

Meat by-products utilization
and
waste disposal

Studies on the Preparation of Spent Hen Meal and its Utilization in Pet Foods

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Dr. Vivek Vinayak Kulkarni
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Poultry industry in India has come a long way from backyard venture about four decades ago to a well organized, most dynamic and rapidly expanding segment of our livestock economy. Layer poultry industry in and around Namakkal houses about 3 crore-layer population and the spent hens are mainly sold in the Kerala and Karnataka markets. Preparation of pet foods incorporating spent hen meal could be a profitable way of utilization of spent hens and it may open a new way for getting more returns to the poultry farmers, small scale entrepreneurs and self help groups.

The present study was planned to attempt a profitable utilization of spent hens. The spent hens collected from a commercial poultry farm, were slaughtered and subjected to dry rendering process. The spent hen fat was separated and the meal was pulverized in hammer mill and it was packed in LDPE bags and stored at room temperature.

The average yield of spent hen meal (SHM) and spent hen fat was 31.76 per cent and 4.74 per cent, respectively. The efficiency of the dry rendering process adopted in the present study was evident as the spent hen feathers were completely hydrolyzed and the colour of the spent hen meal was golden brown with pleasant meaty odour.

The average values of moisture, crude protein, ether extract, crude fibre, total ash, calcium and phosphorus were 5.47, 72.12, 9.52, 0.23, 12.34, 4.38 and 2.15 per cent, respectively. Storage studies of the spent hen meal revealed that TBA, tyrosine, free fatty acid and acid values and total bacterial counts increased significantly ($P < 0.01$) during 90 days of room temperature storage. There were no *E. coli*, *Salmonella spp.*,

Clostridium spp., *Staphylococci spp.* and yeast and mould in the spent hen meal during the entire storage period. The odour score decreased significantly ($P < 0.05$) from 4.00 to 3.16 during the storage studies. However no off or rancid odour was detected during the entire storage period. The results of the present study indicated that the spent hen meal can be safely stored in LDPE bags at room temperature up to 90 days without addition of antioxidants.

The pet food formulation was prepared as per the recommended nutritional requirements for an adult dog (whole meal). The spent hen meal was incorporated at two levels of 10 per cent and 20 per cent. The pet foods were prepared by extrusion process, packed in LDPE bags and stored at room temperature. The acceptability of the pet foods was assessed by conducting feeding trial in pet dogs and pet owner's opinion was obtained through a proforma.

The average values of moisture, crude protein, ether extract, crude fibre, total ash, calcium phosphorus, NFE and ME for pet food incorporating 10 per cent and 20 per cent level of SHM were 4.90, 4.92; 22.26, 22.71; 12.27, 12.52; 2.85, 2.55; 4.30, 4.22;

1.14, 1.31; 0.79, 0.85 and 58.33, 58.01 per cent and 3886.4, 3889.2 kcal/kg, respectively. Even though no artificial colouring and flavouring agents were used in preparing both the types of pet foods, the colour of the pet foods was uniformly brown with pleasant meaty odour. The physical attributes of the pet foods were preferred by the pet owner and the palatability in pet dogs was very good.

The pet food prepared by incorporating spent hen meal at 10 and 20 per cent during storage period of 45 days revealed that that TBA, tyrosine, free fatty acid and acid values and total bacterial counts increased significantly during 45 days of room temperature storage, however the pet food samples were negative for *E. coli*, *Salmonella spp.*, *Clostridium spp.*, *Staphylococci spp.* and yeast and mould during the entire storage period.

Observations on the pet owner's opinion on pet food revealed that both types of pet foods were acceptable to them. Body weight of the adult pet dogs did not decrease during the entire feeding trial of one month and the health condition of the pets was good and no digestive disturbance and allergic reaction was recorded.

The cost of production of pet food prepared by incorporating 10 per cent and 20 per cent SHM was Rs.18.00 / kg and Rs. 22.75 / kg, respectively. The cost of commercially available pet food (whole meal) based on the market survey, ranged between Rs. 60 - 120 per kg.

Hence it could be concluded that a pet food (whole meal) with good nutritive quality and palatability to dogs can be prepared by incorporating 10 - 20 per cent of spent hen meal, which can be safely stored up to 45 days at room temperature. A lower production cost of the pet foods prepared in the present study was indicative of its good market potential.

Studies on Preparation of Pet Food incorporating Dry Rendered Spent Hen Meal, Assessment of its Storage Stability and Acceptability in Pet Dogs

K.Rajendra Kumar Dr.VivekVinayak Kulkarni M.V.Sc.Thesis 2009Chairman

Problems faced by the commercial egg industry are the disposition of mortality and the utilization of spent hens. Spent hen meat is tough, dry and sinewy. Rendering is the process of recycling of raw animal tissue and it is the safest way of inactivating disease-causing microbes while recovering value added products such as meat cum bone meal and fat. Poultry protein meals are a popular high quality protein source used in pet foods. Preparation of pet foods incorporating spent hen meal could be a profitable way of utilization of spent hens.

The spent hens were slaughtered and subjected to dry rendering process. After separating fat, the meal was pulverized in hammer mill and it was stored at room temperature. The average yield of spent hen meal (SHM) and spent hen fat was 30.77 per cent and 3.93 per cent, respectively. The average proximate values of SHM: moisture, crude protein, ether extract, crude fibre, total ash, calcium and phosphorus were 8.90, 62.24, 10.94, 0.74, 12.05, 3.54 and 1.58, per cent, respectively. The meal was pulverized in hammer mill and was stored at room temperature.

The pet food (whole meal) formulation was prepared as per the recommended nutritional requirements for grower and adult dog. The spent hen meal was incorporated to meet the total protein requirements. The pet foods were prepared by palletization process, packed in polypropylene bags and stored at room temperature ($35\pm 2^{\circ}\text{C}$) and storage studies were conducted on 10 days interval up to 90 days.

The average values of moisture, crude protein, ether extract, crude fibre, total ash, calcium phosphorus, NFE and ME for grower and adult pet foods were 8.87, 9.08; 21.62, 18.10; 8.5, 5.69; 2.49, 4.30; 4.75, 2.84; 1.32, 1.15; 0.61, 0.57; 58.52, 62.84 and 4420.66, 4689.98 kcal/100kg, respectively. Even though no artificial colouring and flavouring agents were used in preparing both the types of pet foods, the colour of the pet foods was uniformly brown with pleasant meaty odour.

The mean values of biochemical and microbiological parameters of the pet food prepared for grower during storage period of 90 days revealed that moisture (%) increased significantly from 8.62 to 9.70. The TBA (thiobarbituric acid) and tyrosine values increased significantly from 1.37 to 5.38 mg/kg and from 84.50 to 108.24 mg/100g, respectively during storage. The free fatty acid values and acid value increased significantly from 2.44 to 12.99 per cent and from 0.98 to 6.25, respectively during storage. The total viable count ($\log_{10}\text{cfu/g}$) increased significantly from 3.88 to 21.05 during the storage studies. The pet food was negative for *E. coli*, *Salmonella spp.*, *Clostridium spp.*, *Staphylococci spp.*, *Streptococci spp.* and yeast and mould during the entire storage period. The odour score decreased significantly from 4.00 to 3.30 during the storage studies.

The mean values of biochemical and microbiological parameters of the pet food prepared for adult during storage period of 90 days revealed that moisture (%)

increased significantly from 8.60 to 9.84. The TBA (thiobarbituric acid) and tyrosine values increased significantly from 2.21 to 6.79 mg/kg and from 85.35 to 111.44 mg/100g, respectively during storage. The free fatty acid and acid values increased significantly from 2.82 to 14.45 per cent and from 0.78 to 6.15 during the storage. The total viable count (\log_{10} cfu/g) increased significantly from 2.83 to 20.00 during the storage studies. The pet food was negative for *E. coli*, *Salmonella spp.*, *Clostridium spp.*, *Staphylococci spp.*, *Streptococci spp.* and yeast and mould during the entire storage period. The odour score decreased significantly ($P < 0.05$) from 4.00 to 3.33 during the storage studies.

The scores given by the pet owners for both the types of pet foods prepared for grower and adult dogs were 6.92 and 6.67 for colour, 5.83 and 5.50 for consistency, 6.17 and 6.42 for odour and 6.50 and 6.83 as overall rating, respectively. The physical attributes of the pet foods were preferred by the pet owners as the palatability in pet dogs was also very good. However lower consistency scores of the pellet indicated about the hardness of the pellet. During the feeding trial the palatability of the pet food was very good. Maintenance of body weights of the pet dogs and absence of any adverse reaction (allergic reaction or digestive disturbances) was indicative of the nutritive quality and better palatability of the pet foods prepared in the present study.

