-6.73 log cfu/g in all the samples. The PCR based speciation of *Lactobacilli* and sequencing was done and it was inferred that 99% of *Lactobacilli* population was *Lactobacillus fermentum*. *Streptococcus thermophilus* was observed in the range of 6.51-6.64 log cfu/g in all the smoked and dried fermented chicken sausage. The greatest change in myofibrillar protein pattern of chicken sausage occurred after the fermentation and drying process. The band intensity of protein band of molecular weight 94 kDa (α -actinin) decreased after fermentation and completely disappeared after drying in control samples. Similar pattern was also observed for Myosin light chain-I (molecular weight-24 kDa). The tropomyosin (T-1) of molecular weight 35 kDa also completely disappeared in all the fermented samples after fermentation and drying. Few bands of bioactive peptides (molecular weight 62, 51 and 37 kDa) appeared in all the samples after drying. It can be concluded from the present study, curd/dahi @4 and 8% can successfully be used as starter culture directly in the meat emulsion to achieve desirable pH and *lactobacilli* population of sausage without having detrimental effects on the quality. The study has also conclusively shown that many small peptides produced in fermented sausage originated from both the sarcoplasmic and myofibrillar proteins.

Quality characteristics of restructured mutton slices developed by cold-set binding system

G. VIJAYBHASKAR REDDY, A. R. SEN*, P. N. NAIR*, K. KONDAL REDDY AND K. SUDHAKAR REDDY

CVS, SVVU, Rajendranagar, Hyderabad, *NRC on Meat, Hyderabad

The present investigation was carried out to evaluate the influence of various levels (0, 0.5, 1.0 and 1.5 %) of calcium alginate as cold-set binder on cold-set gelation of restructured mutton slices (RMS). Addition of 1.5% calcium alginate showed significantly ($P<0.05$) higher cooking yield, batter stability, water-holding capacity and pH. However, calcium alginate did not significantly affect both collagen content and collagen solubility of RMS. There was a significant ($P<0.05$) difference in % diameter shrinkage between control and RMS extended with various levels of calcium alginate. RMS formulated with 1.5 % calcium alginate had significantly ($P<0.05$) highest moisture content than remaining formulations. Control sample had significantly ($P<0.05$) higher protein content than the other treatments (T1, T2 and T3). Addition of various levels of calcium alginate did not significantly influence the fat and total ash content of RMS. Addition of 1.5% calcium alginate had significantly ($P<0.05$) increased chewiness, cohesiveness, gumminess and springiness values of RMS. The RMS added with 1.5% calcium alginate had significantly higher sensory colour, cohesiveness, juiciness and overall palatability scores than remaining formulations. The results of this study reveals that RMS formulated with of 1.5% calcium alginate as cold-set binder recorded highest physico-chemical, proximate characteristics, better textural stability and superior sensory scores than control and relieves the problems of discoloration and lipid oxidation which was very prone in hot-set binding system.

Effect of starter culture and packaging methods on amino acid profile and eating quality characteristics of pork ham

**GOGOI PROTIV, BORPUZARI R. N., BORPUZARI T.,
HAZARIKA R. A. AND BORA, J.**

**Department of LPT, CVS, Assam Agricultural University Khanapara,
Guwahati**

The amino acid profile of the hams inoculated with mixed starter culture of *Lactobacillus acidophilus* and *Micrococcus varians* 483 at the dose rate of 106cfu/g and stored at 4°C under MAP and VP conditions were evaluated on the 60th day. Treated hams liberated higher concentration of free amino acids confirming the proteolytic activity of the inoculated cultures. The packaging systems had significant effect on the concentration of FAAs. VP hams of the treated group had higher concentration of free proline, glycine, alanine, valine, methionine, isoleucine, phenylalanine, lysine and histidine than the MAP samples. Neither the bacterial cultures nor the packaging system was found to influence the textural property of ham. Spectrophotometric analysis of the colour of ham revealed that the treated samples had significantly higher L*, a* and b* components. The L* and a* values were higher in the hams packaged under MAP than those under VP systems while the b* values were higher in the VP samples. Starter culture inoculated hams superior in terms of their organoleptic properties. Hams packaged under MAP were rated superior than those packaged under VP in terms of appearance, colour, taste, tenderness, flavour, juiciness and overall acceptability.

Effect of starter culture and packaging methods on the physico-chemical, microbiological and sensory properties of pork ham

**GOGOI PROTIV, BORPUZARI R. N., BORPUZARI T.,
HAZARIKA R. A. AND BORA, J.**

**Department of LPT, CVS, Assam Agricultural University
Khanapara, Guwahati**

Brine cured pork hams were prepared with the inoculation of starter culture of *Lactobacillus acidophilus* and *Micrococcus varians* 483 at the dose rate of 10⁶cfu/g. Hams were fermented for 10 days before cooking. Microbiological analysis performed during the fermentation period revealed that the treated hams had higher total viable count, lactic acid bacteria and Micrococcaceae counts and lower Enterobacteriaceae and coliform counts. The effects of the starter cultures, packaging systems (vacuum and modified atmosphere packaging) and storage time (0, 15, 30, 45, 50, 55 and 60 days) on the physico-chemical properties were investigated. pH of the inoculated hams was lower than the control samples. VP hams had lower pH value than the MAP samples in either of the groups. ERV, WHC and water activity decreased significantly with increasing storage period. ERV of the treated samples were higher and also the VP samples of both the treated and the control groups showed higher ERV than the MAP samples throughout the storage period. Packaging systems also had significant effect on the ERV. WHC of the treated samples were significantly lower than the control ones in either of the packaging systems and VP hams showed lower WHC than the MAP in both the groups. The control samples showed higher aw than the treated group. MAP was found to be a better method of packaging in maintaining reduced aw of hams during refrigeration storage in both the groups. Microbiological quality of the cooked hams evaluated on the 60th day of storage showed that the treated samples had significantly higher TVC, LAB and Micrococcaceae count than their control counterparts whereas, the Enterobacteriaceae and coliform counts were significantly lower. MAP lowered the TVC, LAB, Micrococcaceae and Enterobacteriaceae counts significantly than the VP whereas, the coliform counts were significantly lower in VP than the MAP. Starter culture inoculated hams were rated superior in terms of their organoleptic properties. Hams packaged under MAP were rated superior than those packaged under VP in terms of appearance, colour, taste, tenderness, flavour, juiciness and overall acceptability.

Effect of fermented bamboo shoot on physico-chemical, sensory and shelf-life of pork tenderloin butterfly

**BORPUZARI, R. N., DAS, J., KHAUND. M., BORAH, L.,
RAHMAN, M., HAZARIKA, D. AND GOGOI PROTIVA**

**NAIP (Component - 2), CVS, Assam Agricultural University,
Khanapara campus, Guwahati**

The effect of incorporation of 5% fermented bamboo shoot to the recipe of pork tenderloin butterfly on physico-chemical, sensory and shelf-life was investigated. Addition of fermented bamboo shoot lowered the pH and TBA number of tenderloin butterfly up to 10th day of storage at refrigeration temperature. Proximate composition remained unaltered. Spectrophotometric analysis of the samples revealed that the L*, a* and b* colour components were lower in the treated samples. Concentration of b* colour component was found to increase with the advancement of storage period. No statistical differences were observed in the mean shear force value between the treated and the control samples. TVC and colititre values were as low as 4.56 and 4.86log₁₀cfu/g and 4.3 and 15 in the treated and control samples, respectively. Fermented bamboo shoot incorporated samples enjoyed better panel ratings in terms of appearance, colour, taste, flavour, juiciness, texture and overall acceptability of the product.

Effect of types of casing and packaging systems on proximate composition, physico- chemical, microbiological and sensory Properties of cooked pork sausage

**BORPUZARI, R. N., RAHMAN, M., HAZARIKA, D., DAS, J.,
KHAUND, M., BORAH, L. AND GOGOI PROTIVA**

**NAIP (Component - 2), CVS, Assam Agricultural University,
Khanapara campus, Guwahati**

Cooked pork sausages stuffed into natural and cellulose casings and packaged under aerobic, vacuum and modified atmosphere packaging with O₂, CO₂ and N₂ at 1:1:1 ratio were studied for their shelf stability at refrigeration temperature of 4°C up to 12th day. Crude protein content was found to be significantly higher in AP than the VP samples. Duration of storage significantly altered the proximate composition of the sausage samples. Sausage samples stuffed into cellulose casings had significantly lower pH and TBA values than those into natural casings. With the advancement of the storage period, there was a significant reduction in the pH values and increase in the TBA values. Types of casings did not seem to affect the TVC and coliform counts of the samples. AP samples, however, had higher TVC and coliform counts. The TVC increased on storage of the product up to 12th day whereas, the coliform counts showed a declining trend. Pork sausage stuffed into natural casings and packaged under MAP were preferred for colour, flavour, tenderness and overall acceptability attributes whereas, those stuffed into cellulose casings were rated higher for taste and juiciness.

**Quality and shelf stability of fermented bamboo shoot added
pork pickle**
**BORPUZARI, R. N., DAS, J., KHAUND, M., BORAH, L.,
RAHMAN, M., HAZARIKA, D. AND GOGOI PROTIVA**

**NAIP (Component - 2), CVS, Assam Agricultural University,
Khanapara campus, Guwahati**

Pork pickle added with fermented bamboo shoot was investigated for its quality and shelf stability. Pork pickle had a storage life of over 2 months at room temperature. A decrease in pH value and an increase in TBA number were observed during storage period up to 60 days at room temperature. Proximate composition of pork pickle did not change during the storage period under review. Colititre, *Clostridium*, *Staphylococcus* and *Salmonella* counts were not detected up to 60 days of storage. TVC and yeasts and moulds counts were recorded at $4.24 \log_{10} \text{cfu/g}$ and $4.36 \log_{10} \text{cfu/g}$, respectively on 60th day of storage. On 60th day of ambient storage, the product enjoyed very high panel ratings for colour, taste, flavour, juiciness and overall acceptability.

Effects of Packaging materials and methods on physical properties and food safety of Duck Sausage

**DEBASHIS BHATTACHARYYA^a, MITA
SINHAMAHA PATRA^c AND SUBHASISH BISWAS^{b,a,b}**

**Department of LPT, WBUAFS, ^c School of Agriculture,
IGNOU, New Delhi**

Utilization of spent duck through sausage preparation and estimating the optimum storage condition throughout the retail chain was the objective of the present study. PET/Poly and laminate of metalized PET/Poly with polyethylene pouches under aerobic and vacuum packaging stored in refrigerator ($4\pm 1^\circ\text{C}$) and freezer ($-18\pm 1^\circ\text{C}$) condition were considered in the experiment. TBA value, pH, Tyrosine value, TPC, TPSC and YMC of the samples increased with the storage period whereas a decreasing trend in case of moisture and all the sensory parameters throughout the storage period was observed. Irrespective of the packaging material, duck sausages were acceptable upto 30th and 50th day of refrigerated storage and 4th and 6th month of freezer storage in aerobic and vacuum packaging respectively. Freezer temperature enhanced the product quality upto 3rd and 5th month against 20th and 40th day of refrigerated storage in aerobic and vacuum packaging respectively.

Effect of plant binders on the quality of novel enrobed chicken meat products

**SURBHI YADAV, V. APPA RAO, ROBINSON J. J. ABRAHAM,
R. NARENDRA BABU AND N. BRINDHA**

MVC, TANUVAS, Chennai

A study was conducted to assess the effect of plant binders on the quality of novel value added enrobed chicken meat products with three different plant binders viz. rice flour, tapioca flour and corn flour, along with roasted gram flour in coating batter. Three experiment trials were conducted to select the optimum level of inclusion of the three binders on the basis of physico-chemical and sensory evaluation. From the three experiment trials the optimum level of inclusion of the three binders viz. rice flour (25:75), tapioca flour (35:65) and corn flour (35:65) were selected. Enrobed chicken meat products from the optimum selected plant binders were prepared and subjected to shelf life studies stored for a period of 21 days in polyethylene bags at refrigeration temperature ($4 \pm 1^{\circ}\text{C}$) and subjected to further analyses to determine the proximate composition, physico-chemical qualities and amino acid profile analysis. The study revealed that the enrobed chicken meat products prepared using corn flour(35:65) in coating batter was found to be superior and this product can be recommended and chosen for adoption by entrepreneurs.

Retort processed chettinad chicken using desi and broiler meat

P. NALINI, ROBINSON J. J. ABRAHAM, V. APPA RAO, R. NARENDRA BABU AND VASANTHI SURESH

MVC, TANUVAS, Chennai

Traditional meat products in a ready-to-eat form are having considerable demand owing to its ease of utilization in the market. The current study was carried out to standardize a shelf-stable ready-to-eat chettinad chicken using broiler and desi meat by retort pouch processing. Total viable count of desi and broiler meat on 0 day and 90th day was below the standard. The chettinad chicken samples did not have anaerobic, staphylococcal, coliform, clostridium, salmonella and yeast and mould during the entire storage period. Hence the product is microbially safe up to 90 days. It was determined based on references, commercial sterility test, visual observation, sensory evaluation and preliminary trials. Results of the study revealed that the chettinad chicken from broiler and desi meat was biochemically and microbially safe.

**Determination of shelflife and sensory studies of novel enrobed
chicken meat products**
**SURBHI YADAV, V. APPA RAO, ROBINSON J. J. ABRAHAM,
R. NARENDRA BABU AND S. EZHILVELAN**

MVC, TANUVAS, Chennai

A study was conducted to assess the Microbiological quality and sensory quality of novel enrobed chicken meat product (viz. Total viable count and Yeast and mould count) at 7 days interval for up to 21 days of refrigerated storage period. The enrobed chicken meat product was prepared using three different plant binders (viz. rice flour, tapioca flour and corn flour). Sensory evaluation was carried out (viz. Appearance, crust colour, flavour, product texture, crust crispiness, batter adherence and overall acceptability) at 7 days interval. The cost of production of the optimum selected plant binder proportions of enrobed chicken meat product was also analysed. There was a significant decrease in crust crispiness, batter adherence scores in all the three products. The study revealed that the enrobed chicken meat products can be stored for 7 days without affecting the quality.

