

## Research Article

# QUALITY AND SHELF LIFE EVALUATION OF NUGGETS PREPARED FROM SPENT DUCK AND SPENT HEN MEAT

Rajesh Kumar<sup>1</sup> \*, S. Biswas<sup>2</sup>, V. Singh<sup>3</sup>, M. Ram<sup>4</sup>

**ABSTRACT:** A study was conducted to compare the quality of nuggets prepared from spent hen and duck meat. The cooked nuggets were analyzed for pH, thiobarbituric acid (TBA), tyrosine value (TV), moisture, fat, protein, total plate count (TPC) and sensory evaluations. Nuggets prepared from spent hen meat showed significantly higher ( $p<0.05$ ) moisture content however pH, fat and protein content were significantly higher ( $p<0.05$ ) in duck nuggets. TBA values, TVs and (TPC) were highest in duck nuggets but were within the acceptable level up to 7<sup>th</sup> day of refrigerated storage ( $4\pm 1^{\circ}\text{C}$ ) in both types of nuggets. Both nuggets maintain their sensory quality up to 7<sup>th</sup> day of refrigeration storage but spent hen nuggets were preferred by consumers compared to nuggets prepared from spent duck meat. Result of the study indicated that, despite the comparative differences among these nuggets, spent duck and hen meat could be used for preparation of nutritionally rich and acceptable nuggets.

**Key words:** Physico-chemical properties, Nuggets, Spent duck meat, Spent hen meat.

## INTRODUCTION

Demand and acceptability of a meat product depends on some basic parameters like palatability, juiciness, tenderness etc. Meat from spent duck and hen has not been consumed frequently by the consumers because of its dryness, less juiciness and higher toughness due to high collagen content (Abe *et al.*, 1996). This has caused a large environmental pollution and high disposal cost for carcass burning or burying. India has a large population and has a great demand for animal products that too the

cheaper products, so that the poor section of society can get adequate nutrients. Meat consumers and processors can benefit from the development of efficient and economical technology for processing undervalued meat such as spent birds meat into value added meat product like sausage, nuggets, patties, cutlet etc. that are palatable and reasonable in cost. The processed meat products like nuggets are gaining importance in the consumer market as this could find increasing popularity in food service industry particularly at fast food outlets.

<sup>1</sup>Dept. of Livestock Products Technology, Ranchi Veterinary Colloge, Kanke,, India.

<sup>2</sup>Dept. of Livestock Products Technology, West Bengal University of Animal & Fishery Sciences, Kolkata-700037, India.

<sup>3</sup>Division of Veterinary Pharmacology & Toxicology, Indain Veterinary Research Institute, Bareilly, U.P, India.

<sup>4</sup>Dept. of Veterinary Pharmacology & Toxicology, Ranchi Veterinary Colloge, Kanke,, India.

\*Corresponding author. e - mail: lucky.26mailme@gmail.com

Thus, with a view to assess the quality and acceptability of nuggets prepared from spent hen and duck the present study was conducted to compare the quality and acceptability of nuggets prepared from spent hen and spent duck in terms of physicochemical, proximate composition, microbiological and sensory qualities.

## MATERIALS AND METHODS

Spent hens and ducks were obtained from local market. For each trial, five birds were taken and such nine trials were carried out. The work was designed to prepare nuggets using meat from breast, thigh and drumstick of birds from each group. Slaughter and dressing was performed as per the standard procedure. After chilling overnight, the carcasses were hand-deboned and the meat was kept in freezer (-18°C) until further use.

Two types of nuggets, *viz.* nuggets from spent hen and spent duck meat, were prepared. After adequate thawing, the meat was weighed, cut into small chunks and minced in a meat mincer (10 mm plate). Recipe for preparation of 1 kg nuggets batter included: minced meat 690g, skin fat 70 g, ice flakes 45 g, salt 15 g, sugar 10 g, Sodium tripolyphosphate (STPP) 2.0 g, sodium nitrate and sodium nitrite 0.1 g each, condiments 60 g, spice mix 20 g, egg yolk 14 g, soya powder 26 g and refined wheat flour 50 g.

Nuggets emulsion was prepared in a bowl chopper. The emulsion was stuffed in specially prepared a steel box having size (14 x 7 x 3 cm) so as to get proper shape. The lid was fixed so as to make air tight. The moulds containing emulsion was kept in a steam cooker and cooked for 35 min without pressure. The temperature of loaves was maintained at 75±2°C. Cooked loaf was cooled at room temperature and cut into 4 x 1.5 x 1.5 cm sized nuggets which were

subsequently packed in polyethylene pouches. The samples were immediately subjected to sensory evaluation and physico-chemical analysis. Chicken nuggets were prepared from emulsion according to the method of (Nag 1994) with slight modification as shown in flow chart. Cooked nuggets samples were packed in polyethylene bags and stored in refrigerator (4±1°C) for study at 0<sup>th</sup>, 3<sup>rd</sup>, 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> day of storage period and were analyzed.