The mean values of blood parameters of grower pet dogs during the feeding trial revealed that haemoglobin and haematocrit increased significantly ($P < 0.05$) from 11.86 to 12.75 g/dL and from 35.70 to 38.39 per cent, respectively. The cholesterol values increased numerically from 119.34 to 122.52 mg/dL. The calcium values decreased numerically from 6.66 to 6.15 mg/dL per cent. The phosphorus values increased significantly ($P < 0.05$) from 3.07 to 3.40 mg/dL. The mean values of blood parameters of adult pet dogs during the feeding trial revealed that haemoglobin and haematocrit increased significantly ($P < 0.05$) from 13.35 to 13.76 g/dL and from 40.11 to 41.39 per cent, respectively. The protein values increased significantly ($P < 0.05$) from 6.30 to 6.80 g/dL. The cholesterol values decreased numerically from 163.54 to 156.48 mg/dL. The calcium values decreased numerically from 8.36 to 8.00 mg/dL. The phosphorus values increased numerically from 4.14 to 4.25 mg/dL. However the blood parameters recorded in grower and adult pet dogs were in normal range also further confirmed that there was no stress on these dogs during feeding trial.

The digestibility of pet food for grower and adult pet dog was 72.64 and 69.06 per cent, respectively. The cost of production for grower and adult was Rs.31.30/kg and Rs. 26.20/kg, respectively.

Hence it could be concluded that a pet food (whole meal) with good nutritive quality and palatability to dogs can be prepared by incorporating spent hen meal as a total replacer for protein requirement. The pet food can be safely stored up to 90 days at room temperature.

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

PramilaUmarawb Vikas Pathak M. V. Sc: Thesis, 2013 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 re commended 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.

Studies on Indigenous Processing Technologies of Buffalo Casings.
JamanLal Dr. H. B. Joshi M. V. Sc. Thesis, Dec.-1989 Chairman

Observational study of casings processing revealed that the average weight of oesophagus, oesophageal meat and weasand (mucosa) was 422.57 ± 8.64 gm, 312.85 ± 5.47 gm. And 101.79 ± 1.98 gm respectively. Length of the raw weasand was 81.40 ± 0.77 cm. The dry weight of weasand was 25.82 ± 0.50 gm. The average length of dry, deflated weasand (finished weasand) was 58.07 ± 0.66 cm. The mean weight of green urinary bladder, trim and bladder, was 314.28 ± 7.80 gm, 150.56 ± 5.33 gm respectively. The average weight of dry bladder was 38.50 ± 0.96 gm. The final length (finished, deflated bladder was 35.18 ± 0.59 cm.

The average length of raw runners was 25.70 meters. The period of fermentation was found to be 24 hrs. There was a slight rise in temperature during fermentation. Average period of drying was 3 hrs. Six percent of the runners were found to have holes. Fifty four percent of the runners had fat streaks ranging from 2 cm to 9 cm. The average length of finished runners (dried rolled) was 23.82 ± 0.45 M, however, the flat measure (half circumference) of the runners was 54.9 ± 0.50 mm.

A subjective evaluation for different types of casings was made on a five point hedonic scale for colour, uniformity of colour, lustre, strength, overall quality by awarding appropriate scores. Microbial evaluation of dried casings showed that the total plate counts were least in runners (38×10^4 /g) followed by weasands (63×10^4 /gm) and bladders (19×10^5 /g). Yeast and mould counts were least in weasands (63×10^4 g) followed by runners (82×10^4 g). Coliform counts ranged from 100 to 300/g. Salmonella was not detected in any of the three categories of casings.

Fractionation and Characterization of Neat's Foot Oil from Buffalo Hooves

A. K. Mittal Dr. B. N. Kowale*M. V. Sc. Thesis, Nov.-1989* **Chairman**

Neats foot oil, an important animal byproduct is extracted from animal hooves. The quality of oil depends essentially on its cloud point. The present study was taken up-to obtain neats foot oil of low cloud point by fractional crystallization from buffalo hooves and study its physic-chemical properties.

Neats foot oil extracted from buffalo hooves was subjected to fractionation by fractional crystallization using acetone as solvent. Three fractions viz. fraction I (non-freezing at 10°C), fraction II (non-solidifying at 4°C) and fraction III (solidifying at 4°C) were obtained. Fraction II was the major fraction (62.17%) obtained followed by fraction III (34.16%). From the results of the present study, it was evident that among the three fractions obtained by fractional crystallization, yield of fraction I was very low (3.665). Moreover it contained higher amount of unsaturated fatty acids as compared to other fractions, which might be responsible for its non-freezing property at lower temperatures. This fraction could be used in fine machineries operation under low temperature (0 to -10°C). Yield of fraction II (62.17%) was higher as compared to other fractions of neats foot oil. The cloud point of neats foot oil could be lowered by removing stearin from whole oil, thereby making it suitable for its use as a lubricant at low temperature (0 to 4°C) with the yield of 34.16% was the second major fraction. It was stable chemically because of low content of unsaturated fatty acids. This fraction could be used as a lubricant at higher temperatures.

Studies on Recovery of Proteins From Ovine Lungs and Rumen and Incorporation in Mutton Patties

SheruGaneshbabuDr.V.KesavaRao *M. V. Sc. Thesis, Nov.-1990*

Chairman

Recovery of proteins from slaughter house by-products for human consumption has been given considerable importance in recent years. The present study was aimed at preparation of protein isolates from ovine lungs and rumen, working out suitable levels of incorporation of these protein isolates in mutton patties without any loss in quality and acceptability and studying the shelf life of patties under refrigerated storage ($4\pm 1^{\circ}\text{C}$).

Protein was recovered by improved alkaline extraction and isoelectric precipitation suggested by Swinglar and Lawrie (1979). The percentage recovery of protein isolate from lungs and rumen were 38.2 and 31.0, respectively. On dry matter basis there was no difference in yields of protein from lungs (30.35g) and rumen (30.30g). In spite of equal amount of collagen than the protein isolate from rumen indicating in the former.

The sensory evaluation scores for general appearance, flavor, texture, saltiness, juiciness and overall acceptability of mutton patties incorporated with lung and rumen protein isolates at different levels indicated that up-to 20% level the product were rated as very good to excellent. However, patties with 25% and 30% of lung and rumen protein isolates were within the range of consumer acceptance.

The improved alkaline extraction methods is simple and resulted in better yield of protein isolates from ovine lungs and rumen. The alkaline extraction also lowered microbial load in protein isolates rendering the isolates microbiologically safe. Further the protein isolate could be incorporated in the mutton patties up-to 20% level, replacing high cost lean, without any loss in quality characteristics and sensory attributes. The mutton patties incorporated with protein isolates could be stored safely at refrigerated temperature ($4\pm 1^{\circ}\text{C}$) for 15 days without any deteriorative changes in quality and acceptability.

Characterization and Detergency of Bile from Food Animals.

Ravindra Sharma Dr. V. Kesava Rao M. V. Sc. Thesis, Aug.-1991 Chairman

The present work was undertaken to study the physicochemical properties of bile from food animals viz., sheep, goat buffalo and buffalo-calves. An attempt was also made to study the detergent properties of buffalo bile. The salient findings are summarized below.

The colour of bile was dark green for sheep and goat and light green to straw yellow for buffalo and buffalo-calf. The yield of bile was higher in goat (18.52 ml) than sheep (15.05 ml). Adult buffalo also yielded more quantity of bile (328.88 ml) as compared to buffalo-calf (244.04 ml). The pH of sheep bile (6.83) was higher than goat bile. The pH of buffalo and buffalo-calf bile. The pH of buffalo and buffalo-calf bile was on the alkaline side being 7.34 and 7.55, respectively. The refractive index, protein, total lipid, cholesterol content and fatty acid composition of biles were also determined. Bile could be preserved at room temperature for longer time by adding 1.5% (w/v) sodium bicarbonate or sodium carbonate alone or in combination with 2% (w/v) tetra-sodium pyrophosphate. Highest foaming property of bile was noticed with 1.5% sodium bi-carbonate along with 2% tetrasodium pyrophosphate at 20% bile concentration. Phosphates enhanced the detergent property of bile by exhibiting their sequestering action.

Bile, preserved with sodium bicarbonate inhibited the growth of Klebsiella organisms at 20, 30 40 and 50% concentrations, while pure bile had inhibitory effect on Proteus organisms at 40 or 50% concentrations. At 30% concentration it was found to be more effective against Staphylococcus organisms. In most of the slaughter houses, buffalo bile goes waste or is sold at a marginally low price. Having very good detergent properties/action, it has wide scope in detergent industry either as a pure detergent or as an additive to other detergents depending on the nature of commercial use and quality.