Shelf-life of retort processed pepper chicken

**P. NALINI, ROBINSON J. J. ABRAHAM, V. APPA RAO, R.
NARENDRA BABU AND VASANTHI SURESH**

MVC, TANUVAS, Chennai

Heritage meat products in a ready-to-eat form are in great demand in the domestic and international market. The present study was undertaken to standardize a shelf-stable ready-to-eat pepper chicken using broiler meat by retort pouch processing. Three experiments were conducted, in the first experiment the recipe was standardized (pilot scale study) on the basis of sensory evaluation and in second experiment retort pouch processing temperature (F_0 value) was determined based on references, commercial sterility test, visual observation, sensory evaluation and preliminary trials. The come up percentage was 27.27 and the F_0 value was 7.2 minutes. In third experiment, shelf stability was assessed for a period of 90 days by microbiological, physico-chemical, nutritive and sensory qualities by repeating the trials for six times. Results of the present study revealed that the pepper chicken from broiler meat was biochemically and microbially safe. Total viable counts, *E. coli*, *Salmonella spp.*, *Clostridium spp.*, *Staphylococci spp.*, anaerobic count and yeast and mould counts were assessed during the entire storage period.

Preparation and quality evaluation of fermented chevon sausages using fermented bamboo shoot powder

**J. PRIYA VINNARASI, C. D. DAS, V. KESAVA RAO, R.
SARAVANAN AND SELVAMUTHU**

Department of LPT, RGCVAS puducherry

A study was undertaken to develop fermented chevon sausages using fermented bamboo shoot powder at 3 and 5%. Fermented bamboo shoot is a naturally available neutraceutical with low pH which can be used as source of acidification in sausage preparation. Major steps of processing included coarse emulsion preparation, fermentation (at 25 C till pH dropped below 5.2), filling in casings, drying (at 4-5 C for 12-14 hr), and smoking (at 95-100 C for 7hr). Physico chemical evaluation of the product revealed that cooking yield and ash content of the product increased significantly ($P < 0.01$) with increase in level of FBSP. The cooking yield and ash content of the chevon sausages at 3 and 5 % level of bamboo shoot was 64.36, 65.03 per cent and 4.12, 5.75 percent respectively. Other parameters like pH, titrable acids, moisture (%), protein (%) and fat (%) did not show any significant differences. Sensory evaluation was done for parameters like appliances, texture, juices, saltiness, flavour and overall palatability on 8 point hedonic scale (1-extremely undesirable and 8-extremely desirable). Results revealed a significant decrease in flavour and overall acceptability of the products with increase in FBSP. Sensory scores of the products were acceptable and rated as moderately palatable to very palatable. Based on the sensory quality it can be concluded that FBSP at 3 % level was acceptable in preparation of fermented chevon sausages.

Quality & storage stability of hen pickle

B. JAGANNATHA RAO¹, PRADEEP KUMAR², VIVEK M. PATIL³

**¹Department of LPT, ²Department of VPH and Epi, CVC ,
Hyderabad,**

³Department of LPM, KVAFSU, Bidar Karnataka.

The objective of this study was to prepare highly acceptable long shelf life spent Hen pickle, quality evaluation and storage study at 32 °C (summer months.). Meat pickle was prepared using deboned meat from spent layer hens using pickling solutions viz., ground nut oil+ acetic acid, ground nut oil + citric acid, mustard oil+ acetic acid, mustard oil + citric acid combinations. Product from all pickling solution combinations were studied for Physico- chemical, chemical, microbial & sensory analysis on 0,30,60,90 days at room temperature. Microbiological and sensory quality traits did not show appreciable change and remained satisfactory throughout storage period. Product found stable upto 60 days in all pickling solutions, but sensory score was highest to meat pickled with groundnut oil + acetic acid combinations. Meat pickled with mustard oil + acetic acid combinations had good score in terms of Physico-chemical, Chemical and microbial analysis. Therefore present study suggests that a highly acceptable spent hen pickle can be prepared and stored upto 60 days of shelf life even during summer months.

Formulation of shelf stable chicken meat crisps (*Vadialu*) with different extenders

E. NAGA MALLIKA AND K.SUDHEER

Department of LPT, NTR College of Veterinary Science, Gannavaram

The study was aimed at optimizing the extender and its incorporation levels in the formulation of chicken meat crisps (*Vadialu*) for better acceptability. For preparation of chicken meat crisps with different extenders minced meat was added with salt (2.0%), Ginger and Garlic paste (7.0%), Dry spices (1.5%), fat (3.0%) and three different extenders like rice flour, black gram flour and tapioca paste each separately at 3.5 percent level. The batter after blending all ingredients was spread like a thin sheet of approximately 3 mm thickness and is moulded in circles. The moulded circles were dried at different time and temperature combinations and a combination of 45⁰ C for 1 hour 30 minutes was judged as the better one depending on the assessment of the sensory panel. Dried product was fried for a second and sensory evaluation was conducted at this stage keeping in view of its importance in food industry. There was significant difference between the treatments for cooking yield and all sensory parameters. The sensory acceptability was significantly ($P<0.05$) higher for treatments with tapioca paste. The level of incorporation was tested at three different levels and 3.5% level was proved better when compared to the other levels of incorporation with higher sensory scores for colour (8.95), flavour (8.00), crispiness (7.85) and overall acceptability (8.65) and was with moisture content of 14.37% and with higher percent crude protein (35.9) and lower crude fat (14.83) with a pH of 6.17. The product was stable at refrigerated temperature ($4\pm 1^0\text{C}$) for a period of two months. During the storage period pH, Thiobarbituric acid values and Total plate counts showed an increasing trend but were at acceptable levels at the end of the storage period.

Development of beef salami with incorporation of different levels of beef fat

**Z. RAHMAN, M. L. BRAHMA, S. K. LASKAR, NASHRIN JEBIN
AND D. M. CHAVHAN**

CVS, Assam Agricultural University (A.A.U.), Guwahati, Assam

A study was carried out to prepare beef salami with highly acceptable qualities by incorporating beef fat at three different levels viz. 15 %, 20 % and 25 % along with necessary seasonings in formulation A, B and C respectively. Emulsion stability was found to be non significantly highest in formulation C as compared to A and B. The per cent cooking loss also increased non significantly from formulation A (13.81) to C (16.13) with increase in the beef fat from 15 % to 25 % respectively. The per cent moisture, protein and ash content of the salami decreased significantly ($P < 0.01$) with increase in the levels of beef fat from formulation A to C. The per cent fat contents revealed a significant increase ($P < 0.05$) viz. 14.77, 20.22 and 24.81 in formulations A, B and C respectively. Moreover, the organoleptic evaluations revealed significantly ($P < 0.01$) higher scores in formulation B as compared to A and C. Finally, it could be concluded that fat levels up to 20 % could be successfully utilized for preparing desired quality of beef salami. This study mainly emphasized on incorporation of some low cost processing ingredients in preparing salamis for increasing the marginal profits of the Indian meat sector.

Studies on percent cooking yield and shear force value of thigh fillet and breast meat of chicken

R. J. ZENDE AND D. M. CHAVHAN

Department of Veterinary Public Health, Bombay Veterinary College, Parel, Mumbai

In the present study chicken thigh fillet and breast meat was collected from two Different chicken processing plants located nearby Mumbai. A total of 12 samples, 6 each of thigh fillet and breast meat were collected from plant A on 6 different occasions. Similarly equal number of samples was collected from the Plant B. The shear force (kg/cm^2) values of the chicken thigh fillet and breast meat were tested using Warner-Bratzler shear force equipment available in the department, while the chicken thigh fillet cooked in microwave oven at 900 watts for 1.5 min and breast meat for 2 min to calculate the percent cooking yield. The study revealed that the average shear force values (kg/cm^2) of the breast meat collected from Company A and Company B were 1.38 ± 0.13 and 1.28 ± 0.11 , respectively, whereas the average shear force of thigh fillet collected from Company A and Company B was 1.13 ± 0.12 and 1.08 ± 0.07 , respectively. However, the average percent cooking yields of the thigh fillet and breast meat of company A was found to be 72.84 ± 1.44 and 76.88 ± 1.53 while respective values for Company B were observed as 76.91 ± 1.66 and 79.02 ± 1.55 . The shear force (kg/cm^2) and the percent cooking yield of the breast meat was found higher than that of thigh fillet in samples collected from both the companies. Shear force (kg/cm^2) of thigh fillet and breast meat collected from Company A was found more than that of samples from Company B whereas the percent cooking yield of both the meat collected from Company A was found less than the samples from the Company B. Thus the study concluded that the chicken thigh fillet and breast meat samples procured from the company A were tenderer than the samples from Company B.

Studies on development of process for cooked emu meat patties

S. K. MANER, R. D. KOKANE, S. S. ZANZAD, K. A. PATIL AND Y. P. GADEKAR¹

**Department of LPT, Bombay Veterinary College (BVC), Mumbai
¹CSWRI, Avikanagar**

A process for emu meat patties was developed. The emu meat and emulsion were analyzed for proximate composition as well as pH, WHC and moisture and were found in normal. The patties were prepared by two methods viz. deep fry cooking (170 °C for 45 second, T1) and hot air oven cooking (110 °C for 25 minutes, T2). Patties prepared by deep frying exhibited significant ($P < 0.05$) difference in cooking yield and loss from oven cooking method. The patties were analyzed for proximate composition and changes in TBA, tyrosine, pH, WHC, moisture, shear force as well as microbial parameters during storage at refrigeration temperature ($4 \pm 1^{\circ}\text{C}$). Fat content was significantly higher ($P < 0.05$) and moisture was significantly lower ($P < 0.05$) in deep fried than oven cooked patties. Storage study revealed that TBA number, tyrosine value and microbial counts increased considerably at the end of 15 days storage, while pH, moisture content and shear force value declined gradually with the progress of storage in both the treatments. Sensorial oven cooked patties were significantly superior in sensory attributes over deep fried patties. Though the values for TBA, tyrosine and pH was below the critical limit of spoilage, due to higher count of TPC and YMC the study restricted on 15th day of storage.

Study on incorporation of carrot (*Daucus carota*) and radish (*Raphanus sativus*) paste on the quality of spent hen chicken nuggets
1R. K. Kanimozhi and S. K. Mendiratta

Division of LPT, IVRI, Bareilly, ¹ PGRIAS, Kattuppakkam, T.N

Changes in the life style of consumer resulted in developing novel meat products with incorporation of functional ingredients such as vegetable and vegetable proteins. Vegetables are rich source of phytochemicals such as carotenoids, flavonoides and other phenolic compounds. Therefore, it is important to consume a diet high in phytonutrients/ phytochemicals to reduce the harmful effects of oxidative stress. Synthetic antioxidants (BHA and BHT) have no longer in use by the consumers due to their carcinogenic effect. Vegetables are classified as non meat ingredient, utilized in comminuted meat products to improve the nutritive value, palatability, texture and also to reduce the cost of production in the finished product. An experiment was conducted with incorporation of raw carrot (*Daucus carota*) (CR) and radish (*Raphanus sativus*) (RD) paste at the level of 5% each (CR+RD@10%) in the spent chicken emulsion for the preparation of chicken nuggets. It is reported that CR has free radical scavenging and singlet oxygen quenching properties due to presence of β - carotene and RD is an excellent source of vitamin C acting as powerful antioxidant food. The emulsion was prepared as per the standard procedure developed at Division of LPT, IVRI, Bareilly, UP, India with slight modification and compared with the control (CN) (without CR and RD paste) for the effect on emulsion stability (ES), cooking yield (CY) and shear force (N) value. The results revealed that incorporation of CR+RD paste in chicken nuggets had no significant effect on ES and CY compared to CN. But, however the shear force value (N) of chicken nuggets treated with CR+RD paste @ the level of 10% (5% each) was significantly lower (6.97 ± 0.15) than CN (8.98 ± 0.32).

**Preparation and quality evaluation of fermented chevon sausages using
fermented bamboo shoot powder**

J. PRIYA VINNARASI, C. D. DAS, V. KESAVA RAO, R.

SARAVANAN AND S. SELVAMUTHU

No 45, Serumavelangai, Nedungadu, Karaikal-609603

A study was undertaken to develop fermented chevon sausages using fermented bamboo shoot powder at 3 and 5%. Fermented bamboo shoot is a naturally available nutraceutical with low pH which can be used as source of acidification in sausage preparation. Major steps of processing included coarse emulsion preparation, fermentation (at 25°C till pH dropped below 5.2), filling in casings, drying (at 4-50 °C for 12-14 hr), smoking (at 95-100°C for 7hr). Physico chemical evaluation of the product revealed that cooking yield and ash content of the product increased significantly ($P < 0.01$) with increase in level of FBSP. The cooking yield and ash content of the chevon sausages at 3 and 5 % level of bamboo shoot was 64.36, 65.03 per cent and 4.12, 5.75 percent respectively. Other parameters like pH, titrable acids, moisture (%), protein (%) and fat (%) did not show any significant differences. Sensory evaluation was done for parameters like appearance, texture, juiciness, saltiness, flavour and overall palatability on 8 point hedonic scale (1-extremely undesirable and 8-extremely desirable). Results revealed a significant decrease in flavour and overall acceptability of the products with increase in FBSP. Sensory scores of the products were acceptable and rated as moderately palatable to very palatable. Based on the sensory quality it can be concluded that FBSP at 3 % level was acceptable in preparation of fermented chevon sausages.