Nuggets prepared from spent hen and spent duck carcasses were analyzed for pH, moisture, protein, fat, total plate count (TPC) thiobarbituric acid (TBA) values and tyrosine value (TV). All these parameters of cooked sausages were studied on 0<sup>th</sup>, 3<sup>rd</sup>, 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> day of refrigerated storage. The pH of cooked nuggets was determined (Trout *et al.*, 1992) by digital pH meter (Systronics, Model 335). The moisture, protein and fat contents of nuggets were determined by the methods of AOAC (1995). TBA value was determined by following the method of Strange *et al.* (1977) and was expressed as milligram of malonaldehyde per 1000g of sample. Tyrosine value was calculated by referring to the standard curve prepared as per the procedure of Pearson (1968) and expressed as milligrams of tyrosine per 100g of sample. Data was analyzed by statistical method of one way ANOVA using SPSS version 20.

## RESULTS AND DISCUSSION

The mean values of quality characteristics of cooked nuggets prepared using meat from spent hen and spent duck has been tabulated (Table 1). The pH during storage revealed an increasing trend irrespective of the type of meat. It was evident that spent hen nuggets showed a significant ( $p<0.05$ ) change in pH at 14<sup>th</sup> day of storage while in duck nuggets on the 7<sup>th</sup> day

of storage. Between the groups, pH showed a significant variation up to 3<sup>rd</sup> of storage after that non-significant increase in pH throughout the storage periods. It was higher for duck meat nuggets as compared to chicken nuggets. The present finding is in accordance with the reports of Brahma *et al.* (1984) who also stated that the pH of duck meat nuggets was significantly higher than that of chicken nuggets that might be due to variation in glycogen reserves and quantity and quality of glycolytic enzymes in these two species.

The TBA value showed a non significant ( $p < 0.05$ ) change in spent hen nuggets up to 14<sup>th</sup> day of storage while there was a significant increase on 21<sup>st</sup> day storage time. In case of spent duck nuggets the TBA value varied significantly at 3<sup>rd</sup> day of storage after that increased non-significantly increased throughout the storage. Between the groups, the TBA value of both types of nuggets showed a significant difference on 3<sup>rd</sup> and 21<sup>st</sup> day of storage as well as duck nuggets was showed higher TBA value as compared to spent hen. This was in conformity with the findings of Rao and Reddy (2000) who also reported a higher value of TBA in duck nuggets which was due to higher percentage of fat in the duck meat compared to chicken meat and higher amount of fat was responsible for more lipid oxidation. It was evident that chicken nuggets prepared from spent hen had better keeping quality. But the TBA values in the present study never exceeded the values expected to produce detectable off odours or flavour as TBA values of 0.6-2.0 mg / kg are indicative of rancidity (Greene and Cumuze 1982).

The results revealed a significant ( $p < 0.05$ ) increase in Tyrosine values (TV) in both the meat products with increase in storage period at refrigerated temperature from 7<sup>th</sup> day of

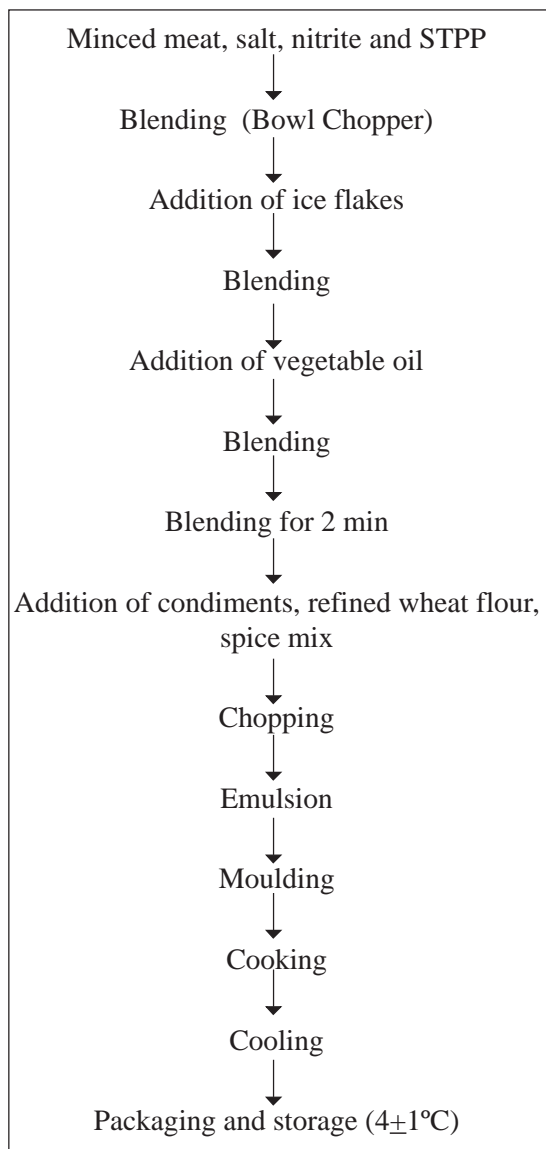
storage. Between the groups, the spent hen nuggets showed a significant increase of TV from 7<sup>th</sup> day onwards as compared to duck nuggets. Eyas (2001) also found that the tyrosine value of enrobed buffalo meat cutlet increased on 10<sup>th</sup> day as compared to the 0<sup>th</sup> day storage at refrigerated temperature. He further stated tyrosine as an indicator of proteolysis and protein degradation.