Studies on Incorporation of Raw and Hydrolysed Fascia in mutton Patties.

Ch. Raja Thimma Reddy Dr. V Kesava Rao M.V. Sc. Thesis, Nov.-1992

Chairman

Present study was envisaged with the objective to work out suitable levels of incorporation of raw and hydrolysed fascia in mutton patties without any loss in quality and acceptability and to study the shelf life of patties under refrigerated storage ($4\pm 1^{\circ}\text{C}$). Fascia from healthy sheep carcasses was defatted with alcohol: either mixture (1:1) and dried. Powdered fascia was hydrolysed with 0.1% pepsin. Rendered mutton fat was used in the patties formulation. Mutton patties were prepared by incorporating raw and hydrolysed fascia at 10 and 20% levels replacing lean meat and were analyzed for their proximate composition, quality characteristics viz., emulsion stability, pH cooking loss and shear force value and nutritional characteristic like collagen, free amino acids, non protein nitrogen, available lysine and protein efficiency ration. Sections of emulsions were observed under microscope to see the effect of fascia on emulsion formation. SDS-PAGE was performed to confirm the hydrolysis of fascia.

Patties incorporated with raw and hydrolysed fascia showed significant increase in collagen content from that of control. No adverse effect on the texture of patties was observed by incorporating raw fascia up-to 20% level. Patties incorporated with hydrolysed fascia showed lower shear force values which was attributed to the disintegration of structure of the native collagen after enzymatic hydrolysis. There was a significant increase in free amino acid and non protein nitrogen contents of the patties incorporated with raw and hydrolysed fascia at 20% level. Available lysine content of patties incorporated with hydrolysed fascia increased significantly. The sensory evaluation scores of mutton patties incorporated with raw and hydrolysed fascia up-to 20% level were rated as good to very good.

From the present study it is concluded that the raw and hydrolysed fascia at could be incorporated in the mutton patties up-to 20% level, replacing high cost lean, without much loss in quality and nutritional characteristics and sensory attributes. Patties could be enriched with lysine by incorporating hydrolysed fascia could be incorporating hydrolysed fascia could be stored safely at refrigerated temperature ($4\pm 1^{\circ}\text{C}$) for 15 days without any deterioration in quality and acceptability.

Processing and Evaluation of Sun Dried Blood Meal.

B. Jagannatha Rao Er. Murari Prasad *M. V. Sc. Thesis, Nov.-1998*

Chairman

Blood account for 3-5% of animal live weight and contains about 18-19% of protein. The meat industry is under constant pressure to improve the utilization of blood. In this context, Blood meal production to livestock industry and helping in economic upkeep of meat plant also serves to check environmental pollution.

Average amount of blood that could be collected from buffalo was about 9.6 liters, which contained about 17.5% protein. Blood meal preparation included hygienic collection of blood, addition to lime, pressure-cooking, subjecting the protein coagulum to sun drying, grinding and storing. Blood meal so prepared contained 82.13% of protein, 0.38% calcium and 0.18% of phosphorus. There was tremendous saving of energy to the extent of 0.39 to 0.46 KwS-1 (4400 Kw then total drying time 27-30hrs) in sun drying of blood meal obtained from 25 liters of blood. Microbiological quality of blood meal was acceptable. With the addition of lime to the extent of 1.5%, there was tremendous decrease in microbial counts.

The total protein efficiency (TPE) value of blood meal (1.3) indicated that the protein quality of blood meal protein were inferior as compared to fish meal (1.64) and blood meal cannot be used as a sole source of protein in rations. When possible utilization of blood meal in poultry ration was attempted, it was found that fifty percent replacement of fish meal nitrogen could be replaced by blood meal nitrogen without effecting growth. There was growth depression when seventy five percent replacement of fish meal nitrogen replaced by blood meal nitrogen. Reduced feed cost, increase in net profit per bird were observed when incorporation of blood meal at a desired level was done in poultry rations.

Studies on Utilization of Slaughterhouse By-products of Goats in Bareilly

V. Esakkimuthu Dr. V. Lakshmanan*M. V. Sc. Thesis, Nov.-1998* Chairman

A pragmatic field study was undertaken at the local sheep and goat slaughterhouse and related establishments to collect firsthand information on yields of by-products and methods of utilization of edible and inedible offals of nondescript market slaughter goats. Offal meats and goat casings were evaluated for some quality parameters.

The overall mean slaughter weight and carcass yield were 19.27 kg and 49.69% respectively. The yields of blood, head, forefeet, hindfeet, skin, pluck, intestinal tract, omental fat, R&R (full and empty) and O&A (full and empty) were 0.71, 1.27, 0.29, 0.21, 1.34, 0.97, 1.27, 0.37, 2.64, 0.49, 0.40 and 0.25 kg respectively. Sex had significant effect on percent yields of blood and forefeet, age on pluck and omental fat, size on head, skin, pluck, forefeet and O&A (empty) and conformation on carcass and all the byproducts except blood and feet. Indigenous techniques, for deboning of heads and preparation of casings and musical drums from small intestines and skins respectively, were vividly documented. The yield of head meat was 58.16%. The mean weight, length and width of goat skins 1.35 kg, 95.04 and 30.81 cm respectively. The mean measurement recorded on finished product of skins used as musical drums were: weight -267 g, length-90.83cm and width-69.11 cm.

The survey on profile of offal meats consumers showed that the primarily belonged to socially, economically and educationally backward communities. Head, feet and pluck are consumed by all, whereas only 75% use GI tract. Fry, soup and curries prepared from brain, feet and other offals respectively. The charring of head and feet for removal of hair and cleaning of GI tract are very time consuming and laborious tasks. Labour community are the major customers for offal meat products vendors.

Among offal meats, R&R and intestines had higher content, liver highest protein, tongue highest fat and calorific value. All were lower in WHC than skeletal meat. The counts for mesophiles, coliforms and staphylococci in goat casings were 4.09, 2.63 and 4.32 log₁₀ cfu/g respectively. Salmonella and aeromonas were absent.

Utilization of Collagen Isolated from Skin for Production of Low-fat Sausages

Vedamuthy C. B. Dr. V. Kesavarao M. V. Sc. Thesis, Dec.-1998 Chairman

A large amount of skin trimmings covering head and legs from slaughtered animals are not properly utilized by slaughter houses in India and thrown away as waste. However, they can be utilized for isolation of food grade collagen. Such processing of an otherwise useless byproduct would mean additional gains to livestock owners, besides minimizing the present study was proposed to utilize collagen isolated from goat skin trimmings in the formulations of low-fat chevon sausages and to study its possible beneficial effects on physico-chemical properties and shelf life of these sausages during refrigerated storage.

Incorporation of collagen hydrolyzate at different levels (0,5,10 and 15%) significantly decreased the emulsion stability, increased the cooking loss and decreased the shear force value. However, the sausages with 5 and 10% did not differ significantly from controls with respect to emulsion stability and shear force. There was an increase in pH and FAA value upon increase in the levels of incorporation of collagen hydrolyzate. When the sausages were subjected to sensory evaluation, the sausages with 10% collagen hydrolyzate were rated significantly better for flavor, juiciness, texture and overall acceptability. Incidentally, studies under SEM revealed an improved product structure at 10% collagen level. Cost of production was brought down by Rs. 4.57/ Kg. Sausages.

Storage studies of sausages under refrigeration ($4\pm 1^{\circ}\text{C}$) over a period of 20 days showed an increase in levels of TVN, FAA, tyrosine value, standard plate count psychrotrophic plate count and a decrease in pH values. However, all the values were far below the threshold values for spoilage. The TBA values increased upon storage up to 15th day and then decreased on 20th day. Utilization of collagen isolated from skin trimmings in meat products, would be not only from an economical and qualitative standpoint, but also from an eco-friendly perspective, since it would contribute to reducing the environmental pollution problem.

Quality Characteristics and Utilization of Rumen Meats from Goat Sheep, and Buffalo.

B.R. Parivell Dr. V. Lakshmanan M. V. Sc. Thesis, Aug.-1999 Chairman

Rumen meat, otherwise known as “tripe” and colloquially called as “butt” is one of the important edible offals of ruminants, from yield point. The present study, comprising field investigations and laboratory studies, was undertaken to generate baseline information on handling and utilization and quality characteristics of this valuable material.