Optimization of low salt restructured chicken nuggets using response surface methodology

FEBY LUCKOSE, M. C. PANDEY, K. RADHAKRISHNA

**Freeze Drying and Animal Products Technology Division, DFRL,
Mysore**

Response Surface Methodology (RSM) was used to optimize low salt restructured chicken nuggets considering four factors viz; whey protein, black gram flour, sodium chloride (NaCl) and potassium chloride (KCl) and three responses as overall acceptability (OAA), saltiness and hardness. OAA and saltiness were evaluated using 9 point hedonic scale rating test for likability and hardness measured using texture analyzer. The range for the selected factors was chosen based on preliminary sensory trials. The minimum and maximum limits for the factors were selected as 0.5 to 1.5% for protein, 2 to 4% for black gram flour, 0.5 to 1% for NaCl and 0.5 to 1% for KCl. Experimental design was set up with 8 axial points and 6 replicates at center. The responses were evaluated and the factors were optimized. Analysis of variance for all responses indicated that quadratic model was significant with non-significant lack of fit with $R^2 > 0.95$. The final optimized values were obtained keeping all the factors in the range including the response hardness. However, other responses like OAA and saltiness were maximized. The optimized values for protein, black gram flour, NaCl and KCl were obtained as 1.18%, 2.49%, 0.75% and 0.69% respectively with a desirability of 97.8%.

Development of low sodium meat products
M. ANNA ANANDH AND C. VEERAPANDIAN
VCRI, Orathanadu, Tamil Nadu,

Sodium chloride (NaCl) or common salt is most widely used as an ingredient in foods, particularly in meat, dairy and fishery products. Traditionally it has been added as a preservative. Functional and nutritional considerations are now becoming more important in the use of such ingredient in food processing industry. In response to increased perception linking sodium intake to health problems, the public has become more concerns with their sodium intake since NaCl is the major source of sodium in the human diet and processing food products. It is reported that 20-30% of the salt intake comes from meat products. Reports suggested that food products containing 300-500 mg sodium per serving are best candidate for sodium reduction. Processed meat products frequently contain more than 300 mg sodium/100 gm. The primary aim of lowering the salt in meat products is to reduce the sodium intake for these individuals sensitive to dietary sodium. The more productive approach for low sodium product has been the target salt content to the minimum necessary for function by either leaving out a portion or replacing it with other ingredient that contribute to maintaining ionic strength or providing salty flavour or do both simultaneously. They are several approaches can be used to investigate the feasibility of reducing the NaCl content of processed meat products that includes reducing NaCl content only, replacing part or all of the NaCl with other chloride salts, replacing the part of the NaCl with non chloride salts, by use or altering processing techniques or process modifications and combination of the above methods. However, decreasing salt content has many implications in meat products that include textural changes, decreased moisture retention, shortened shelf life, safety and even product appearance.

Development of designer meat products for health conscious consumers

M. ANNA ANANDH, C. VEERAPANDIAN AND K. SIVAKUMAR
VCRI, Orathanadu, Tamil Nadu,

Meat and meat products are essential component of our diet. They contain components like fat, cholesterol sodium, nitrite etc. in higher level which are harmful to health. Designer meat products may be a health promoting food, a meat product to which a component has been removed by technological means for additional physiological benefits, i.e., prevent or reduce the risk of diseases. Three options are suggested to achieve designer meat and meat products which includes production practices, post harvest techniques and reformulation techniques. A Number of approaches are followed to design the healthier meat products that include alternation of lipid and its composition, reduction of sodium reduction of nitrite and incorporation of designer food ingredients during processing of meat products, Based on the approaches involved, the designer meat foods have been categorized into four groups, viz, low fat meat products, low sodium meat products, nitrite reduced meat products and other types containing designed food ingredients. For reduction of fat, modification of fatty acid contents and to enhance the vitamins and protein content of meat, a number of approaches are followed at production level. Such production practices include feeding practices, hormonal treatments, genetics and breeding and biotechnological approaches. However, the production practices not suitable for designer meat development because of less effective quality control and technological challenges including physicochemical and sensory problems. Therefore, in addition to traditional composition, it is possible to include a wide variety of health promoting ingredients in meat products for health claim. They may be dietary, fibres, oligosaccharides, plant proteins, dairy proteins, vegetable oil, synthetic lipids, bioactive ingredients photochemical and probiotics. However, the level for health claim with optimum organoleptic properties of majority of these ingredients in meat products has yet to be determined.

Standardization of formulation in development of shelf-stable meat after using combination of turkey and spent hen meat

A. K. BISWAS, C. K. BEURA AND A. K. SACHDEV

Division of Post-Harvest Technology, CARI, Izatnagar, Bareilly

For development of shelf-stable meat wafer a formulation is developed with the combination of minced turkey and spent hen meat (70:30), table salt, sodium tri-polyphosphate, skimmed milk powder, textured soya protein, baking powder, spice mix, condiments, monosodium glutamate, rice flour, maida and oat flour @ 70, 1.0, 0.2, 3.5, 5, 0.5, 1.75, 3.0, 0.25, 8.2, 3.0 and 3.6 %, respectively. These entire ingredients were mixed properly for preparation of dough. The raw wafer was prepared by cold extrusion method and cooked in microwave oven. The developed products were cooled and then kept at room temperature for evaluation of various physicochemical and sensory quality parameters. The cooking yield was in the range of 42 - 46 %. The pH of the raw and cooked product was 6.21 ± 0.10 and 6.44 ± 0.14 respectively. Moisture content of the product was $8.46\pm 0.66\%$. The water absorption index and water solubility index was 3.24 and 0.085, respectively. In regards to sensory attributes, the products were rated very good to good and were exhibited appearance and colour, texture, meat flavour intensity, after taste, crispiness and overall acceptability scores 6.42, 6.26, 5.81, 6.08, 6.38 and 6.45, respectively. Finally, it may be concluded that shelf-stable meat wafer can be prepared with the combination turkey and spent hen meat without affecting physicochemical and sensory quality parameters.

EFFECT OF DIFFERENT LEVEL OF HONEY ON THE QUALITY OF MICROWAVE OVEN COOKED CHICKEN PATTIES

**B.M.Naveena, A.R.Sen, S.Vaithyanathan, .Muthukumar,
S. Girish Patil and Y.Babji**

**National Research Centre on Meat, CRIDA Campus, Santoshnagar,
Saidabad (Po), Hyderabad, 500059, A.P.**

The objective of the study was to evaluate the antioxidant capabilities of liquid honey (0, 5, 10 & 15% w/w) in delaying lipid oxidation in microwave cooked chicken patties compared to patties containing 500 ppm vitamin C. Inclusion of honey increased ($P < 0.05$) the cooking yield from 82.74 to 85.3% and reduced the cooked pH from 6.05 to 6.00. The water activity has reduced from 0.933 to 0.912 in 15% honey patties. Both surface and internal colour values (Hunter lab a^* /redness) have increased from 4.62 to 6.83 and 4.76 to 6.65 in honey containing patties compared to control indicating development of attractive colour in honey patties. Sensory evaluation studies revealed significant ($P < 0.05$) increase in appearance scores of all honey containing patties compared to control. Patties containing 5% honey scored ($P < 0.05$) better for all sensory attributes compared to others. Honey at higher level (10 and 15%) resulted in lower ($P < 0.05$) scores for flavour, juiciness, sweetness and overall palatability. Treatment with honey at all levels reduced the TBA values compared to control. No difference was observed in TBA values between different honey levels. However patties containing vitamin C have exhibited lowest ($P < 0.05$) TBA values compared to others. Therefore it is concluded that inclusion of 5% w/w honey resulted in increased cooking yield and Hunter lab a^* values, lower water activity and TBA values and significant improvement in sensory attributes. Thus 5% w/w honey can be used as a natural antioxidant in chicken patties.

COLOUR, MYOGLOBIN DENATURATION AND STORAGE STABILITY OF RAW AND COOKED MUTTON STEAKS AT DIFFERENT END POINT COOKING TEMPERATURE

AR.Sen. B.M.Naveena, M.Muthukumar, S.Girish Patil, C.Ramakrishna and Y.Babji

National Research Centre on Meat, CRIDA campus, Santoshnagar, Hyderabad - 500 059, A.P. India.

Mutton steaks (*Longissimus dorsi*) were cooked by grilling (Microwave oven) at various end point temperatures (51°C to 79°C) to determine the effect on visual and instrumental colour values (Hunter Lab L*, a*, b*, Hue, Chroma), myoglobin state (metmyoglobin, % denatured myoglobin, PMD), pH, oxidation-reduction potential (ORP) Water Holding capacity, water activity (a_w) and moisture %. The raw and cooked mutton steaks were stored at refrigerated temperature (4±1°C) and pH, Thio-barbituric acid reactive substances (TBARS), microbiological count, and sensory odour were determined on 0, 4th and 8th day of storage. The Hunter a* (redness) value decreased from 11.40 (raw) to 8.21 after reaching end point temperature 79°C. Hue increased from 48.78 (raw) to 64.77 and 68.40 at end point temperature 71 °C and 79 °C respectively. Water activity did not vary much and ranged from 0.91 to 0.93. As internal cooking temperature increased soluble myoglobin content decreased with a corresponding increase in PMD. The PMD values ranged from 0% (raw steaks) to 77.30% in steaks cooked at 79 °C internal temperature. The TBARS increased significantly ($P<0.01$) from 0.18 (0 day) to 0.90 (8th day). The aerobic plate counts of both raw and cooked mutton steaks were well within the acceptable limits (log 3.54 to 5.62) during storage. It is concluded that the a* (redness) values decreased and PMD increased with the increase in end point cooking temperature. It is also concluded that raw and cooked mutton steaks can be stored upto 8 days at refrigerated temperature without any microbial spoilage. However raw mutton steaks exhibited slight off odour at the end of storage.

THE ROLE OF CARNOSINE, GINGER, AND CINNAMON ON SOME PHYSICO-CHEMICAL QUALITIES OF COOKED GROUND BUFFALO MEAT

S.Biswas, R.Banerjee and G.Patra

**Department of Animal Products Technology and Marketing,
Faculty of Veterinary and Animal Science, West Bengal
University of Animal & Fishery Sciences 37, K.B.Sarani,
Kolkata-37**

Considering the need of extending the shelf life of buffalo meat in the perspective of its export potentiality, a various items in terms of antioxidant and preservatives have been tried with varying degree of success. In vogue of present national and international barriers regarding use of chemical feed additives to food processing and preservation, the biological and plant origin food additives have got better significance and require emphasis for attention and study. In view of the above, a study was conducted to evaluate the physico-chemical, microbial and organoleptic quality of cooked ground buffalo meat treated with 1% level of carnosine, ginger, and cinnamon. It was observed that meat samples treated with carnosine significantly ($P<0.05$) improved meat pH and water holding capacity and lowered cooking loss and thiobarbituric acid (TBA) value as compared to control and other treated samples. Carnosine also improved ($P<0.05$) desired colour and flavour of meat samples. Though there were no significant ($P>0.05$) difference in juiciness, tenderness and overall acceptability scores of the treated meat samples, however, treatment with carnosine score highest in general.

FISH BALL - A DIVERSIFIED FISH PRODUCT FROM LOWCOST SCIAENIDS SP. (JONIUS TOLITHUSRUBER)

**P. Velayutham, G. Sugumar, M. Saravanan, and S. A.
Shanmugam**

**Department of Fish Processing Technology Fisheries
College and Research Institute, Thoothukudi - 628 008**

From low value Sciaenids sp. (*Jonius otolithusruber*) i. cooked and chilled ii. Steam cooked, Battered and breaded and iii. Battered and breaded, flash fried fish balls stored at refrigerated temperature (5°C). Biochemical parameters such as moisture, protein, fat, carbohydrate, ash, free fatty acids, pH, crude protein and lipids were analysed in the above different types of fish balls. Microbiological parameters such as total plate count; total fungal count, spore count, total staphylococci, *E. coli*, *Salmonella* and psychrophiles were also estimated. In cooked and chilled fish balls the acceptable condition was upto the storage period of 15 days and the total plate count was recorded as 2.5×10^8 cfu/g. Total fungal count, *E. coli* and Psychrophiles were < 10 cfu/g at 15 days. The *Salmonella* was absent. Among, the different types of fish balls maximum shelf life of 24 days in battered and breaded, flash fried fish balls and minimum shelf life of 12 days in steam cooked, and battered and breaded fish balls were observed.

STUDIES ON PROCESSING, PRESERVATION AND QUALITY OF MEAT SANDWICH SPREAD

R.C. Keshri and A.S.R. Anjaneyulu

**Division of Livestock Products Technology, Indian Veterinary
Research Institute, Izatnagar - 243 122**

Attempts were made to develop suitable formulation and processing conditions for manufacture of chicken meat sandwich spread of indigenous nature. Meat sandwich spread may be considered as an industrialized product of animal origin in which utilization of meat from aged birds and animals seem possible. This may also become a less expensive meat product to use as substitute of butter, cheese spread, jam, jelly, mayonnaises etc.

Three processing methods namely Microwave Cooking, Pressure Cooking and Simmering of minced meat along with seasonings, spices and condiments were tried. The processed product from all the three ways was subjected for sensory evaluation by panel of judges. The sensory scores for attributes like appearance, flavour and overall acceptability were highest in case of samples processed by simmering which was selected as the method of choice. Further studies were also carried out to find out a suitable level of fat to be incorporated in the product. Out of the two levels of fat from the combination of three sources ie. Butter fat, native fat and vegetable fat, the judges, on the basis of flavour and overall acceptability preferred the samples containing 45% of fat level over those containing 65%. The level of different other ingredients to be incorporated in the meat sandwich spread was standardized and formulation was finalized. The samples containing low fat level were subjected to consumer panel evaluation. Sixty percent people rated the product into the category excellent, twenty percent as very good and another twenty percent between good and satisfactory.