The TPC content of spent hen and duck nuggets increased significantly throughout the storage period while in case of spent duck nuggets microbial load was higher than that in spent hen. This increase in TPC of duck nuggets with increase in storage period may be due to multiplication of microorganisms during storage (Bawa *et al.*, 1988). The values observed in this experiment were far below the incipient spoilage level of log 6.70/g as indicated by Vonholly and Holzaptel (1991).

The mean values of proximate composition of cooked nuggets prepared using meat from spent hen and spent duck has been tabulated (Table 2). It was evident that the hen meat nuggets showed a significant decrease in moisture percent on 7<sup>th</sup> day of storage after which increased insignificantly, while duck meat nugget moisture increased significantly on 7<sup>th</sup> day of storage there after increased non-significantly. Between the groups, nuggets prepared from spent hen meat showed significantly higher moisture percentage throughout the storage period. Moisture content of nuggets prepared from spent hen was higher than that of nuggets prepared from spent duck because of difference between chicken and duck meat in their chemical composition (Sharma 1999).

The protein content of spent hen and duck nuggets decreased throughout the storage period. A significant decrease was observed on

**Flow chart for the preparation of chicken nuggets:**



the 14<sup>th</sup> day and onward of storage in spent hen nuggets while in case of duck nuggets protein content decreased significantly on 7<sup>th</sup> day of storage after that decreased non-significantly. Between groups, protein content varied non-

significantly but spent duck nuggets showed higher protein value than spent hen meat sausage. The decrease in protein contents of nuggets may be due to increase in no. of microbes with storage period which utilizes the protein content of the products. Protein content of all these nuggets were within the permissible limit of BIS (1992), which specifies that the minimum protein content of nuggets should be 14%.

The fat percentage of spent hen and spent duck nuggets decreased non-significantly up to 14<sup>th</sup> day of storage after that decreased significantly. Between groups, fat content varied significantly throughout the storage. The fat content of nuggets prepared from duck carcass showed significantly higher value than that of spent hen because of higher fat content in duck meat as also described by Sharma (1999) But fat content of all these nuggets were within the permissible limit of BIS (1992) which specifies that the maximum fat content of sausage should be 20%. This result was in conformity with the report of Lingaiah and Reddy (2001) who stated that cooking caused diminution of moisture content resulting in enhanced percentage of fat in the cooked product.

The results of sensory evaluation in Table 3 shows that there were no significant difference between two types of nuggets in terms of different sensory qualities like color, flavor, juiciness, tenderness and overall acceptability. The duck nugget was better in color owing to its darker color, which was enhanced with the cooking process. Duck nuggets scored a little bit less (non-significant) value in respect of flavor probably because of its inherent ducky odor, very much characteristic of the duck meat, that could not be masked by the spices and condiments added during emulsion preparation. In case of tenderness value, although the

**Table1. Physico-chemical characteristics and total plate count (TPC) of cooked spent hen and spent duck meat sausages at different storage period.**