Rumen & reticulum and rumen muscular coat constitute tripe in small ruminants and buffaloes, respectively. Separation of muscular and mucous coats of buffalo rumen is a highly arduous and dexterous job. Mean yield of trips for sheep and buffaloes were 0.59 and 5.45 Kg, respectively. Sheep and goat tripes are scalded and cooked in ample water into “tripe-curry” Buffalo tripes are deodorized and shallow fried in a limited quantity of oil into “tripe-fry”. It is excellent in taste and has no trace of unpleasant odour of raw material. Based on practical experience from many scalding trails of small ruminant tripes, the “degree of ease” for separation of mucous membrane and the “efficiency of scalding” were subjectively placed under 7 and 6 scales, respectively. An “optimum scalding specification” (60°C for 120 sec.) was developed. Functional properties of optimum scalded tripes were comparatively higher than traditionally scalded (97°C for 15 sec) tripes.

Quality characteristics and microbial profile of rumen meats (RMs) of sheep, goat and buffalo were compared with skeletal meats (SMs) of respective species. RMs has significantly higher moisture and fat and lower protein and ash contents than SMs, pH and WHC of RMs were significantly higher collagen content and lower collagen solubility than SMs. The y also had significantly higher microbial load. While salmonella was absent in SMs, one sample of rumen meat (buffalo) was positive.

Evaluation of shelf life of RMs at ambient temperature was made by sensory evaluation at hourly intervals. Sheep and goat tripes were acceptable up-to 4 hrs and buffalo tripe, up-to 7 hrs. Storage studies at refrigeration temperature was conducted by sensory evaluation, physic-chemical characteristics and microbial load. TBA number pattern of buffalo tripe indicated higher susceptibility to oxidative deterioration than sheep and goat tripes. Significant increase in microbial load and decrease in ERV values were observed with increasing storage period. Sheep and goat tripes were acceptable up-to 5 days and buffalo tripe, up-to 3 days.

The cost of Food Animal is Higher than the Sale value of its Meat. Testing the Hypothesis for Sheep and Goat.

Y.R. Ambedkar DR. V. LakshmananM. V. SC. Thesis, Dec.-2000 Chairman

The widely held hypothesis in meat trade states that the cost of food animal often exceeds the sale price of meat and the key to profitability is from byproducts. The present study was undertaken to test this hypothesis for sheep and goats at Bareilly through collection of data on slaughter components and market price of live animals and various slaughter products. The mean yields of slaughter components for nondescript market slaughter sheep and goats were collected of either sex under two age (young and adults), three size (small, medium and large) and three conformation groups. Data were collected from 69 sheep and 59 goats. The overall mean slaughter and carcass weight of market slaughter sheep and goat were 22.36 and 10.47 kg, 19.98 and 19.51 kg respectively. In both species, slaughter and carcass weight increased progressively with progressive increase in size and conformation. The overall dressing percentage in sheep and goats was higher in sheep (2.19 kg) than goats (1.139 kg). Omental fat yield was higher in goats (330g) than sheep (150g): Pluck yield was higher in sheep (950g) than goats (820g). Goats have heavier legs than sheep.

The mean live animal price of male market slaughter sheep was considerably higher (Rs.901) than female sheep (Rs.815). Overall mean live animal price of market slaughter sheep was higher (Rs.861) than goats (Rs. 763). Sale value of meat was also higher in sheep (Rs.998) than goats (Rs. 884). Sale values of skin was very high sheep (Rs. 143) than goats (Rs. 43). Sale value of sum of by-products was higher in sheep (Rs. 289) than goats (Rs. 197) due to huge differential in skin price. Since the sale value of meat was higher than the purchase price of live animal in both sheep and goats; it is interpreted that the hypothesis of this study does not exist for small ruminants in this part the country. Since the total sale proceeds in sheep and goats expressed as % of live animal price was found to be 149.37 and 146.01% respectively, it was concluded that small ruminants meat trade is a profitable enterprise.

Both mutton and goat carcasses are fabricated in the same style. Each carcass is divided into two halves-foresaddle and hindsaddle-by cutting through 12th and 13th ribs. Foresaddle is separated into two forequarters. Each forequarter is made into 4 cuts-neck, shoulder, ribs and breast. Hind saddle is divided into two parts. Three cuts-flank, loin and leg are made from each part. Saleable meat in sheep and goat carcasses was about 94.27 and 93.23% respectively. Carcass trimmings are sold to dog owners for use as pet food.

Studies on Development of Extruded Tripe Snack Food from Buffalo Rumen Meat

M. Anna Anandh Dr. V. Lakshmanan*M.V.Sc. Thesis, July-2001* Chairman

Buffalo population of India is a quite large contributing to 56.5% world buffalo population. Buffalo rumen meat (tripe) is one of the important edible offals with substantial yield (4.36 to 5.45 kg/animal). It has two limitations- off odour and poor functional properties. Rumen meat offers good scope for processing into product manufacture, subject to successfully overcoming these limitations. In this study, a scientific approach was made in this direction leading to the development of a snack food of very acceptable quality from buffalo rumen meat.

For removal of off odour in buffalo rumen meat, five chemicals i.e. Trisodium phosphate (TSP), sodium carbonate(SC), sodium hypochlorite (SHC), calcium hydroxide (CH) and hydrogen peroxide (HP) at different concentrations (1%, 2%, 3%, 4% and 5%) were evaluated for their efficacy based on sensory analysis. 5% TSP, 3% SC and 3% SHC were shortlisted. On further study, based on sensory evaluation for odour and bleaching effect, 5%TSP was selected. TSP was, then, evaluated at different concentrations (4.5%, 5%, 5.5%and 6.0%) and 5% concentration was found to be optimum. 5%TSP solution was evaluated at different holding periods (15 min, 30 min. and 45 min) and 30 min holding period was found to be optimum.

A `process schedule` was developed for preparation of buffalo tripe snacks after successfully overcoming the critical problems for added water and cooking schedule. To develop a standardized formulation for buffalo tripe snack food of acceptable quality, three flours (corn, rice and wheat) were tried in succession (treatment 1, 2 and 3, respectively). Control products comprised 100% of concerned flour. Control and tripe snacks were evaluated for various quality attributes. 50% corn flour, 50% rice flour and 60% wheat flour were selected levels of flours and compared organoleptically. Eventually, corn flour at 50% level was selected as the best flour. Linear and significant trends were observed for all physic-chemical parameters from control to treatment 3, with increasing values for pH, moisture, bulk density and proximate principles and decreasing values for hydratability, water absorption index and water solubility index.

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Isolation Evaluation and Utilization of Globin & Serum Protein Isolates from Buffalo Blood in Food.

P.K. Mandal Dr. V. Kesava Rao *Ph. D. Thesis, March-1996* Chairman

To minimize the protein malnutrition in the third countries, blood protein would offer a promising solution. The present investigation was envisaged to study the quality of buffalo blood obtained from local slaughterhouse, to standardize the methods for preparation of serum protein isolate (SPI) and decolourised globin protein (GPI), to evaluate their microbiological, chemical and functional properties and utilize these protein isolates in sausages by replacing lean and in cake by replacing egg.

Average production of blood from buffalo was 9.4 liters yielding 62% serum and 38% RBC concentrate. The quality of blood was microbiologically safe, having no pathogens and was having a protein content of about 17.21%. Procedure was standardized for the preparation of serum protein isolate (SPI) by precipitation with acetone. Microbiological quality of SPI was acceptable. However, functional properties were reduced. It is recommended that precipitation of serum proteins should be carried out at pH 3.0 and temperature 25-30°C. Decolourised globin protein isolate (GPI) was prepared with sodium alginate at 0.2% in pH 3.0 and NaCl 2% of haemoglobin solution.

The GPI was microbiologically safe but functional properties were reduced. Buffalo meat sausages could be prepared by replacing lean with SPI up-to 9% replacement of lean with GPI. Cake could be prepared by replacing egg up-to 50% without affecting the quality and acceptability. Cake could also be prepared by replacing egg up-to 25% with GPI without affecting the acceptability.

Studies on Indigenous Processing Technologies of Buffalo Casings.
JamanLal Dr. H. B. Joshi M. V. Sc. Thesis, Dec.-1989 Chairman

Observational study of casings processing revealed that the average weight of oesophagus, oesophageal meat and weasand (mucosa) was 422.57 ± 8.64 gm, 312.85 ± 5.47 gm. And 101.79 ± 1.98 gm respectively. Length of the raw weasand was 81.40 ± 0.77 cm. The dry weight of weasand was 25.82 ± 0.50 gm. The average length of dry, deflated weasand (finished weasand) was 58.07 ± 0.66 cm. The mean weight of green urinary bladder, trim and bladder, was 314.28 ± 7.80 gm, 150.56 ± 5.33 gm respectively. The average weight of dry bladder was 38.50 ± 0.96 gm. The final length (finished, deflated bladder) was 35.18 ± 0.59 cm.