**ROXIMATE COMPOSITION AND MICROBIOLOGICAL
QUALITY OF YOO-ASO - A TRADITIONAL MEAT
PRODUCT OF RUNACHAL PRADESH**

**Borpuzari, R. N., Sai, Mobia, Das, Ankur, Saikia, P.P.,
Borpuzari, T., and Maurya, P.**

**Department of Livestock Products Technology, Faculty of
Veterinary Science Assam Agricultural University,
Khanapara: Guwahati - 78122**

Yoo-Aso is a traditional pork product of the Apatani tribe of Arunachal Pradesh. The sub-cutaneous fat layer with the skin of the trunk of pig carcass is removed and a herbal preparation called pila is applied over the surface uniformly as preservative. Pila is the aqueous filtrate of the ash of millet and a locally grown fern. The product has amazing shelf-life of over 10 years at room temperature. The proximate composition of yoo-aso preserved for 3½ years revealed that it contains $26.64\% \pm 1.08$ moisture, $57.12\% \pm 1.67$ ether extract, $14.56\% \pm 0.65$ protein and $1.66\% \pm 0.18$ total ash. Microbiological examination of the sample indicated that the samples had a mean total viable mesophilic aerobic count of $6.02 \pm 0.72 \log_{10} \text{cfu/g}$. The samples were negative for coliforms at 0.001g. Further work on preservative properties of pila and changes in the microbial population during various stages of preservation of yoo- aso are being undertaken.

DEVELOPMENT AND QUALITY EVALUATION OF COOKED BUFFALO TRIPE ROLLS

**M.Anna Anandh, V.Lakshmanan, A.S.R.Anjaneyulu,
S.K.Mendiratta,K. Radha and R.P.Singh**

**Division of Livestock Products Technology, Indian
Veterinary Research Institute, Izatnagar - 243 122 U.P.**

Rumen meat otherwise known as tripe, is one of the important edible offals of buffaloes and it accounts for 1.3% of the slaughter weight with substantial yield of 4.36 to 5.43 kg per animal. Development of technologies for converting tough, less palatable and more perishable buffalo tripe into more tender, convenient and more palatable processed products results in better and higher utilisation of this by-product. In this perspective, a study was conducted for preparation of cooked tripe rolls. Cooked buffalo tripe meat rolls were prepared from a combination of buffalo tripe (75%) and buffalo skeletal meat (25%). Two types of cooked buffalo tripe rolls were developed i.e. minced buffalo tripe meat rolls (using mincing) and blade tenderized buffalo tripe meat rolls (using blade tenderization). The rolls prepared from 100% minced buffalo skeletal meat were used as control. Physico-chemical and sensory attributes of products were evaluated. Results of physico-chemical parameters revealed that pH, product diameter shrinkage and shear force value were slightly lower in minced buffalo tripe meat rolls as compared to blade tenderized buffalo tripe meat rolls. The product yield was slightly higher in minced buffalo tripe meat rolls whereas drip loss value was significantly lower in blade tenderized tripe meat rolls. All physico-chemical parameters of minced buffalo tripe meat rolls were comparable with control. Sensory evaluation results indicated that buffalo tripe rolls prepared by blade tenderization technique were 'moderately acceptable' whereas rolls prepared by mincing were rated 'very acceptable'. Both products were well accepted by the panelists with minced buffalo tripe meat rolls rated higher sensory scores than blade tenderized tripe meat rolls. Findings of this study have shown that buffalo tripe (75%) and buffalo skeletal meat (25%) can be successfully used for preparation of cooked tripe rolls of acceptable quality by mincing or blade tenderization with substantial value addition to the buffalo tripe.

UTILISATION OF LOW VALUE FISH THREADFIN BREM (NEMIPTERUS BLEEKARI) IN TO VALUABLE PRODUCTS

K.Rathnakumar, S.Sangeetha and G. Indra Jasmine

**Deaprtment of Fish Processing Technology Fisheries
College and Research Institute, Thoothukudi**

Three different flavoured fish fillet viz. tamarind, pepper and spice were prepared using threadfin bream (*Nemipterus bleekari*) fish fillet and its storage behaviour was evaluated for 120 days. Bio chemical parameters like pH, salt, moisture and VBN were measured. Sensory qualities such as appearance, taste, odour, and overall acceptability of the dried fish fillets were assessed. No significance difference ($P>0.01$) in the overall acceptability of fish fillet prepared by three treatments was observed. Flavoured fish fillets of all three treatments were found to be acceptable till the end of the 20 days.

ISOLATION OF CHITIN FROM SHRIMP SHELL WASTE USING VARIED CONCENTRATIONS OF HYDROCHLORIC ACID AND ITS CONVERSION TO CHITOSAN

**G. Indra Jasmine, K. Rathnakumar and G. Athiveerarama
Pandidurai**

**Department of Fish Processing Technology Fisheries
College and Research Institute, Thoothukudi- 628 008**

Shrimp shell waste is an important source of chitin and chitosan which have many applications in industry such as sizing of stabilizing and thickening agents, rayon, cotton, synthetic fibres, wool, paper, cellophane, as adhesives in pharmaceuticals and cosmetics etc. In the present experiment, chitin was isolated from shrimp shell waste by treatment with varied concentration of acid for removal of minerals and boiling with 3 % sodium hydroxide for the removal of proteins. The chitin thus produced was converted to chitosan by boiling with 40% sodium hydroxide. The effect of different treatments on the quality characteristics of chitin and chitosan produced was assessed, The percentage of mineral content removed by treatment with 1.25, 1.5 and 2 N hydrochloric acid were 96.5, 97.3 and 98.2. The percentage of protein removed in the samples by the above treatment were 26.3, 40.1 and 39.7 per cent respectively. The samples prepared by treatment with 1.25 and 1.5 N hydrochloric acid showed higher viscosity than that produced by treatment with 2N hydrochloric acid.

EFFECT OF PECTIN COATING ON SENSORY QUALITY OF BUFFALO MEAT PATTIES

Chidanandaiah and R.C. Keshri Division of Livestock

Products Technology Indian Veterinary Research Institute,

Izatnagar, Uttar Pradesh - 243 122

Edible coatings are the substances that are used to preserve and enhance the food quality. Application of edible films and coatings involved to extend the shelf life and improve the quality of fresh, frozen and fabricated foods. An attempt was made to improve the quality of buffalo meat patties (BMP) by coating different concentrations (0, 2, 4, and 6%) of pectin solution along with preservatives. Method of coating involves dipping BMP during end of the broiling process in pectin solution for 30 sec., followed by dipping in calcium chloride solution for 30sec., followed by draining for 30 sec. The coated BMP were kept at refrigeration ($4\pm 1^{\circ}\text{C}$) temperature in a polyethylene bag. They were analyzed for sensory quality changes at regular intervals of 0,7,14 and 21 days. Pectin coating at 2% level significantly ($P=0.05$) improved the overall sensory attributes viz., appearance & colour, juiciness, flavour, texture and overall palatability of the product when compared to control and found optimum for coating BMP. During storage overall sensory attributes viz., appearance & colour, juiciness, flavour, texture and overall palatability decreased at each interval.

EFFECT OF ENROBING ON THE ACCEPTABILITY OF CURD (DAHI) MARINATED CHICKEN MEAT CHUNKS

A.K.Biswas, R.R.Kumar, Chidanandaiah and V. Pathak
Division of Livestock Products Technology, Faculty of Veterinary
Sciences & Animal Husbandry Sher-e-Kashmir University of
Agricultural Sciences and Technology-Jammu, R.S.Pura-181 102
(J & K), India.

Enrobing with different cereal flours are used to add value to a product by improving texture, flavour, weight and volume and reducing water loss during frying which in turn, increases juiciness. In the present investigation, the acceptability of deep fat fried chicken meat chunk were studied using model systems based on bengal gram flour (BGF), corn flour CF), and refined rice flour (RRF) after over-night marination in curd (200 g/kg) along with 2% added salt of each. Crispiness was higher in RRF based coated meat chunks; however, coating containing CF had better adhesive qualities than those containing other cereals. Batter consistency and pick-up was higher in BGF based chicken meat chunks followed by RRF>CF. Marination before enrobing reduced times required for doneness. Temperature of heating was negatively correlated with the oil absorption. From the experiment it has also been observed that addition of whole egg liquid in stead of combination of WEL and water offer the promising results in term of adhesiveness, coating thickness, crispiness, colour, and attractive appearance.

EFFECT OF MARINATION IN GINGER AND ENROBING ON THE ACCEPTABILITY OF DEEP FAT FRIED CHICKEN PARTS

V. Pathak, A.K.Biswas, R.R.Kumar, and Chidanandaiah

Division of Livestock Products Technology, Faculty of Veterinary Sciences & Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology-Jammu, R.S.Pura-181 102 (J & K)

The present study was envisaged to evaluate the effect of marination in ginger as well as enrobing using different flours on the acceptability of deep fat fried chicken parts. In the investigation, cut-up broiler (1.5 kg dressed weight) parts were obtained from retail outlets, marinated over-night in ginger paste (200 g/kg) with addition of 2% salt and then coated with bengal gram flour (BGF), corn flour (CF) and refined rice flour (RRF) as base materials, separately. Marination in ginger had very good acceptability on textural effect. Bengal gram based coated products had higher batter pick up and coating thickness, whereas corn flour had least value of the same. However, CF based chicken chunks had higher cooking yield and sensory scores viz., appearance & colour, flavour, texture, juiciness, coating adhesion and overall acceptability but BGF based product had significantly higher protein content followed by CF > RRF.

THE STORAGE STABILITY AND TEXTURAL, PHYSICO-CHEMICAL AND SENSORY QUALITY OF GOAT MEAT PATTIES EXTENDED WITH FULL-FAT SOY PASTE AND SOY GRANULES

**Arun K Das*, ASR Anjaneyulu, Arun K Verma and N. Kondaiah
Division of Livestock Products Technology**

Indian Veterinary Research Institute, Izatnagar, Bareilly-243 122, India

***CIRG, Makhdoom, Farah-281 122, Mathura (UP)**

The performance of reduced beany flavour full-fat soy paste (FFSP) made by simple processing technology was compared with the commercially available soy granules in goat meat patties. Addition of soy paste and soy granules did not significantly affected the emulsion stability and product yield. Shrinkage of patties with soy paste was comparable with control. A significant ($P < 0.05$) reduction in redness and increase in yellowness of patties was due to addition of soy proteins than in controls. Patties with soy paste had comparable total lipid and cholesterol content with that of control but higher than patties with soy granules. Lower force was required to compress or shear the sample as hardness decreased in soy incorporated patties. Addition of soy proteins did not affect their sensory attributes except flavour and overall acceptability. Flavour and overall acceptability scores between control and patties with soy paste did not differ significantly whereas patties with soy granules were rated significantly lower. The patties remained stable with some changes in physico-chemical, microbiological and sensory quality during refrigerated storage ($4 \pm 10\text{C}$) for 20 days and in frozen storage ($-18 \pm 10\text{C}$) for 90 days. It is concluded from this study that FFSP had potential application similar to commercially available soy granules in comminuted meat products.

EFFECT OF DIFFERENT FATS ON THE QUALITY OF GOAT MEAT PATTIES INCORPORATED WITH FULL-FAT SOY PASTE

**Arun K Das*, ASR Anjaneyulu, Arun K Verma and N. Kondaiah
Division of Livestock Products Technology**

Indian Veterinary Research Institute, Izatnagar, Bareilly-243 122, India

***CIRG, Makhdoom, Farah- 281 122, Mathura (UP).**

Effect of different fats such as goat fat, chicken fat, combination of goat and chicken fat and refined mustard oil (RMO) were evaluated in goat meat patties incorporated with full-fat soy paste. Goat fat adversely affected the emulsion stability compared to RMO, chicken fat and combination. Addition of RMO contributed significantly ($P < 0.05$) better emulsion stability (ES) whereas emulsion prepared with goat fats showed least emulsion stability. The yield of patties containing RMO and chicken fat were found to be significantly ($P > 0.05$) higher than that of goat fat. Moisture content was significantly ($P < 0.01$) lower and fat content was significantly ($P < 0.01$) higher in GMP with chicken fat and RMO than in other products. Protein and ash content of patties did not differ significantly among fat groups. There was no significant ($P < 0.05$) effect on expressible moisture content due to different fat incorporation. Patties with refined mustard oil and chicken fat indicated better water holding compared to patties with goat fat. There were no significant textural attributes of patties except gumminess and shear force but patties with goat fats alone required markedly higher force to cut test sample compared to others obviously due to addition of saturated hard goat fat in the formulation. Patties with RMO had significantly ($P < 0.05$) lower cholesterol content than other groups and had similar calorific value with patties with chicken fat. Sensory analysis showed that goat meat patties with RMO, chicken fat and chicken and goat fat combination were rated higher for all sensory attributes than patties with goat fat which had significantly ($P < 0.05$) higher mouth coating and lower overall acceptability. Flavour and overall acceptability were higher in patties with chicken fat. Histological study showed improper dispersion of goat fat in continuous phase of meat protein matrix (emulsion) compared to others. This study indicated that highly acceptable goat meat patties can be prepared using goat fat with chicken fat along with full-fat soy paste.

EFFECT OF EDIBLE COATING ON PHYSICO-CHEMICAL, NUTRITIONAL AND SENSORY QUALITY OF CHICKEN PATTIES

Sanjay Yadav, D.P. Sharma and Rajendra Yadava

Department of Livestock Products Technology, Ranchi Veterinary College, B.A.U.Ranchi-6

An investigation was conducted to assess the effect of rice flour (RF) and refined wheat flour (RWF) with or without carboxymethyl cellulose (CMC) and guar gum (GG) as coating materials on physico-chemical, nutritional and sensory quality of steamed, enrobed and deep fat fried (SDFF) chicken meat patties. Initial levels of coating material were selected on the basis of batter viscosity and adhesion characteristics. One combination each from RF and RWF based patties was selected on the basis of sensory characteristics. Finally selected batters for enrobing were also added with preservatives (nisin and tocopherol). CMC and GG when used alone or in combination were able to provide desired viscosity and adhesion characteristics at a lower level of rice flour and refined wheat flour in batters. Higher level of RWF in comparison to RF was required to reach at a desired level of viscosity and adhesion. Sensory characteristics of chicken patties containing CMC alone or in combination with GG were more desirable in RF and RWF patties. Enrobing resulted in an increase in cooking yield with RWF having significantly higher cooking yield than RF treatment. Higher moisture and lower protein content were observed in enrobed SDFF patties. Fat content was significantly higher in RWF and lower in RF treatment in comparison to control. Enrobed patties had significantly lower shear force and pH values. TBA value of RF was lower and that of RWF higher than control. Organoleptically and nutritionally acceptable SDFF chicken patties can be prepared using RF and RWF along with CMC and GG as coating materials.

DEVELOPMENT OF A READY-TO-EAT PORK PRODUCT "COSMORK" WITH BAMBOO SHOOT EXTRACT

**S. Sangmai, M. Hazarika, and M.L. Brahma Department of Livestock
Products Technology, College of Veterinary Science, Assam
Agricultural University, Khanapara, Guwahati - 781 022,**

Pork is one of the most popular meats in North Eastern Region (NER) and there is a growing demand for ready-to-eat pork products in recent years. Pork consumers often express their desire to have easily available locally produced pork products with an indigenous taste which could be stored at room temperature for a considerable period without affecting its qualities. Ripened bamboo shoot (Khoricha) is being used by the tribal people of NER since time immemorial for preservation of meat products which is reported to have antibacterial, nutritional and organoleptic values. Keeping in view the above facts, a study was undertaken to develop a new ready-to-eat cooked-smoked pork products with and without bamboo shoot extract. Pork stripes of two inches were made from loin and ham region of Hampshire pig. The stripes were cured, marinated with species. One half of the stripes were treated with bamboo shoot extract (BSE). The stripes were pressure cooked-smoked and packed in HDPE and stored at room temperature. The products were subjected to different physico- chemical, organoleptic and microbial quality evaluation. Cooking loss was significantly higher while the shear force values were significantly lower in products with BSE than the control. The proximate composition, water activity, pH, TBA values, organoleptic attributes and microbial qualities were found to be non-significant between the products. The product with BSE was liked by higher percentage of consumers and both the products could be stored up to 10 days at room temperature without quality deterioration. A new name "COSMORK" is given to the product which could be commercially exploited in NER.

EFFECT OF ADDITION OF VARIOUS LEVELS OF WHEY PROTEIN CONCENTRATE (WPC) ON THE QUALITY OF CHICKEN PATTIES

D. T. Sakunde, R. K. Ambadkar, P. N. Zanjad

Department of Livestock Products Technology College of Veterinary and Animal Sciences, Parbhani - 431 402

Quality of chicken patties formulated with the proportionate replacement of lean broiler meat with various levels (0, 3, 6 & 9%) of Whey Protein Concentrate (WPC) was assessed on the basis of different physicochemical characteristics viz., yield, cooking loss, proximate composition (moisture, fat and protein contents) and sensory evaluation. pH and fat contents of the chicken patties significantly ($P < 0.05$) increased with the increase in the level of WPC. Cooking yield, moisture and protein contents were also improved while cooking loss was reduced significantly ($P < 0.05$) with added levels of WPC over control. Incorporation of WPC up to 3 per cent significantly ($P < 0.05$) improved flavour, juiciness, texture and overall palatability of the product. Thus, study revealed use of 3 per cent level of WPC was optimum for the production of improved quality of chicken patties.

POULTRY MEAT SPECIATION BY FORENSICALLY IMPORTANT NUCLEOTIDE SEQUENCING (FINS)

Girish, P.S.¹ Anjaneyulu, A.S.R.² and Bhilegaonkar, K. N.³
¹National Research Center on Meat, Hyderabad-23, ²Division of LPT, IVRI, Izatnagar, Bareilly, Uttar Pradesh-243 122,

A method for species identification of meats from different poultry species viz., chicken (*Gallus gallus*), duck (*Anas platyrhynchos*), domestic quail (*Coturnix japonica*), turkey (*Meleagris gallopavo*) and guinea fowl (*Numida meleagris*) has been tried here by sequencing and analysis of mitochondrial (mt) 12S rRNA gene. Method involves DNA extraction from tissues, polymerase chain reaction (PCR) amplification of mt 12S rRNA gene, sequencing of amplicons followed by sequence analysis. Successful PCR amplification of the targeted gene was achieved in both fresh and processed meat products, including the meat samples cooked at 121°C for 30 min. Sequence analysis could distinguish all the species including closely related species such as chicken-quail and turkey-guinea fowl. Sequences were also compared with mt 12S rRNA gene sequences of Goose (*Anser rosii*), ostrich (*Struthio camelus*) and emu (*Dromaius novaehollandiae*). Results showed that sequencing and analysis of mt 12S rRNA gene can unambiguously and authentically detect species from all available forms of poultry meat samples.

DEVELOPMENT OF READY TO EAT SNACK CROQUETTES FROM SPENT HEN MEAT

K.Sivakumar, D.Jayanthi, V.V.Kulkarni and V.Chandirasekaran
**Department of Meat Science and Technology, Veterinary College and
Research Institute, Namakkal**

Spent hens are the by-products of layer industry. Spent hen meat is tough, dry and sinewy. Processing problems, declining acceptance and lowered prices contribute to the economic losses in the layer poultry industry. Spent hen meat can be profitably utilized by preparing value added meat products. Studies were conducted on preparation of an easy to make, ready-to-eat meat snack product croquette. 25 numbers spent hens of above 72 weeks were purchased from the local poultry farm and the birds were slaughtered by humane method, dressed hygienically and deboned. Slaughter data was collected and de-boned meat was stored in deep freeze (-200C) for further use. Frozen meat was thawed in the refrigerator for making product. Meat was minced using a meat mincer. Salt, spices, ginger garlic paste, polyphosphates, and a binder, rice flour were added and mixed in a spar meat homogenizer to get a uniform batter. It was molded into 10-gram balls and deep-fried in refined vegetable oil to uniform brown colour using a deep fat fryer. The storage studies were conducted by packing product in LDPE bags at room temperature, chiller (40C) and freezer (-200C). The parameters recorded were dressing percentage, giblet percentage, total meat and bone yield, cooking yield of the product, proximate composition (moisture, crude protein, ether extract, salt and ash), microbial analysis, TBA value and sensory evaluation. The dressing percent, giblet percent, percent meat and bone yield were 57.88, 9.44, 30.71 and 20.74, respectively. Average cooking yield of the croquettes was 77.61. The mean moisture, crude protein, ether extract, salt and total ash percentages of the freshly prepared croquettes were 54.75, 20.02, 10.22, 1.56 and 1.94, respectively. Salmonella species, Clostridium species and E.coli were absent in the product irrespective of the storage conditions. In the product stored at room temperature the TBA value increased and the product was acceptable up to two days as per the sensory scores. During refrigerated and frozen storage the TBA values increased and the sensory analyses revealed that the product was acceptable up to 12 days and 50 days under refrigerated and frozen storage, respectively.

GAS FLUSHING AND ANTIOXIDANT VITAMINS AS IMPORTANT TOOLS FOR STORAGE STABILITY OF GOAT MEAT SAUSAGES

Sahoo J

**Department of Livestock Products Technology, College of Veterinary
Science, Guru Angad Dev Veterinary and Animal Science University,
Ludhiana- 141004(Punjab)**

Two batches of meat emulsion was prepared from preblended minced goat meat (control without additive and treated with 600 ppm Sodium ascorbate and 10 ppm Tocopherol acetate) obtained from 2½ yr Beetal buck carcasses. The above meat emulsion was stuffed into natural casings, linked, steam cooked for 35 minutes, cooled, delinked, gas flushed in laminated pouches (19∞PVDC pet/12∞Met pet/50∞poly) using CO₂ or N₂ gas in a Roscherwerke Vacuum packaging machine model 19S. All total four different experimental batches of Goat Meat Sausage (GMS) viz. control CO₂, control N₂, Treated CO₂ and treated N₂ were prepared, stored at refrigerated temperature (4±10C) for a period of 45 days and examined for changes in various physico-chemical, sensory and microbiological parameters. The experiment was repeated thrice. It was observed that there was no significant effect of treatment on PH and W-B shear force value of GMS. During the storage period, the mean PH was significantly (P<0.05) decreased on day 40 and 45 and W-B shear force was significantly increased from day 35 onwards. The TBARS value was significantly (P<0.05) lower in control CO₂ batches, while FFA% was significantly lower in treated N₂ sample. The mean TBARS value remained almost stable until day 40 and FFA% until day 10. The average microbial load in respect of aerobic mesophiles count (AMC) was significantly lower in treated CO₂ batches (log 3.543/g), while TPC was significantly lower in control N₂ batches (log 3.017/g). There was no significant change in Lactobacilli count and Total Anaerobes count due to the effect of treatments. The different batches of GMS remained within microbial safe limit throughout the storage period of 45 days. The treated GMS whether N₂ or CO₂ flushed, showed significantly (P<0.05) higher organoleptic scores for all the sensory attributes studied as compared to the control batch during the storage period and were moderately palatable to very palatable even on day 45. It was concluded that gas flushing and antioxidant vitamins are important tools in significantly extending the shelf-life of GMS.

STUDIES ON THE STORAGE BEHAVIOUR OF FISH NOODLES

K.Rathnakumar, S.Sangeetha and G. Indra Jasmine
Department of Fish Processing Technology Fisheries College and
Research Institute, Thoothukudi

Minced meat of pinkperch (*Nemipterus japonicus*) fish was used at three different levels viz. 10%, 15%, and 20% and noodles were prepared. Among the three, fish noodles prepared using 10% fish meat had significant ($P < 0.01$) acceptability. Fish noodles with 10% fish meat was packed in LDPE bag of 400 micron thickness and stored at ambient temperature. Biochemical, microbiological and organoleptic quality of the stored noodles was analysed. Noodles prepared using 10% fish meat was found to be organoleptically acceptable and biochemically safe at the end of 120 days of storage period.

QUALITY AND SHELF LIFE OF CHICKEN NUGGETS INCORPORATED WITH LINSEED AND SOY PASTE DURING REFRIGERATED STORAGE

A.S.R. Anjaneyulu, N. Kondaiah and R. Thomas

**Division of Livestock Products Technology, Indian Veterinary
Research Institute, Izatnagar, Bareilly, (U.P.) 243 122, India**

Broiler chicken is devoid of separable fat unlike in spent hens which is required for making emulsion type chicken products since fat contributes flavour and juiciness to the products. Therefore, oil seeds as alternative to fat are explored in chicken products. The linseed and soy paste and their combination at equal proportion were incorporated at 10% level in the formulations of chicken nuggets and patties. Use of raw soy bean paste significantly reduced the flavour and overall acceptability of nuggets due to lipoxygenase which imparts beany flavour. Heat treatment (boiling) inactivates it. Paste from heat treated soybean is found to be better for use in meat products. However, use of raw linseed had no significant effect on yield. Panelists preferred use of raw linseed paste than mild roasted in chicken products. The quality of chicken nuggets incorporated with linseed at 10% level and linseed and soy paste each at 5% level as fat source and their shelf life during refrigerated ($4\pm 1^{\circ}\text{C}$) storage was studied. There was no significant difference in the emulsion stability and product yield. Use of linseed paste has significantly increased the moisture content and reduced the fat content of the product without marked changes in the sensory attributes. The TBARS number and total plate count significantly increased and sensory attributes of the product declined with increasing storage period. Both chicken nuggets and patties were well acceptable up to 30 days of storage. Linseed and soybean paste alone or in combination could be used to produce acceptable chicken products with low fat content.

QUALITY OF MUTTON NUGGETS AND PATTIES CONTAINING CHICKEN BYPRODUCTS, EGGS AND VEGETABLES

A.S.R. Anjaneyulu, N. Kondaiah, H. Pragati, V. Lakshmanan and S.K.

Mendiratta

**Division of Livestock Products Technology, Indian Veterinary
Research Institute, Izatnagar, Bareilly, (U.P.) 243 122, India**

Value added mutton products are made with or without incorporating binders/ extenders which offer several benefits to the processed meat products. Effect of seasonal vegetables incorporation on the quality of mutton products was evaluated. Quality of nuggets and patties made from choice mutton formulation containing skin, gizzard and heart (SGH) and chicken fat was compared with that of economy mutton formulation incorporated SGH, textured soy protein granules, blanched cauliflower and cabbage. The emulsion stability, product yield and fat content of nuggets and patties incorporated with vegetables were markedly lower than choice quality products. The flavour and overall acceptability of products containing vegetables were markedly lower. However, both the products packed in LDPE bags were highly acceptable for 21 days even during refrigerated storage ($4\pm 1^{\circ}\text{C}$). The panelists preferred the mutton nuggets and patties incorporated with chicken byproducts better than the products containing vegetables. Use of vegetables at optimum level in meat products would have the benefit of low fat and high fiber content. Addition of chicken byproducts and vegetables in the formulations of mutton products improve their palatability and reduce their production cost.

SENSORY EFFICACY OF POTASSIUM CHLORIDE AND POTASSIUM LACTATE ALONE AND IN COMBINATION AS TABLE SALT SUBSTITUTE IN LOW-SALT, LOW-FAT PORK MEAT BALLS

B.D. Sharma and N. Kondaiah

Division of Livestock Products Technology Indian Veterinary Research Institute, Izatnagar- 243 122

Use of potassium chloride (KCl) as a table salt (NaCl) substitute at 30,40 and 50% levels in emulsion based low-salt, low-fat, pork meat balls revealed that saltiness and overall acceptability of the product was not significantly affected ($P>0.05$) at 30% replacement as compared to control, although flavour was significantly affected ($P<0.05$) at this level. Both saltiness as well as flavour of the product were affected at 40% salt replacement with KCl. Texture and juiciness were significantly affected ($P>0.05$) at 40 and 50% replacement levels, respectively. Use of potassium lactate (K-lactate) as a table salt substitute at 30, 40 and 50% levels revealed that saltiness was significantly affected ($P<0.05$) at replacement levels of 40% and above. Substitution of salt with K-lactate did not bring about as drastic change in flavour of the product as with KCl. Hence it should be more acceptable in meat products than KCl, which has distinct typical flavour. Pork meat balls prepared with either of the two substitutes were comparable with respect to general acceptability, juiciness and texture. Further studies were conducted by using KCl (20, 25 and 30% levels) along with K-lactate (30, 25 and 20% levels) in a mix to substitute 50% salt in pork meat balls. Saltiness and flavour of the product with the resultant combinations was less as compared to control. However, the product prepared with 50% salt substitute comprising KCl-20% and K-lactate- 30% was better than the other two combinations. This product was also comparable to control with respect to general appearance, juiciness, texture and overall acceptability in spite of lower ratings. Product prepared with 50% salt substitute mix comprising of KCl- 30% and K- lactate- 20% was least liked because of flavour problem.