The average length of raw runners was 25.70 meters. The period of fermentation was found to be 24 hrs. There was a slight rise in temperature during fermentation. Average period of drying was 3 hrs. Six percent of the runners were found to have holes. Fifty four percent of the runners had fat streaks ranging from 2 cm to 9 cm. The average length of finished runners (dried rolled) was 23.82 ± 0.45 M, however, the flat measure (half circumference) of the runners was 54.9 ± 0.50 mm. A subjective evaluation for different types of casings was made on a five point hedonic scale for colour, uniformity of colour, lustre, strength, overall quality by awarding appropriate scores. Microbial evaluation of dried casings showed that the total plate counts were least in runners (38×10^4 /g) followed by weasands (63×10^4 /gm) and bladders (19×10^5 /g). Yeast and mould counts were least in weasands (63×10^4 g) followed by runners (82×10^4 g). Coliform counts ranged from 100 to 300/g. Salmonella was not detected in any of the three categories of casings.

Fractionation and Characterization of Neat's Foot Oil from Buffalo Hooves

A. K. Mittal Dr. B. N. Kowale*M. V. Sc. Thesis, Nov.-1989* Chairman

Neats foot oil, an important animal byproduct is extracted from animal hooves. The quality of oil depends essentially on its cloud point. The present study was taken up-to obtain neats foot oil of low cloud point by fractional crystallization from buffalo hooves and study its physic-chemical properties.

Neats foot oil extracted from buffalo hooves was subjected to fractionation by fractional crystallization using acetone as solvent. Three fractions viz. fraction I (non-freezing at 10°C), fraction II (non-solidifying at 4°C) and fraction III (solidifying at 4°C) were obtained. Fraction II was the major fraction (62.17%) obtained followed by fraction III (34.16%). From the results of the present study, it was evident that among the three fractions obtained by fractional crystallization, yield of fraction I was very low (3.665). Moreover it contained higher amount of unsaturated fatty acids as compared to other fractions, which might be responsible for its non-freezing property at lower temperatures. This fraction could be used in fine machineries operation under low temperature (0 to -10°C). Yield of fraction II (62.17%) was higher as compared to other fractions of neats foot oil. The cloud point of neats foot oil could be lowered by removing stearin from whole oil, thereby making it suitable for its use as a lubricant at low temperature (0 to 4°C) with the yield of 34.16% was the second major fraction. It was stable chemically because of low content of unsaturated fatty acids. This fraction could be used as a lubricant at higher temperatures.

Studies on Recovery of Proteins From Ovine Lungs and Rumen and Incorporation in Mutton Patties

SheruGaneshbabuDr.V.KesavaRao *M. V. Sc. Thesis, Nov.-1990* Chairman

Recovery of proteins from slaughter house by-products for human consumption has been given considerable importance in recent years. The present study was aimed at preparation of protein isolates from ovine lungs and rumen, working out suitable levels of incorporation of these protein isolates in mutton patties without any loss in quality and acceptability and studying the shelf life of patties under refrigerated storage ($4\pm 1^{\circ}\text{C}$).

Protein was recovered by improved alkaline extraction and isoelectric precipitation suggested by Swinglar and Lawrie (1979). The percentage recovery of protein isolate from lungs and rumen were 38.2 and 31.0, respectively. On dry matter basis there was no difference in yields of protein from lungs (30.35g) and rumen (30.30g). In spite of equal amount of collagen than the protein isolate from rumen indicating in the former. The sensory evaluation scores for general appearance, flavor, texture, saltiness, juiciness and overall acceptability of mutton patties incorporated with lung and rumen protein isolates at different levels indicated that up-to 20% level the product were rated as very good to excellent. However, patties with 25% and 30% of lung and rumen protein isolates were within the range of consumer acceptance.

The improved alkaline extraction methods is simple and resulted in better yield of protein isolates from ovine lungs and rumen. The alkaline extraction also lowered microbial load in protein isolates rendering the isolates microbiologically safe. Further the protein isolate could be incorporated in the mutton patties up-to 20% level, replacing high cost lean, without any loss in quality characteristics and sensory attributes. The mutton patties incorporated with protein isolates could be stored safely at refrigerated temperature ($4\pm 1^{\circ}\text{C}$) for 15 days without any deteriorative changes in quality and acceptability.

Characterization and Detergency of Bile from Food Animals.

Ravindra Sharma Dr. V. Kesava Rao *M. V. Sc. Thesis, Aug.-1991* Chairman

The present work was undertaken to study the physicochemical properties of bile from food animals viz., sheep, goat buffalo and buffalo-calves. An attempt was also made to study the detergent properties of buffalo bile. The salient findings are summarized below.

The colour of bile was dark green for sheep and goat and light green to straw yellow for buffalo and buffalo-calf. The yield of bile was higher in goat (18.52 ml) than sheep (15.05 ml). Adult buffalo also yielded more quantity of bile (328.88 ml) as compared to buffalo-calf (244.04 ml). The pH of sheep bile (6.83) was higher than goat bile. The pH of buffalo and buffalo-calf bile. The pH of buffalo and buffalo-calf bile was on the alkaline side being 7.34 and 7.55, respectively. The refractive index, protein, total lipid, cholesterol content and fatty acid composition of biles were also determined. Bile could be preserved at room temperature for longer time by adding 1.5% (w/v) sodium bicarbonate or sodium carbonate alone or in combination with 2% (w/v) tetra-sodium pyrophosphate. Highest foaming property of bile was noticed with 1.5% sodium bicarbonate along with 2% tetrasodium pyrophosphate at 20% bile concentration. Phosphates enhanced the detergent property of bile by exhibiting their sequestering action.

Bile, preserved with sodium bicarbonate inhibited the growth of Klebsiella organisms at 20, 30 40 and 50% concentrations, while pure bile had inhibitory effect on Proteus organisms at 40 or 50% concentrations. At 30% concentration it was found to be more effective against Staphylococcus organisms. In most of the slaughter houses, buffalo bile goes waste or is sold at a marginally low price. Having very good detergent properties/action, it has wide scope in detergent industry either as a pure detergent or as an additive to other detergents depending on the nature of commercial use and quality.

Studies on Incorporation of Raw and Hydrolysed Fascia in mutton Patties.

Ch.RajaThimma Reddy Dr.V Kesava Rao M.V. Sc.Thesis, Nov.-1992

Chairman

Present study was envisaged with the objective to work out suitable levels of incorporation of raw and hydrolysed fascia in mutton patties without any loss in quality and acceptability and to study the shelf life of patties under refrigerated storage ($4\pm 1^{\circ}\text{C}$). Fascia from healthy sheep carcasses was defatted with alcohol: either mixture (1:1) and dried. Powdered fascia was hydrolysed with 0.1% pepsin. Rendered mutton fat was used in the patties formulation. Mutton patties were prepared by incorporating raw and hydrolysed fascia at 10 and 20% levels replacing lean meat and were analyzed for their proximate composition, quality characteristics viz., emulsion stability, pH cooking loss and shear force value and nutritional characteristic like collagen, free amino acids, non protein nitrogen, available lysine and protein efficiency ration. Sections of emulsions were observed under microscope to see the effect of fascia on emulsion formation. SDS-PAGE was performed to confirm the hydrolysis of fascia.

Patties incorporated with raw and hydrolysed fascia showed significant increase in collagen content from that of control. No adverse effect on the texture of patties was observed by incorporating raw fascia up-to 20% level. Patties incorporated with hydrolysed fascia showed lower shear force values which was attributed to the disintegration of structure of the native collagen after enzymatic hydrolysis. There was a significant increase in free amino acid and non protein nitrogen contents of the patties incorporated with raw and hydrolysed fascia at 20% level. Available lysine content of patties incorporated with hydrolysed fascia increased significantly. The sensory evaluation scores of mutton patties incorporated with raw and hydrolysed fascia up-to 20% level were rated as good to very good.

From the present study it is concluded that the raw and hydrolysed fascia could be incorporated in the mutton patties up-to 20% level, replacing high cost lean, without much loss in quality and nutritional characteristics and sensory attributes. Patties could be enriched with lysine by incorporating hydrolysed fascia. Hydrolysed fascia could be stored safely at refrigerated temperature ($4\pm 1^{\circ}\text{C}$) for 15 days without any deterioration in quality and acceptability.

Processing and Evaluation of Sun Dried Blood Meal.

B. Jagannatha Rao Er. Murari Prasad *M.V. Sc. Thesis, Nov.-1998* Chairman

Blood account for 3-5% of animal live weight and contains about 18-19% of protein. The meat industry is under constant pressure to improve the utilization of blood. In this context, Blood meal production to livestock industry and helping in economic upkeep of meat plant also serves to check environmental pollution.