STUDIES ON INCORPORATION OF SWEET POTATO (IPOMEA BATATAS) IN EMULSION BASED PORK PRODUCTS

S.K.Mendiratta, N.Kondaiah, A.S.R.Anjaneyulu and A.T. hinde
Division of Livestock Products Technology Indian Veterinary
Research Institute, Izatnagar - 243 122 (U.P.)

Sweet potato is an excellent source of β Carotene, a known source of natural antioxidant. To exploit the anti-oxidative activities of sweet potato and to reduce the cost of the meat products, different experiments were conducted to standardize incorporation of sweet potato in emulsion based pork products (patties and nuggets). In first experiment, boiled and mashed sweet potato was incorporated at "0" (Control), 5 and 10% levels in pork patties formulation. Flavour and texture scores were slightly lower for patties containing sweet potato. However, juiciness scores were higher in formulation containing 5% sweet potato. Overall acceptability scores were same for control and 5% sweet potato incorporated patties. In general, sensory scores were lower for patties having 10% level of boiled sweet potato. In second experiment, patties and nuggets were prepared after incorporation of 7.5% boiled potato mince (Control), or 7.5% boiled sweet potato mince (Treated) in the standard formulation. pH, Cooking yield, proximate composition, sensory and microbiological qualities of control and treated products were evaluated on '0' day (fresh) and after one month of storage at refrigerated temperature. Results of physico-chemical characteristics revealed almost same cooking yield and proximate composition values for control and treated products. pH values were slightly lower in products having sweet potato. Total viable counts (\log_{10} cfu/g) of both fresh and stored products were also lower in treated products. Significant reduction was noticed in TBARS values of stored products containing sweet potato. Sensory scores of fresh patties and nuggets indicated marginally lower scores for treated products than controls. However, scores were almost same in products stored for 30 days at refrigerated temperature. The results indicated that sweet potato has good anti-oxidative activities and could be easily exploited as an extender in meat products.

GDL AFFECTS THE QUALITY OF PORK SAUSAGES

R. Thomas, A.S.R. Anjaneyulu, N. Kondaiah, Y.P. Gadekar and H.

Pragati

**Division of Livestock Products Technology, Indian Veterinary
Research Institute, Izatnagar, Bareilly, (U.P.) 243 122, India**

Glucono-delta-lactone (GDL) at different levels (0.1, 0.2, 0.3 and 0.4%) were evaluated as an acidifier during the course of development of shelf stable pork sausages. Its effect on the physico-chemical and sensory attributes of the product were compared with control. The addition of different levels of GDL significantly ($P < 0.01$) reduced the pH of emulsion (6.02, 5.89, 5.86 & 5.70 respectively) and the product (6.18, 6.07, 5.97 & 5.86 respectively) compared to the control (6.12 & 6.27 respectively). Emulsion stability and product yields were reduced significantly ($P < 0.01$) with increasing level of GDL. A significant ($P < 0.01$) inverse relationship was observed between moisture and fat percentage in the products. Shear force values reduced significantly from 0.2% GDL level onwards. Lovibond Tintometer colour evaluation revealed a significant ($P < 0.01$) increase in yellowness (b values), hue and chroma with the increase in GDL in the products. Texture profile analysis indicated a significant ($P < 0.01$) reduction in hardness with increasing level of GDL. Other texture profiles such as adhesiveness, chewiness and cohesiveness were significantly higher for the sausages with 0.2% GDL, while springiness and gumminess were higher for those with 0.1% GDL. Sensory attributes reflected similar trend as those of physico-chemical characteristics. Different sensory attributes such as appearance and flavour of the sausages with 0.2% GDL were comparable with those of control. Juiciness, texture and binding were decreased significantly ($P < 0.01$) with increase in GDL level. Overall palatability scores indicated that the control and the products with 0.1% GDL were highly palatable. The present study suggests the incorporation of GDL in the shelf stable pork sausages up to 0.2% without much adverse effect on different physico-chemical and sensory attributes.

EFFECT OF DIFFERENT FAT LEVELS ON THE PHYSICO-CHEMICAL AND SENSORY CHARACTERISTICS OF PORK SAUSAGES

R. Thomas, A.S.R. Anjaneyulu, N. Kondaiah, Y.P. Gadekar and H. Pragati

Division of Livestock Products Technology, Indian Veterinary Research Institute, Izatnagar, Bareilly, (U.P.) 243 122, India.

The study was aimed at optimizing the pork fat and lean levels in the formulation for processing of shelf stable pork sausages of good acceptability. Three different combinations of lean and fat i.e. 75&10; 70& 15 and 65&20 % respectively were evaluated. There was significant difference between the treatments for pH of emulsion and products and cooking yield, while the emulsion stability was significantly ($P < 0.05$) higher for the treatments with 15 & 20% fat. As expected, a significant ($P < 0.05$) inverse relationship was observed between moisture (60.61, 54.65 & 47.94% respectively) and fat (14.12, 19.12 & 24.28 respectively) of the products. A significant ($P < 0.01$) reduction in shear force (0.53, 0.35 & 0.30 kg/cm² respectively) was observed with increase in fat percentage. Values for redness (a values) and chroma were decreased while those of yellowness (b values) and hue increased significantly ($P < 0.01$) with increase of fat content. All the texture profiles such as hardness, adhesiveness, springiness, cohesiveness, gumminess and chewiness decreased significantly ($P < 0.01$) with increase in fat percentage. Among different sensory attributes flavour and juiciness were significantly ($P < 0.01$) increased with increase of fat percentage while the texture of sausages with 15 & 20% fat did not differ significantly ($P < 0.05$). Panelists rated the sausages with 20% fat highly palatable. Thus it can be concluded that pork fat could be included up to 20%, without any adverse effect on different physico-chemical and sensory attributes, in the pork sausage formulation.

EVALUATION OF SHELF LIFE OF CHICKEN BROTH AND SOUP STORED UNDER REFRIGERATED STORAGE

Y.P. Gadekar, A.S.R. Anjaneyulu, N. Kondaiah, R. Thomas and

H. Pragati

Division of Livestock Products Technology, Indian Veterinary Research Institute, Izatnagar, Bareilly, (U.P.) 243 122, India.

Present study was conducted to find out the suitability of utilization of chicken frames for making soup and to evaluate its shelf life at refrigerated storage. The chicken frames were pressure cooked and the broth obtained was divided into two halves, the soup was made using one half and packaged in LDPE bags and kept under refrigerated storage ($4\pm 1^{\circ}\text{C}$). The second half was stored as broth itself and was used to make fresh soup. The quality of freshly prepared soup from the broth was compared with the stored soup at 3 days interval for 12 days. pH of stored and fresh soups did not differ significantly ($P > 0.05$) except on day 6 and 12. TBARS values, expressed as mg malonaldehyde/ kg, increased significantly ($P < 0.01$) with the advancement of storage period, but stored soup had significantly higher TBARS values than fresh soup throughout the storage period. Similarly, total viable count, expressed as \log_{10} cfu/g, was significantly ($P < 0.01$) higher for stored soup (1.87 to 3.33) than fresh soup (1.87 to 1.89). Significant difference for yeast and mold count was observed among stored and fresh soup only on day 12. Flavour as well as meat flavour intensity of fresh soup made from stored broth were significantly ($P < 0.01$) higher than stored soup. Fresh soup was also rated slightly higher for appearance and consistency than stored soup. Overall acceptability as well as other sensory parameters decreased significantly on day 12 compared to day 9 of storage. Thus, the present study suggests that chicken soup or broth could be kept up to 9 days at refrigerated storage with good acceptability.

MICROBIOLOGICAL SAFETY OF VACUUM-PACKED COOK CHILL FISH CUTLETS DURING CHILLED STORAGE (3°C)

R. Jeya Shakila, A.Vijayakumar and D. Sukumar

Department of Fish Processing Technology, Fisheries College and Research Institute, Thoothukudi

Fish cutlet an important convenience food in Indian fast food trade has limited shelf life at ambient chilled storage. In order to extend the shelf life of fish cutlets prepared from emperor bream, *Lethrinus lethrinus*, four different packaging methods viz. conventional pack (CP), vacuum pack (VP), conventional cook chill (CCC), vacuum pack cook chill (VPCC) process were adopted and tested for their microbiological safety during chilled storage at 30C. The microbiological parameters examined include total acid bacteria, *Listeria monocytogenes* and *Salmonella* sp. The shelf life of CP, VP, CCC and VPCC fish cutlets were 2, 2, 4 and 16 weeks respectively. The total bacterial load of CP, VP and CCC packs exceeded 5 log cfu/ g on the day of rejection. However, the total sensory observation showed slight disappearance of original color. Anaerobic sulphate reducing clostridia were totally absent except in CP and CCC pack wherein they were detected very low (0.3 MPN counts/g) on the day of sensorial unacceptable. Total Aeromonads were present in all the packs except VPCC. Pathogens, *Listeria monocytogenes* and *Salmonella* sp were detected only in CP fish cutlets. Results indicated that vacuum pack cook chill technology can be adopted for the preservation of the fish cutlets as it gave an extended shelf life at chilled condition, yielding microbiological safe products, with excellent retention of nutrient and juiciness.

PROCESSING AND STORAGE STUDIES ON SOUP PREPARED FROM RABBIT FRAMES

Arvind Mohan Verma and B.D. Sharma
Division of Livestock Products Technology Indian Veterinary
Research Institute, Izatnagar-243122

Soup was prepared by utilization of rabbit frames, a byproduct of rabbit carcasses after deboning. For processing of soup, broth was prepared by pressure cooking rabbit frames at 15 lb pressure for 30 minutes. Broth was separated from the frames and diluted with water in ratio of 1:1 (w/w). Then dry spices (1%), condiments (1.5%), table salt (1%), thickener (2%) and monosodium glutamate (0.1%) were added to the total diluted broth. The material was boiled for 5 minutes and filtered through 1 mm sieve to recover soup. Proximate composition of the product was moisture: 93.55%, crude fat: 0.21%, crude protein: 5.27% and total ash: 0.42% and pH was recorded as 6.41 at zero day. The sensory score of the fresh product (0 day) on 8-point hedonic scale was 7.13, 7.1, 6.96, 6.90, 6.46 and 7.06 for general appearance, flavour, meat flavour intensity, saltiness, consistency and overall acceptability respectively. The product was stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$) in low density polyethylene pouches (200 gauge) for 21 days. Total plate count, yeast and mold count, TBA value and pH showed an increasing trend with storage period and recorded 1.21 log cfu/g, 1.13 log cfu/g, 0.22 mg malonaldehyde/kg and 6.41 at zero day and 2.01 log cfu/g, 1.56 log cfu/g, 0.47 mg malonaldehyde/kg and 6.22 respectively at 21st day. Total plate count, yeast and mold count and pH showed a significant difference ($P < 0.05$) at every 7 days interval, while significant difference ($P < 0.05$) was observed in TBA at 14th and 21st day of storage. Sensory attributes viz general appearance, flavour, meat flavour intensity, saltiness, consistency and overall acceptability showed changes with storage period and mean values were recorded as 6.90, 6.73, 6.37, 7.13, 6.87 and 6.77 respectively at 21st day. Sensory score of general appearance, flavour, meat flavour intensity and overall acceptability decreased with storage period, while saltiness and consistency increased with storage period. Significant difference ($P < 0.05$) was observed in general appearance, saltiness and overall acceptability between zero and 21st day, while flavour between zero and 7th day, meat flavour intensity between 7th and 14th day and consistency between 0 and 14th / 7th and 21st day. In general sensory score of all the attributes ranged between good to very good throughout the storage period of 21 days.

UTILIZATION OF DIFFERENT EXTENDERS IN DUCK MEAT PATTIES

P.Sitaram, P. Masthan Reddy and E.NagaMallika

Department of Livestock Products Technology College of Veterinary Science, Tirupati-517502

The effect of inclusion of Bengal gram flour and corn flour each separately at 5 and 10 per cent levels on the physical, physico-chemical and sensory quality of duck meat patties from desi ducks were studied. Raw duck meat patties prepared with 10% Bengal gram flour had recorded significantly (0.005) lower cooking losses (19.55%) and higher emulsion stability (1.27%) and higher Water Holding Capacity (WHC) (53.99%) than those patties added with Bengal gram flour at 5% and corn flour at 5 and 10% levels. Duck meat patties prepared with partially cooked meat added with 10% Bengal gram flour significantly ($P < 0.05$) lower percent moisture (60.65%) ether extractives (10.17%) and higher crude protein (22.91%) than the rest of the formulations. Duck meat patties prepared with partially cooked meat recorded significantly ($P < 0.05$) lower cooking losses (18.17%), WHC (51.23%) and moisture (57.83%) and higher emulsion stability (0.69%), crude protein and ether extractives than those of raw patties. The patties processed by replacing meat with 10% Bengal gram flour recorded superior sensory scores for colour, flavor, juiciness and over all acceptability than the rest of the formulations irrespective if type of meat. Patties prepared with partially cooked meat scored lower organoleptic scores than their raw counter parts.

QUALITY CHANGES OF CHICKEN MEAT NUGGETS UNDER REFRIGERATED STORAGE

K.Prabhakara Reddy and E.NagaMallika

**NATP Research Project, Department of Livestock Products
Technology College of Veterinary Science, Tirupati-517502**

A study was under taken to evaluate the changes in the quality characteristics of chicken meat nuggets preserved by refrigeration ($4 \pm 1^{\circ} \text{C}$). Chicken meat6 nuggets were prepared by utilizing spent chicken meat with addition of corn flour at 10% level as a binder. Different quality characteristics like physical and chemical characteristics, proximate composition, microbial load and organoleptic characteristics were evaluated. Refrigeration of chicken meat nuggets for a period of 12 days caused a significant ($P < 0.05$) decrease in pH, Water Holding Capacity (WHC), % moisture,% protein and fat contents. An increase in 2- Thio Barbituric Acid (TBA) Values and Yeast and Mould counts was noticed during the progress of storage. All the organoleptic scores were decreased with the progress of storage but they were well within the limits of panelist's acceptability up to 12 days of refrigerated storage. Ambient storage of the product caused a significant decrease in pH and increase in WHC, TBA values, Percent moisture and microbial counts. The over all acceptability scores were decrease during the 4 days storage. The product was spoiled at the end of the storage period.