Average amount of blood that could be collected from buffalo was about 9.6 liters, which contained about 17.5% protein. Blood meal preparation included hygienic collection of blood, addition to lime, pressure-cooking, subjecting the protein coagulum to sun drying, grinding and storing. Blood meal so prepared contained 82.13% of protein, 0.38% calcium and 0.18% of phosphorus. There was tremendous saving of energy to the extent of 0.39 to 0.46 Kws-1 (4400 Kw then total drying time 27-30hrs) in sun drying of blood meal obtained from 25 liters of blood. Microbiological quality of blood meal was acceptable. With the addition of lime to the extent of 1.5%, there was tremendous decrease in microbial counts.

The total protein efficiency (TPE) value of blood meal (1.3) indicated that the protein quality of blood meal protein were inferior as compared to fish meal (1.64) and blood meal cannot be used as a sole source of protein in rations. When possible utilization of blood meal in poultry ration was attempted, it was found that fifty percent replacement of fish meal nitrogen could be replaced by blood meal nitrogen without effecting growth. There was growth depression when seventy five percent replacement of fish meal nitrogen replaced by blood meal nitrogen. Reduced feed cost, increase in net profit per bird were observed when incorporation of blood meal at a desired level was done in poultry rations.

Studies on Utilization of Slaughterhouse By-products of Goats in Bareilly. V. Esakkimuthu Dr. V. Lakshmanan M. V. Sc. Thesis, Nov.-1998 Chairman

A pragmatic field study was undertaken at the local sheep and goat slaughterhouse and related establishments to collect firsthand information on yields of by-products and methods of utilization of edible and inedible offals of nondescript market slaughter goats. Offal meats and goat casings were evaluated for some quality parameters.

The overall mean slaughter weight and carcass yield were 19.27 kg and 49.69% respectively. The yields of blood, head, forefeet, hindfeet, skin, pluck, intestinal tract, omental fat, R&R (full and empty) and O&A (full and empty) were 0.71, 1.27, 0.29, 0.21, 1.34, 0.97, 1.27, 0.37, 2.64, 0.49, 0.40 and 0.25 kg respectively. Sex had significant effect on percent yields of blood and forefeet, age on pluck and omental fat, size on head, skin, pluck, forefeet and O&A (empty) and conformation on carcass and all the byproducts except blood and feet. Indigenous techniques, for deboning of heads and preparation of casings and musical drums from small intestines and skins respectively, were vividly documented. The yield of head meat was 58.16%. The mean weight, length and width of goat skins 1.35 kg, 95.04 and 30.81 cm respectively. The mean measurement recorded on finished product of skins used as musical drums were: weight -267 g, length-90.83cm and width-69.11 cm.

The survey on profile of offal meats consumers showed that they primarily belonged to socially, economically and educationally backward communities. Head, feet and pluck are consumed by all, whereas only 75% use GI tract. Fry, soup and curries prepared from brain, feet and other offals respectively. The charring of head and feet for removal of hair and cleaning of GI tract are very time consuming and laborious tasks. Labour community are the major customers for offal meat products vendors.

Among offal meats, R&R and intestines had higher content, liver highest protein, tongue highest fat and calorific value. All were lower in WHC than skeletal meat. The counts for mesophiles, coliforms and staphylococci in goat casings were 4.09, 2.63 and 4.32 log₁₀ cfu/g respectively. Salmonella and aeromonas were absent.

Utilization of Collagen Isolated from Skin for Production of Low-fat Sausages

Vedamuthy C. B. Dr. V. Kesavarao M. V. Sc. Thesis, Dec.-1998 Chairman

A large amount of skin trimmings covering head and legs from slaughtered animals are not properly utilized by slaughter houses in India and thrown away as waste. However, they can be utilized for isolation of food grade collagen. Such processing of an otherwise useless byproduct would mean additional gains to livestock owners, besides minimizing the present study was proposed to utilize collagen isolated from goat skin trimmings in the formulations of low-fat chevon sausages and to study its possible beneficial effects on physic-chemical properties and shelf life of these sausages during refrigerated storage.

Incorporation of collagen hydrolyzate at different levels (0,5,10 and 15%) significantly decreased the emulsion stability, increased the cooking loss and decreased the shear force value. However, the sausages with 5 and 10% did not differ significantly from controls with respect to emulsion stability and shear force. There was an increase in pH and FAA value upon increase in the levels of incorporation of collagen hydrolyzate. When the sausages were subjected to sensory evaluation, the sausages with 10% collagen hydrolyzate were rated significantly better for flavor, juiciness, texture and overall acceptability. Incidentally, studies under SEM revealed an improved product structure at 10% collagen level. Cost of production was brought down by Rs. 4.57/ Kg. Sausages.

Storage studies of sausages under refrigeration ($4\pm 1^{\circ}\text{C}$) over a period of 20 days showed an increase in levels of TVN, FAA, tyrosine value, standard plate count psychrotrophic plate count and a decrease in pH values. However, all the values were far below the threshold values for spoilage. The TBA values increased upon storage up-to 15th day and then decreased on 20th day. Utilization of collagen isolated from skin trimmings in meat products, would be not only from an economical and qualitative standpoint, but also from a eco-friendly perspective, since it would contribute to reducing the environmental pollution problem.

Quality Characteristics and Utilization of Rumen Meats from Goat Sheep, and Buffalo.

B.R. Parivell Dr. V. Lakshmanan M. V. Sc. Thesis, Aug.-1999 Chairman

Rumen meat, otherwise known as “tripe” and colloquially called as “butt” is one of the important edible offals of ruminants, from yield point. The present study, comprising field investigations and laboratory studies, was undertaken to generate baseline information on handling and utilization and quality characteristics of this valuable material.

Rumen & reticulum and rumen muscular coat constitute tripe in small ruminants and buffaloes, respectively. Separation of muscular and mucous coats of buffalo rumen is a highly arduous and dexterous job. Mean yield of trips for sheep and buffaloes were 0.59 and 5.45 Kg, respectively. Sheep and goat tripes are scalded and cooked in ample water into “tripe-curry” Buffalo tripes are deodorized and shallow fried in a limited quantity of oil into “tripe-fry”. It is excellent in taste and has no trace of unpleasant odour of raw material. Based on practical experience from many scalding trails of small ruminant tripes, the “degree of ease” for separation of mucous membrane and the “efficiency of scalding” were subjectively placed under 7 and 6 scales, respectively. An “optimum scalding specification” (60°C for 120 sec.) was developed. Functional properties of optimum scalded tripes were comparatively higher than traditionally scalded (97°C for 15 sec) tripes.

Quality characteristics and microbial profile of rumen meats (RMs) of sheep, goat and buffalo were compared with skeletal meats (SMs) of respective species. RMs has significantly higher moisture and fat and lower protein and ash contents than SMs, pH and WHC of RMs were significantly higher collagen content and lower collagen solubility than SMs. The y also had significantly higher microbial load. While salmonella was absent in SMs, one sample of rumen meat (buffalo) was positive.

Evaluation of shelf life of RMs at ambient temperature was made by sensory evaluation at hourly intervals. Sheep and goat tripes were acceptable up-to 4 hrs and buffalo tripe, up-to 7 hrs. Storage studies at refrigeration temperature was conducted by sensory evaluation, physico-chemical characteristics and microbial load. TBA number pattern of buffalo tripe indicated higher susceptibility to oxidative deterioration than sheep and goat tripes. Significant increase in microbial load and decrease in ERV values were observed with increasing storage period. Sheep and goat tripes were acceptable up-to 5 days and buffalo tripe, up-to 3 days.

The cost of Food Animal is Higher than the Sale value of its Meat. Testing the Hypothesis for Sheep and Goat.

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2.01 Standardization of protocol for preparation of buffalo lung and liver powder

R. J. ZENDE AND D. M. CHAVHAN

Department of VPH, Bombay Veterinary College, Parel, Mumbai

The pet foods are manufactured using inferior quality/low priced carcass parts, bones and organs such as intestines, kidneys, liver, lungs, udders, spleen, and stomach. A total of 30 samples, 15 samples each of raw buffalo lung and liver were collected in a sterile plastic bag from local slaughterhouses and stored at -18°C till further use. The frozen buffalo liver was cleaned, trimmed and washed with clean potable water and small cubes of suitable size (½ cm to 1cm) were made. The cubes were pressure cooked, drained, semidried in a hot air oven and milled with a domestic food processor and kept in hot air oven for complete drying. The granular dried powder was again milled to obtain the fine liver powder. On an average 272.7 gm/kg of grayish brown coloured fine liver powder was obtained from buffalo liver. The buffalo lung was processed to make lung powder in similar way except cooking procedure. On an average 202.99 gm/kg of reddish brown colored fine lung powder was obtained from buffalo lung. Further these powder samples were subjected to microbiological analysis and study revealed that average TVC of raw lung and liver powder observed were 4.14×10^2 and 4.48×10^2 cfu/gm, respectively. However, none of the sample was found to be positive for *E. coli*, *Salmonella* spp., *Staph. aureus* and *B. cereus* in all the lung and liver powder samples. Thus, the study concluded that the average yield of buffalo liver powder was higher as compared to the buffalo lung powder.

**2.06 Studies on certain quality attributes and cost of production of
pork blood sausage**
SADHANA CHOWDHURY¹, M. HAZARIKA¹, D.R. NATH¹
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A study was conducted to develop a pork blood sausage by incorporating whole blood and to find out the best formulation of the sausage products based on microbial and sensory qualities. Four formulations were developed with 10% (A), 15% (B) and 20% (C) incorporation of whole blood and compared with the control sample (Ct) prepared with 55% lean pork, 10% lard, 5% diced pork fat, 10% rice flour, 2.5% skim milk powder, 4% spice mix, 1.5% salt, 5% ice, 4% soya and 3% egg. The ingredients were blended and stuffed into natural goat casings and cooked in hot water at 82°C core temperature for 30 minutes. The products were subjected to microbial and sensory tests. The shelf life study was assessed by storing the products at room (25±5°C) and chilling (4±1°C) temperature. The mean log total bacterial loads were significantly higher ($P < 0.01$) in sample C followed by B, A and Ct both at room and refrigerated temperature. Sensory evaluation revealed that product with 10% blood (A) was highly preferred by the panelists followed by B, C and Ct. The products could be stored maximum for 12 hours at room temperature and for 6 days at chilling temperature. Considering the cost of all ingredients and the processing cost, the cost of production/kg were found to be about Rs.270.00 for control, Rs.260.00 for 10% blood, Rs.253.00 for 15% blood and Rs. 246.00 for 20% blood incorporated sausages. From the above study, it can be concluded that slaughter house blood which is a neglected by-product can successfully be utilized for developing safe pork blood sausage economically by replacing lean pork. Preference of consumers revealed that the product could be exploited commercially in North Eastern Region of India where blood consumption is not a taboo.

2.08 A study on microbial, sensory quality and shelf-life of pork blood sausage and cost of production

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2.10 Preparation of extruded pet food using rendered spent chicken carcass meal

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Pet foods for grower and adult were prepared by pallet process incorporating dry rendered Spent chicken meal (SCM) as a total replacement of protein requirement of the pet dogs, pet foods packed in LDPE bags and stored at ambient temperature ($35\pm 2^{\circ}\text{C}$) up to 90 days. The colour of the pet foods was uniformly brown with pleasant meaty odour. The thiobarbituric acid (TBA), tyrosine values, free fatty acid content and acid value and total bacterial counts increased gradually during storage but *E. coli*, *Salmonella spp*, *Clostridium spp*, *Staphylococci spp* and fungi were not detected during storage. The pet owners rated the pet foods as good. The body weight of the pet dogs did not decrease during the feeding trial of one month and the health condition of pets was good. The digestibility of the grower and adult pet food was 72.64 and 69.06 percent, respectively. The cost of production of pet food for grower and adult was Rs.31.30 /kg and Rs.26.2 / kg, respectively. The results indicated that a pet food (whole meal) with good nutritive quality and palatability to grower and adult dogs can be prepared by incorporating spent chicken meal which can be stored up to 90 days at ambient temperature.

2.13 Development of snack (*Murukku*) by incorporation of chicken skin
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In India large amount of chicken skin is available as byproduct with the increase in the poultry production and processing activities. Chicken skin is less preferred due to high fat content and aesthetic reasons. Therefore, it can be tried to use in the development of cost effective convenient chicken food products. Utilization of byproducts would mean additional gain, besides minimizing the environmental pollution from meat industry. Hence, the present study was proposed to utilize chicken skin in the development of *murukku* and to study its possible effects on the quality of the products during room temperature storage. Incorporation of raw chicken skin at different levels (0, 10, 20, 30%), revealed that cooking yield, pH, water solubility index were not affected but, moisture, hydratability, water absorption index decreased significantly ($P < 0.01$) and whereas protein, fat and ash content increased significantly ($P < 0.01$) as the level of incorporation of raw chicken skin increased. Sensory evaluation scores showed that, products up to 10% raw chicken skin incorporation were highly acceptable. Incorporation of chicken skin powder at different levels (0, 2.5, 5, 7.5 %) did not show any changes in water solubility index. Ash content, pH were not affected but cooking yield, moisture, hydratability, water absorption index decreased significantly ($P < 0.01$) and protein, fat content significantly ($P < 0.01$) increased as the incorporation of chicken skin powder levels increased in the product. Sensory evaluation results revealed that, the products up to 7.5% chicken skin powder incorporation were rated moderately to highly desirable for appearance, flavour, texture crispiness, acceptability. Utilization of chicken skin in *murukku* would not only be economical for poultry industry, but also eco friendly, since it would contribute in reducing the environmental pollution.

2.21 Abattoir material: a source of regenerative medicine

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Stem cells are believed to revolutionize the way medicine is practiced in the near future. Antibiotics and drugs may soon be replaced by cell-based therapies. Extensive research is ongoing to realize their clinical potential. Embryonic stem cells are believed to be highly versatile and possess

precious commodity and are source material used in regenerative medicine. In vitro maturation and in vitro fertilization of oocytes obtained slaughtered buffalo ovaries have recently provided a practical means for producing large number of bovine zygotes at low cost for research and commercial settings. Application of this assisted reproduction technology in buffalo will not only improve productive and reproductive potential but will also help rescue the precious germ plasm going to waste by indiscriminate slaughter of this animal. In the present study we have used buffalo ovaries and testis obtained from the abattoir to establish sophisticated procedures of in vitro maturation, in vitro fertilization of eggs, and embryo culture. To optimize in vitro embryo production of buffalo, study was designed with an objectives (1) to compare the oocyte maturation rates in media containing buffalo estrus serum and foetal bovine serum; (2) to compare the embryonic development of presumed zygotes by co-culturing with and without cumulus cells in the media. Immature oocytes were graded on the basis of cumulus expansion and grade A & B oocytes were matured in TCM 199 supplemented with hormones and growth factors divided in two groups. Twenty-four hours post in vitro oocyte maturation in the medium (TCM-199+ 5µg FSH+ 1µg 17β- estradiol + Gentamicin, 50µg/ml + 0.8mM sodium pyruvate + 5 per cent follicular fluid) supplemented with 10% FBS and 10% EBS, MII stage oocytes were 55.91 and 62.11 per cent, respectively. Total 108 in vitro matured oocytes were fertilized with capacitated spermatozoa and were divided into two groups 1) 54 zygotes cultured in mCR2 medium with cumulus cells and 2) 54 zygotes cultured in mCR2 medium without cumulus cells. In Ist group a total of 29 (53.70 per cent) zygotes were cleaved, 9 (16.67 per cent) zygotes were reached upto morula stage of embryo and 16 (29.63 per cent) zygotes were arrested at different stages of embryonic development, where as in IInd group total 31 (57.41 per cent) zygotes were cleaved, 10 (18.52 per cent) were reached upto morula stage and 13 (24.07 per cent) zygotes were arrested at different embryonic stages of development. Results in the present study upto morula stage of embryonic development are satisfactory and showing marked differences in the both the groups. *In-vitro* maturation, fertilization and embryo culture procedures on oocytes obtained from abattoir ovaries (inedible part of carcass) has created resource material to develop blastocyst as source of embryonic stem cells used in regenerative medicine in near future.

EFFECT OF BLADE TENDERIZATION ON

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CHARACTERISTICS OF BUFFALO TRIPE

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Buffalo rumen meat or tripe is one of the important edible offals of buffaloes with substantial yield of 4.36 to 5.43 kg per animal. Development of value added products from buffalo tripe is very limited because of its inherent toughness due to high collagen content. It is essential to develop technologies for elimination of its toughness by suitable method. In this perspective, a study was conducted to standardize the method for mechanical blade tenderization (BT) on buffalo tripe. Buffalo tripe chunks were blade tenderized for 0, 2, 3 and 4 times through mechanical blade tenderizer. The results of physico-chemical parameters like pH, water holding capacity, cooking loss and drip loss were found to be significantly increased with increasing number of passes through blade tenderizer with mean values of 7.22 to 7.67, 33.12 to 39.25%, 31.73 to 41.62% and 0.42 to 1.57%, respectively. However, the shear force value and fragmentation index values were decreased significantly with increasing number of BT with corresponding values of 4.32 to 3.24 kg/cm³ and 813.00 to 783.75, respectively. The scores for sensory attributes of tripe products were rated highest for 3 times blade tenderized samples, except tenderness scores, which showed increased scores with increasing number of BT. The differences in shear force value and tenderness scores between 3 times and 4 times blade tenderized samples were non-significant. Thus, from these results, it can be concluded that 3 times blade tenderization was found to be optimum for tenderization of buffalo tripe and for preparation of tripe products.