EFFECT OF SAUSAGE MIX FORMULATION ON SENSORY PROPERTIES OF FERMENTED CARABEEF SAUSAGE

Borpuzari, R. N., Das, Ankur, Nath, D.R., Saikia, P.P., Borpuzari, T. and Maurya. P.

**Department of Livestock Products Technology Faculty of Veterinary Science, Assam Agricultural University
Khanapara: Guwahati - 781 022**

The effect of four different sausage mix formulations (I- carabeef lean 80% + carabeef fat 20%; II- carabeef lean 80% + carabeef fat 10% + pork fat 10%; III- carabeef lean 60% + pork lean 20% + carabeef fat 20% and IV - carabeef lean 60% + pork lean 20% + carabeef fat 10% + pork fat 10%) on the sensory properties of fermented carabeef sausage was studied. Curing ingredients and spices and condiments were added as per recipe formulated and a commercial meat starter culture 'T-SP' (M/s Chr. Hansen, Denmark) comprising of *Pediococcus pentosaceus* and *Staphylococcus carnosus* were added at the prescribed dose levels. Sausages were fermented in a fermentation chamber maintained at 10 to 15°C all throughout the fermentation process and relative humidity at 90-85% during Stage I (up to 10-12th d) , at 80-75% during Stage II (10-12 to 22nd d) and at 75-70% at Stage III (22nd d to end of fermentation process). Air circulation rate was maintained at 0.05 -0.1m/sec during States I and II and at 0.1m/sec during State III. Semi-trained panel evaluation of the product using a 7-point hedonic scale rated fermented carabeef sausage prepared with sausage mix formulation I best for colour and flavour with an average score of 6.75±0.13 and 6.67±0.09, respectively. The mean panel score for appearance and juiciness of the product were 5.63±0.24 and 6.08±0.12, respectively which were well within the acceptable limits. The samples of formulation II and III were rated best for juiciness (6.89±0.05) and appearance (6.00±0.09), respectively. The results of the experiment indicated that formulation I could be recommended for production of fermented carabeef sausages with superior sensory properties.

APPLICATION OF HURDLE TECHNOLOGY FOR PRESERVATION OF CHICKEN AS READY TO EAT CURRY AT REFRIGERATION (4±1⁰C) TEMPERATURE

**Rathod K. S., Zanjad, P. N., Ambadkar, R. K., Deogade, A. H. and
Raziuddin, M.**

**Department of Livestock Products Technology College of Veterinary
and Animal Sciences, Parbhani - 431 402 (M. S.)**

Chicken curry being the most popular traditional meat product needs effective method of preservation for extending its shelf life. One such attempt is to create hurdles that inhibit the microbial growth in meat products. Taking into account the growing need for shelf stable meat products, the present study was undertaken to preserve ready to eat chicken meat at refrigeration temperature. Developed ready to eat chicken dehydrated at 45 and 60⁰C were filled in polyethylene pouches and stored at refrigerated temperature (4±1⁰C). The quality of fresh and stored product was evaluated by subjecting the samples for sensory evaluation and also for physico-chemical parameters and microbiological analysis at an interval of 7 days. Results indicated that the product dehydrated at 45⁰C though showed signs of spoilage on 35th day of storage but samples dried at 60⁰C did not show any signs of spoilage indicating that the product dehydrated at 60⁰C could remain safely for more than 35 days. The chicken curry prepared from meat dehydrated at 45⁰C had significantly higher Total plate count and Yeast & mould count as compared product dehydrated at 60⁰C temperature throughout the storage period. Tyrosine value did not changed significantly during storage of sample dehydrated at both the temperatures. However, FFA values of dehydrated sample (60 & 45⁰C) increased to 3.15 and 4.12 % (as Oleic acid) indicating that there is some kind of lypolysis during storage of 35 days.

EFFECT OF MARINATING MIXTURES ON THE QUALITY OF READY TO EAT CHICKEN CURRY

**Deogade, A. H., Zanjad, P. N., Raziuddin, M., Ambadkar, R. K,
Doifode, V. K. and Raut, K. A.**

**Department of Livestock Products Technology College of Veterinary
and Animal Sciences, Parbhani - 431 402 (M. S.)**

Considering the scope of utilization of chicken in convenience form and potential application of hurdle technology for preservation of meat products an attempt has been made to prepare chicken curry using various marination mixtures. Fresh chicken pieces washed with clean water, dipped in 2% acetic acid and rewashed with clean water were kept in different marinating mixtures containing Citric acid (T1), Lactic acid (T2) and Vinegar (T3) as acidulants, with addition of potassium sorbate and water for 12, 15 and 18 hrs at 4+ 10°C. After cooking and dehydration for 2 hrs at 60°C, hot spice mixture was added. The sensory quality of ready to eat chicken curry was evaluated using 8 Point Hedonic scale, after boiling the dehydrated samples for 15 min. Sensory quality revealed that Juiciness, Texture and Overall palatability scores of chicken curry improved significantly using marination mixture containing 0.2 % Citric acid (T1) as compared to lactic acid & vinegar indicating that marinating mixture containing citric acid was more suitable for improving the quality of chicken curry. Marinating mixture containing 0.2 % citric acid used at 12,15 &18 hrs did not show any significant variations in physico-chemical and sensory quality of chicken curry. However, the sensory scores in respect of juiciness, body, texture and overall palatability of product using 12 hrs marinating time were slightly higher as compared to 15 & 18 hrs duration.

PHYSIOCHEMICAL CHARACTERISTICS OF LACTATE TREATED BUFFALO MEAT COOKED SALAMI DURING REFRIGERATED STORAGE

R. K. Ambadkar, N. Sharma, A.S.R. Anjaneyulu and S. K. Mendiratta
Division of Livestock Products Technology
Indian Veterinary Research Institute, Izatnagar, Bareilly - 243122 (U.P.)

Physiochemical characteristics of smoked buffalo meat cooked salami treated with 1% level of different lactates i.e. Sodium lactate (SL), Potassium lactate (KL) & Calcium lactate (CL) was studied at refrigerated storage ($4\pm 1^{\circ}\text{C}$) at weekly interval for 28 days. Overall pH of cooked salami was in the range of 5.71 - 6.05 among the treatments. Product pH in control as well as SL & KL treated samples did not reveal any significant variations ($P < 0.05$). However pH of CL treated samples was significantly ($P < 0.05$) low. Non significant ($P > 0.05$) variations in pH was recorded up to 21 days of refrigerated storage. Thereafter it decreased significantly ($P < 0.05$) on 28th day of storage. Moisture content of treated samples decreased slightly as compared to control. Gradual decrease in moisture content was recorded during the refrigerated storage. However, the decreased was not significant ($P > 0.05$) up to 14 days. Thereafter significant ($P > 0.05$) decrease in moisture was noticed up to 28 days of refrigerated storage. TBA values in control and treated samples with SL & CL did not show significant ($P > 0.05$) variations. However, these values showed significant ($P < 0.05$) increase during the storage period. There was non-significant ($P > 0.05$) variations in the tyrosine values of control as well as SL and KL treated samples. However, significantly ($P < 0.05$) low tyrosine values were observed in CL treated samples. Gradual increase in tyrosine values were recorded throughout the storage period. However, this increase was not significant ($P > 0.05$) up to 7th day of storage. It was observed that residual nitrite was not affected by lactates. However, rapid but significant ($P > 0.05$) decline in residual nitrite content in the sample was recorded with the increase in storage.

SENSORY PROFILE OF LACTATE TREATED BUFFALO MEAT COOKED SALAMI DURING REFRIGERATED STORAGE

R. K. Ambadkar, N. Sharma, A.S.R. Anjaneyulu and S. K. Mendiratta
Division of Livestock Products Technology
Indian Veterinary Research Institute, Izatnagar, Bareilly - 243122 (U.P.)

Sensory quality of smoked buffalo meat cooked salami treated with 1% level of different Lactates i.e. Sodium lactate (SL), Potassium lactate (KL) & Calcium lactate (CL) at refrigerated storage ($4\pm 1^{\circ}\text{C}$) was assessed on the basis of general appearance, flavour, juiciness, texture and overall acceptability. The samples were analyzed at weekly interval for 28 days. Sensory scores for general appearance and juiciness in the treated samples were higher than the control. However, these scores did not differ significantly ($P>0.05$). Flavour scores were significantly higher ($P<0.05$) for lactate treated samples than that of control. Among the treated samples KL and SL did not show any variations in flavour scores. Whereas, flavour scores were significantly ($P<0.05$) lower in CL treated samples. Significant decrease in flavour scores of samples was recorded with the increase in storage. It was further observed that texture scores were significantly ($P<0.05$) higher for samples treated with SL than that of the control. However, these scores for all lactates were nearly same ($P>0.05$). Among the treatments, overall acceptability scores for SL treated samples were optimum up to 21 days of storage. Among the lactates, CL treated samples had the lowest acceptability.

EFFECT OF WHEY PROTEIN CONCENTRATE AND EGG WHITE ON PHYSICO-CHEMICAL, TEXTURAL AND SENSORY PROPERTIES OF CHICKEN NUGGETS FROM SPENT HEN MEAT

A.Devaki, V.Venkataramanujam and K.Dushyanthan
Department of Meat Science and Technology
Madras Veterinary College, Chennai-7

A study to determine the optimum level of inclusion of whey protein concentrate and egg white for preparation of chicken nuggets with 80 per cent deboned spent hen meat and 20 per cent chicken fat was carried out with three levels of whey protein concentrate (1%, 2% and 3%) and three levels of egg white (3%, 5% and 7%). The analysis revealed that nuggets with 1 and 2 per cent of whey protein concentrate had no significant difference in cooking yield and sensory characteristics, where as incorporation of whey protein concentrate at 3 per cent level significantly improved emulsion stability, cooking yield and also markedly improved the sensory characteristics of nuggets. Hence, 3 per cent level of whey protein concentrate was selected optimum. Nuggets with 3 and 5 per cent egg white had no significant difference in emulsion stability and sensory attributes like appearance, juiciness, tenderness and over all acceptability, where as incorporation of egg white at 3 per cent level significantly improved cooking yield and flavour scores of the product. Hence, 3 per cent egg white was selected optimum. Based upon the physico-chemical and sensory characteristics, whey protein concentrate incorporated nuggets were better than egg white incorporated nuggets. After determining the optimum level of inclusion, nuggets were prepared and subjected to physico- chemical (pH, shear force value and TBARS), sensory (Appearance, Flavour, Juiciness, Tenderness and Over all acceptability) and microbial analysis (Total viable count, Psychrophilic count) to study the keeping quality at refrigerated storage upto 25 days. The TBARS number, total viable count as well as Psychrophilic count linearly increased through out the storage period where as scores for sensory attributes decreased for all nuggets during refrigerated storage. Nuggets with 3 per cent whey protein concentrate were well acceptable upto 25 days, where as in case of control and egg white incorporated nuggets were acceptable only for 20 days. The storage stability of whey protein concentrate incorporated nuggets were better than egg white incorporated nuggets. Based on the findings it is concluded that nuggets with 3 per cent whey protein concentrate is considered superior for preparing chicken nuggets with 80 per cent deboned spent hen meat and 20 per cent fat.

STUDIES ON THE PREPARATION AND KEEPING QUALITY OF TANDOORI DUCK

P.Senthilkumar, K.Dushyanthan and V.Venkataramanujam
Department of Meat Science and Technology
Madras Veterinary College, Chennai-600 007.

A study on the preparation and keeping quality of a value added ready-to-eat duck meat product, tandoori duck was carried out and analyzed. Tandoori ducks prepared by soaking with curd for 10-12 hrs of marination recorded the highest score for flavour, juiciness, tenderness and overall acceptability traits. Tandoori prepared from 12 weeks old ducklings recorded the highest score for overall acceptability and cooking yield. From the recipe, time of marination and age of duckling selected, tandoori ducks were prepared and subjected to physico-chemical, microbial and organoleptic evaluation to determine the shelf-life at room ($27-42^{\circ}\text{C}$), chiller ($4\pm 1^{\circ}\text{C}$) and freezer ($-18\pm 1^{\circ}\text{C}$) temperatures. There was a gradual increase in pH, tyrosine value, TBARS value, TVC, psychrophilic count and YMC of tandoori duck throughout the storage. The WHC, sensory and odour score decreased as the storage period advanced. Based on the findings, it was concluded that, the species specific objectionable odour from duck meat could be successfully masked by preparing tandoori duck by soaking with curd for 10-12 hrs of overnight marination and it could be stored safely upto 1, 7 and 42 days in ambient, chiller and freezer temperatures respectively.

PROXIMATE COMPOSITION, MICROBIOLOGICAL AND SENSORY PROPERTIES OF SHAKEMPA - A TRADITIONAL DRY MEAT PRODUCT OF ARUNACHAL PRADESH

Borpuzari, R.N., Nath, D.R., Das, Ankur, Borpuzari, T., Saikia, P.P. and Maurya, P.