BP-2

EFFECT OF AR-HAR DAL FLOUR AS THICKENER ON THE QUALITY OF SHANK - WHEY SOUP

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An experiment was conducted to study the effect of Ar-har dal flour as a thickener on quality of shank - whey soup. It involved pressure cooking of shanks along with whey at 15 psi pressure for 30min. followed by filtration to get bone extract. The yield of extract was found 70%. The shank-whey soup was prepared using ingredients viz. spice mix, condiment mixture, common salt, monosodium glutamate (MSG) @ 0.2%, 2.0, 1.0, and 0.1% W/V of bone extract. The mixture was cooked for 1.5 to 2 minute over flame to get the shank-whey soup. Incorporating Ar-har dal flour as thickner at 2% w/v of shank-whey soup improved the over all sensory attributes of the product along with improved nutritive value and found optimum. Increase in level of Arhar dal flour (at 3% w/v level) linearly increased the consistency of soup but decreased the scores for other sensory attributes of the product viz. colour & appearance, flavour, meat flavour intensity and over all palatability and did not have significant effect on pH &titratable acidity of the soup. The improvement in quality of soup by incorporation of Ar-har dal flour would indirectly benefit both poultry and dairy industry.

BP-3

CHANGES IN PHYSICO-CHEMICAL QUALITY OF SHANK-
WHEY SOUP THICKENED WITH AR-HAR DAL FLOUR
DURING STORAGE AT $4\pm 1^{\circ}\text{C}$ IN POLYETHYLENE
POUCHES

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Soup is a liquid food made by cooking vegetable, meat etc. together in a stock or water. Soups are popular because of their nutritive values, palatability, easy digestibility, low cost and simple techniques involved in their preparation. Therefore, an attempt was made to prepare the shank-whey soup using ingredients viz. spice mix, condiment mixture, common

salt, monosodium glutamate (MSG) @ 0.2%, 2.0, 1.0, and 0.1% w/v of shank bone extract. The mixture was cooked for 1.5 to 2 minute over flame to get the shank-whey soup (C). Soup was thickened with Ar-har dal flour at 2% w/v level (T). Both products were stored at $4\pm 1^{\circ}\text{C}$ in polyethylene pouches to assess the changes in physico-chemical quality at regular interval of 0, 3 and 6 days up to spoilage. The shelf life of products (both control and treated) was 6 days at refrigerated ($4 \pm 1^{\circ}\text{C}$) storage. During storage the pH and lactose content of control and treated products decreased, whereas, titratable acidity, total solid content, protein content increased during storage. The estimated ash content and ether extract content remain unchanged during storage periods. The TBA value both variant of soups(control and treated) increased up to day 3 and later decreased on day 6. The soup containing Ar-har dal had comparatively higher pH, total solid content, protein content, and lower titratable acidity, lactose content & TBA value during entire storage period. The change observed in pH, titratable acidity and TBA value were well within the consumption range of the products.

BP-4

CHANGES IN SENSORY QUALITY OF SHANK-WHEY
SOUP THICKENED WITH AR-HAR DAL FLOUR DURING
STORAGE
AT 4 ± 1 °C IN POLYETHYLENE POUCHES

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Meat and bone broth have been used extensively in the preparation of soups. Soup made from skimmed bone broth is considered as an important convalescent food. Chicken meat is widely used for making a variety of soups such as chicken corn soup, yang soup, chicken peanut soup etc. The shank-whey soup was prepared using ingredients viz. spice mix, condiment mixture, common salt, monosodium glutamate (MSG) @ 0.2%, 2.0, 1.0, and 0.1% w/v of shank bone extract. The mixture was cooked for 1.5 to 2 minute over flame to get the shank-whey soup (C). Soup was thickened with Ar-har dal flour at 2% w/v level (T). Both products were stored at 4 ± 1 °C in polyethylene pouches to assess the changes in sensory quality at regular interval of 0, 3 and 6 days up to spoilage. The shelf life of products (both control and treated) was 6 days at refrigerated (4 ± 1 °C) storage. Later on the 7th day the products got spoiled. The scores for sensory attributes of the products viz., color and appearance, flavour, consistency, meat flavour intensity and overall palatability decreased

at each interval of 0, 3 and 6 days. The treatment (Ar-har dal) had comparatively higher scores for flavour, consistency and overall palatability whereas, scores for colour and appearance remain unchanged during entire storage periods. The control was rated higher for meat flavour intensity on day 3 and 6. The sensory scores of the products (control and treated) are well within the consumption range of products up to day 6.

BP-5

DRY RENDERING OF DEAD LAYER CHICKENS

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Proper disposal of dead birds is necessary to reduce environmental pollution and spread of disease. Studies were conducted on the processing of dead birds by dry rendering method in the carcass and by products utilization plant established in the department. Dead birds received from the Avian Disease Laboratory, Namakkal were stored in the deep freezer at -20°C. On the day of trial the birds were subjected to pre-breaking and the processed in the dry rendering cooker through three steps as cooking (100°C for 20 minutes), sterilization (140°C for 20 minutes at 3 bars pressure) and drying (100°C for 40-60 minutes). The cooked material was centrifuged for 20 minutes for fat separation and the defatted material was then dried on the cooling platform for 2 days. It was then ground in the hammer mill and stored in the gunny bags. Eleven trials were conducted. The average yield of the poultry carcass meal was 35.6% and that of fat was 2.31%. The proximate composition of the carcass meal revealed a mean moisture of 8.5%, crude protein of 60.9%; crude fibre 0.54%, ether extract 10.7%, sand and silica 0.71%, total ash 13.16%, and salt 0.53%. The mean calcium and phosphorus were 3.63% and 2.15%, respectively. The microbial analyses revealed absence of pathogens like Salmonella, E.coli and Clostridium. The odour of poultry carcass meal was pleasant and no off odour (rancid) was observed even after 6 months of storage at room temperature. The end products carcass meal can be used as fertilizer for horticulture and floriculture while technical fat can be used for making washing soaps and candles.

BP-6

UTILIZATION OF PROTEOLYTIC EXTRACT FROM CARICA PAPAYA FOR THE PREPARATION OF CHITIN FROM SHRIMP SHELL WASTE

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Shrimp shell waste is an important source of chitin and chitosan which have many applications in industry such as sizing of stabilising and thickening agents, rayon, cotton, synthetic fibres, wool, paper, cellophane, as adhesives, and in pharmaceuticals and cosmetics etc. Current research has focused on ways to extract chitin from the shrimp shell waste. In this experiment, the effect of adding proteolytic extract from *Carica papaya* on the degree of hydrolysis of shrimp waste protein was investigated. The quality of the chitin was compared with that produced by conventional chemical method.

BP-7

UTILIZATION OF TANNERY FLESHINGS : STANDARDIZATION OF DE-LIMING PROCESS AND EVALUATION OF DIFFERENT LACTIC CULTURES FOR FERMENTATION OF DELIMED FLESHINGS

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Leather industry generates considerable amount of wastes in the form of fleshings, during processing of leather, creating a solid waste disposal problem. De-liming the tannery fleshings becomes essential before they are utilized for any purpose. These fleshings contain considerable amount of proteins that are not utilized at present. Thus, an attempt was made to standardize a acid based process for de-liming the tannery fleshings without generation of hydrogen sulfide. It was observed that washing the leather waste twice with 1:10 (w/v) water containing 1.0 % H₂O₂, followed by washing the waste twice (each treatment lasting 90') with 0.2 N HCl (1:10 w/v) containing 0.1% H₂O₂ reduced the pH from 12.1 to 6.28.

As

the pH of the de-limed material is suitable for bacterial action, fermentation ensilaging was evaluated as a method for preservation for further utilization. Different lactic acid bacteria (LAB) were evaluated for their efficiency in reducing the pH to a level where the material could be preserved. Among the LAB cultures tested, *Pediococcus acidolactici* isolated from ragi was found to be the most efficient in reducing the pH of the de-limed fleshing.