Shakempa is a traditional dry meat product of Arunachal Pradesh. It is prepared from yak meat or beef. The meat is cut into long strips and dipped in a saturated salt solution for few days and then kept hung over the fire place or in the sun for drying. The product has a shelf-life of over one year. Before consumption, the product is washed and rehydrated by boiling in water for about an hour and a variety of meat dishes are prepared. The proximate composition of smoke-dried Shakempa prepared from yak meat revealed that it contained $8.41 \pm 0.23\%$ moisture, $78.25 \pm 3.10\%$ total protein, $12.29 \pm 1.02\%$ ether extract and $1.03 \pm 0.37\%$ total ash indicating that it is a highly nutrient dense meat product. The product had a mean surface total viable count of $4.74 \pm 0.64 \log_{10} \text{cfu/cm}^2$ and a mean count of $3.06 \pm 0.54 \log_{10} \text{cfu/cm}^2$ of yeasts and mould. Taste panel evaluation of the smoke-dried Shakempa revealed that the product was rated best for its flavour quality (8.34 ± 0.78) followed by taste (7.86 ± 1.05) and colour (6.54 ± 0.42). The product was, however, rated poor (4.28 ± 0.32) for its tenderness quality.

QUALITY AND SHELF-LIFE OF SMOKED CHEVON SAUSAGES PACKED UNDER VACUUM AND STORED AT $4\pm 1^{\circ}\text{C}$

S. Dharmaveer, V. Rajkumar, and K. P. Mukesh

**Central Institute for Research on Goats, Makhdoom, Farah - 281 122,
Mathura, India**

Smoked chevon sausages were prepared using four-year-old Barbari bucks to study their shelf-life under refrigeration. Smoked sausages were packed in HDPE bags under vacuum (VP) and aerobically (AP). Packed sausages were evaluated for proximate, physico-chemical, microbiological and sensory changes on day 0, 7, 14 and 21 due to storage. The cooking yield (%) and cholesterol (mg per 100 gm of sausages) content of fresh smoked chevon sausages were 73.50 and 98.74. Overall mean moisture, fat, protein and ash contents were 55.48, 17.05, 18.36 and 3.00 percent respectively. Overall mean water activity (a_w), pH and W-B shear force values (kg/5 cm length sausages) were 0.972, 6.41 and 3.20 respectively. In microbial analysis overall SPC, PBC and LAB were log 5.86, 5.00 and 4.24 CFUg⁻¹ respectively. Coliform, yeast and mould were also detected. To identify day of spoilage SPC values were plotted in graph. Over all spoilage based on storage period mean was day 12 but yeast and mold growth was visible on the surface of sausage on day 14. Smoking and vacuum packaging of spent goat chevon sausages has some beneficial effect on pH, protein, SPC and sensory scores but did not extend the shelf -life. In light of the observations, it can be concluded that vacuum packaging has no definite advantage in preserving quality and sensory attributes. Product can be stored under refrigeration up to seven days irrespective of packaging condition.

DEVELOPMENT OF SHELF STABLE CRISPS AND THEIR QUALITY CHARACTERISTICS

**R. K. Gupta, V. Rajkumar and N. Katiyar
Central Institute for Research on Goats,
Makhdoom, Farah - 281 122, Mathura, India**

Present work was to standardize the snack type chevon product made from spent goat meat and non meat ingredients like rice or sago and to study their quality characteristics like proximate composition, physico-chemical properties and shelf- life by microbiological analysis. Sensory evaluation was conducted keeping in view of its importance in food industry both for quality control and new product development. Yield of the chevon crisps made from uncooked meat and cooked rice (T₁), cooked meat and cooked rice (T₂) and cooked meat and cooked sago (T₃) was 25.69, 28.57 and 28.84 % respectively. Moisture content was 9.64, 7.51, and 5.94 % for T₁, T₂, and T₃ chevon crisps and fat content of 0.72, 8.13 and 4.68 % respectively. Protein content of chevon crisps of T₁, T₂, and T₃ were 30.64, 34.18 and 35.11 % and ash content was 4.65, 4.97 and 5.08 % respectively. Carbohydrate content ranged from 46 to 54 percent. Treatment had highly significant (P<0.01) effect on moisture, fat and carbohydrate content of chevon crisps. Cholesterol content of T₁, T₂, and T₃ chevon crisps was 43.41, 90.58, and 103.53 mg/100 g respectively. Water activity (a_w) of chevon crisps was 0.39 to 0.28. The pH value around 5.87 to 6.13. Cholesterol, a_w and pH values were observed to be significant (P<0.05) under different treatment. Overall microbial counts of Chevon crisps were well within the limits. Microbial counts were not significant (P>0.05) for crisps prepared under various treatments. Standard Plate Counts (SPC) of T₁, T₂, and T₃ chevon crisps was log 2.90, 3.03 and 2.70 and coliform counts were 0.083, 0.34, and 0.0 CFU/g respectively. Yeast and mold count of chevon crisps of T₁, T₂, and T₃ was 0.65, 0.69 and 0.23 respectively. In light of the above observations, it can be concluded that all the three types of chevon crisps can be stored at room temperature without any deterioration. Out of the three types of chevon crisps, the chevon crisps blended with cooked meat and cooked sago (T₃) was rated best by the panelists. The shelf life of the product. As per Lee et al., 1986. Ginger was found to contain a powerful proteolytic enzyme that could be used for tenderizing meat. The samples of both the treatments did not show any significant difference in their sensory evaluation scores, due to uniform cooking time and oil temperature maintained during processing. Also, there was no significant difference in the total viable count and anaerobic count of both the treatments. The microbial loads were within the safety level up to 28 days of storage in both the treatments. Thus the tough, less palatable, spent chicken meat could be converted into highly palatable chicken chukka, by value addition with condiments and spice mix marination, which could be stored at room temperature up to 28 days, which will definitely alleviate the difficulties faced by the layer farmers in marketing live spent chicken.

CHICKEN CHUKKA: A READY-TO-EAT PRODUCT FROM SPENT CHICKEN MEAT

R. Ramani, V. Venkataramanujam and C. Vasanthi
Department of Meat Science and Technology
Madras Veterinary College, Chennai-7.

Spent hen meat which is less juicy, less tender and has poorer functional properties, fetching low demand and marketability is converted into a shelf stable, ready-to-eat, value added, highly tender and tasty product, chicken chukka. The quality parameters like sensory evaluation, odour score, moisture percent, thiobarbituric acid number, tyrosine value (mg/100g), total viable count (log/g) and anaerobic count (log/g) for different periods at room temperature for the samples [preservative added (P) and without preservative (NP)] were analysed and discussed. The absence of significance between the two treatments in their sensory evaluation scores and the mean total viable count (log/g) of the two treatments lying within the limits as mentioned by Soriano et al. (2000) for cooked meat samples prove the fact that the product chicken chukka could be prepared without preservative and could be stored at room temperature up to 28 days.

UTILIZATION OF LOW VALUE MEAT AND MAIDA IN PREPARATION OF VALUE ADDED BUFFALO MEAT NUGGETS

**K. Dushyanthan, R.Narendra Babu, C. Vasanthi and V.
Venkataramanujam**

**Department of Meat Science and Technology,
Madras Veterinary College, Chennai - 600 007**

With the advent of increasing buffalo meat consumption, a study on incorporation of low value meat viz. heart, tongue and head and cheek meat @ 25% in preparation of value added carabeef nuggets has been undertaken by incorporating different levels of maida as binder viz. 3%, 5% and 7%. The parameters like emulsion pH, product pH, emulsion stability(%), product yield (%) and sensory evaluation were studied to assess the optimum level of binder that improves the functional and palatable attributes of low value meat incorporated emulsion based meat product. The results revealed highly significant difference between treatments for emulsion pH, product pH, emulsion stability (%) and product yield (%). Though there was no significant difference observed for sensory parameters for different levels of maida incorporated nuggets, 7% incorporated nuggets were observed to have highest product yield (99.16%) and were equally rated to that of control which was prepared using only lean meat. Based on the results, it was concluded that 7 % incorporation of maida is effective in increasing the value of low value incorporated carabeef nuggets.

POUCH PACKAGED READY-TO-EAT (RTE) CHICKEN CURRY

M.Nithyapriya

**Department of Food & Process Engineering,SRM Institute of Science
& Technology (Deemed University)Kattankulathur, Kanchipuram
District.**

Chicken curry was prepared using different sizes of boneless chicken meat and 3.5 x 3.5 x 1.5 cm was optimized based on the sensory evaluation and the cooking properties. The preparation of recipe suitable for chicken curry acceptable to Indian palate was standardized. The chicken (60°C for 10 min) and gravy (70°C for 15 min) were precooked and mixed proportionately (2 parts gravy and 1 part chicken by weight basis), packaged and sealed in four layered retortable pouches (filling volume 175 g with a seal width of 6 mm) were kept in retort for further processing. Heat penetration characteristics such as heating rate index, heating lag factor, lethality rate, cook value, U and g values of chicken curry were found to be 14.3 min, 1.0125, 9.9105 min, 84.77 min, 9.9105 min and 1.1, respectively. Process time such as Ball process time, operator's process time and total process time were found to be 27.1, 20.8 and 35.8 min, respectively. The studies on physical, biochemical and microbial parameters were carried out for shelf life studies on stored chicken curry in pouches. During storage it was found that the pH and total plate count of packaged chicken curry increased whereas water activity, thiobarbituric acid value, extract release volume, water holding capacity and scores for sensory evaluation of packaged chicken curry decreased with increase in storage period. In case of colour, there was an increase in 'a' and 'b' values and decrease in 'L' values during storage. However, Chicken curry processed to a F_0 value of 9.91min gave an acceptable product with desired texture and sensory characteristics. The pouches remained sterile throughout the storage period at an ambient temperature of $25 \pm 5^\circ\text{C}$. The cost of chicken curry packaged in retortable pouches was worked out and found to be Rs.11/-

**ASSESSMENT OF SLAUGHTER AND POST SLAUGHTER
LOSSES OF BUFFALO, SHEEP, GOAT AND PIG IN
TIRUVALLUR DISTRICT OF TAMIL NADU**

**M.Siddharth, P.Suresh, K.Dushyanthan and V.Venkataramanujam
Department of Meat Science and Technology,
Madras Veterinary College, Chennai-600 007.**

Production of meat in India is increasing every year and the total production does not match with the total consumption. This difference in quantity of meat is going as loss during slaughter and post slaughter. Despite the lack of meat production the losses incurred by the way of slaughter and post-slaughter losses also play an important role in the marketing of meat. Apart from the inedible portion of animal like skin, horn and offals which can be used for by-product preparation, the edible portion of the carcasses are thrown away by the butchers mainly because of the injuries found in the carcasses during slaughter. Though the quantity of this loss of meat is smaller, the amount it fetches is huge. To assess the quantity of losses of meat during slaughter and post slaughter in Tiruvallur district, two butchers for each animal namely buffalo, sheep, goat and pig are selected. The primary data were collected from all 8 butchers. Losses were assessed for five consecutively slaughtered animals in a day in a month for 3 months. As a whole 3-7% losses were observed in all these animals.

**PHYSICO-CHEMICAL, MICROBIOLOGICAL
AND SENSORY QUALITIES OF WATER ACTIVITY
ALTERED BUFFALO MEAT SAUSAGE STORED
UNDER AMBIENT TEMPERATURE**

**S.Sureshkumar*, V.Venkataramanujam, K.Dushyanthan
Department of Meat Science and Technology**

Madras Veterinary College, Chennai-7

***Scientist, Central Sheep and Wool Research Institute (ICAR)
Avikanagar-304501, Rajasthan.**

Water activity (a_w), temperature & pH have been identified as the three primary factors controlling microbial growth. The study was undertaken to find the effect of water activity on buffalo sausage quality and storage stability at ambient temperature. The water activity of the buffalo meat sausage (treated) was adjusted to 0.88 by addition of humectants viz., salt, sugar, ISP, HVP, sodium lactate and subsequent heat treatment while the a_w of the Untreated sausage was 0.932. Tyrosine value showed a significant increase throughout the storage periods. There was a marked but not significant decrease in the TBARS number of the treated samples. On 5th day, the TBARS value of the treated sausages exceeded the threshold limit of 2mg/kg resulting in the spoilage. The treatment had a significant inhibitory effect on the TVC, Staphylococcal count and Streptococcal count and anaerobic count. Whereas in case of coliform and yeast mould count it had no significant effect. On the third day of storage the flavour and texture, juiciness and over acceptability scores were well within the acceptable range. Whereas in the case of untreated samples there was a slime formation and off odour development on the 3rd day of storage. Although the sensory score (over all acceptability) of the treated samples were scored less ($P>0.05$), the product was acceptable upto 3rd day storage whereas the untreated samples spoiled after 1st day of storage.

EFFECT OF NISIN AND BUTYLATED HYDROXY ANISOLE (BHA) ON THE PRODUCT QUALITY AND STORAGE STABILITY BUFFALO MEAT SAUSAGE

S.Sureshkumar*, V.Venkataramanujam, K.Dushyanthan
Department of Meat Science and Technology
Madras Veterinary College, Chennai-7

***Scientist, Central Sheep and Wool Research Institute (ICAR)**
Avikanagar-304501, Rajasthan.

Buffalo meat sausage was prepared and the water activity was adjusted to 0.88 using Humectants and heat treatment. Nisin and Butylated Hydroxyl Anisole (BHA) were added at different levels to study their effects on the product shelf life of the water activity adjusted buffalo meat sausage. There were three treatments viz. Nisin 100ppm+BHA 100ppm (A); Nisin 100ppm (B); BHA 100ppm (C) and Control (D) without nisin and BHA. Then the sausages were vacuum packaged in PET Poly pouch and stored at room temperature ($35\pm 20^{\circ}\text{C}$). The pH was increasing upon storage of the sausage where as the overall moisture content was significantly higher in the treatment C. Tyrosine value was significantly low (18.07 mg%) in treatment A when compared other. There was no significant difference among Control and C. The TBARS number of the treatment A and C were significantly lower than Control and treatment C. The nisin and BHA together exhibited a significant inhibitory effect on TVC, Staphylococcal, Streptococcal and anaerobic counts. There was no significant difference in the yeast and mould counts among three treatments. Upto day 5 the treatment A had a better appearance, flavour, texture and overall acceptability scores. Throughout the storage period the sensory scores showed a decreasing trend as storage days increases. The product was acceptable upto 5th day of storage (overall acceptability score was 7.68) at room temperature with the addition of nisin 100ppm and BHA 100ppm.