Parameters	Nuggetstype	0 day	3 <sup>rd</sup> day	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>st</sup> day
pH	Spent hen	5.46 ±0.01 <sup>ba</sup>	5.60 ±0.02 <sup>Ca</sup>	5.66 ±0.15 <sup>Ca</sup>	6.26 ±0.02 <sup>cB</sup>	6.08 ±0.02 <sup>bcB</sup>
	Spent duck	5.56 ±0.02 <sup>cA</sup>	5.53 ±0.02 <sup>bcA</sup>	6.05 ±0.05 <sup>cB</sup>	6.14 ±0.05 <sup>bb</sup>	6.12 ±0.04 <sup>cB</sup>
TBA	Spent hen	0.37 ±0.004 <sup>baB</sup>	0.38 ±0.004 <sup>bb</sup>	0.35 ±0.01 <sup>aA</sup>	0.36 ±0.004 <sup>aAB</sup>	0.46 ±0.01 <sup>aC</sup>
	Spent duck	0.37 ±0.01 <sup>ba</sup>	0.44 ±0.01 <sup>cB</sup>	0.47 ±0.01 <sup>bb</sup>	0.47 ±0.01 <sup>cB</sup>	0.53 ±0.01 <sup>bd</sup>
TV	Spent hen	0.22 ±0.02 <sup>aA</sup>	0.27 ±0.03 <sup>aA</sup>	0.37 ±0.03 <sup>cB</sup>	0.55 ±0.02 <sup>bc</sup>	0.55 ±0.02 <sup>aC</sup>
	Spent duck	0.22 ±0.03 <sup>aA</sup>	0.24 ±0.02 <sup>Aa</sup>	0.34 ±0.02 <sup>abB</sup>	0.48 ±0.02 <sup>aC</sup>	0.55 ±0.01 <sup>aD</sup>
TPC (cfu/gm)	Spent hen	4.62 ±0.09 <sup>aA</sup>	4.82 ±0.11 <sup>aA</sup>	4.83 ±0.13 <sup>aA</sup>	6.22 ±0.08 <sup>aB</sup>	6.35 ±0.01 <sup>Ab</sup>
	Spent duck	4.62 ±0.09 <sup>aA</sup>	4.74 ±0.07 <sup>aAB</sup>	4.94 ±0.11 <sup>aB</sup>	6.32 ±0.01 <sup>aC</sup>	6.41 ±0.03 <sup>bC</sup>

<sup>a,e</sup> Mean ± S.E. with different superscript in same column significantly differ (P < 0.05).

<sup>A-D</sup> Mean ± S.E. with different superscript in same row significantly differ (P < 0.05).

difference is non-significant, the duck meat, as it is having coarser fiber, results into less tenderness through the panelist. Spent hen nuggets prepared scored a little high value in respect of juiciness because of its finer fiber and higher moisture percentage. Thus, the overall acceptability differed non-significantly among the two types of nuggets. Storage study revealed that the values of all sensory qualities decreased significantly with the advancement of the storage period. There were no significant decrease in all these parameters up to 3<sup>rd</sup> day of storage but on 7<sup>th</sup> day they decreased significantly. Values of all these sensory

qualities decreased non-significantly from 7<sup>th</sup> day to 21<sup>st</sup> day of storage and the nuggets became unacceptable after 14<sup>th</sup> day of storage. These findings are in agreement with the findings of Reddy and Vijayalakshmi (1998). All the sensory qualities showed slightly higher values in the nuggets which is prepared from spent hen compared to spent duck but these differences were not significant.

## CONCLUSION

It was concluded that the spent duck and spent hen meat can be efficiently utilized for the preparation of nuggets with good nutritive

**Table 2. Proximate compositions of cooked sausages prepared from spent hen and spent duck meat at different storage period.**

Parameters	Nuggets type	0 day	3 <sup>rd</sup> day	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>st</sup> day
Moisture	Spent duck	59.07 ±0.46 <sup>abA</sup>	57.41 ±0.83 <sup>aA</sup>	57.87 ±0.55 <sup>aA</sup>	59.28 ±0.19 <sup>aA</sup>	57.67 ±0.80 <sup>aA</sup>
	Spent hen	64.31 ±0.20 <sup>dC</sup>	62.35 ±0.49 <sup>bAB</sup>	63.29 ±0.39 <sup>dBC</sup>	62.14 ±0.29 <sup>bcA</sup>	62.87 ±0.32 <sup>cdAB</sup>
Protein	Spent duck	17.09 ±0.31 <sup>aA</sup>	16.89 ±0.67 <sup>aA</sup>	16.64 ±0.36 <sup>bA</sup>	16.50 ±0.54 <sup>aA</sup>	16.24 ±0.29 <sup>aA</sup>
	Spent hen	16.67 ±0.23 <sup>aA</sup>	16.01 ±0.36 <sup>aAB</sup>	15.89 ±0.54 <sup>abAB</sup>	15.09 ±0.23 <sup>aA</sup>	14.99 ±0.42 <sup>aA</sup>
Fat	Spent duck	11.43 ±0.53 <sup>aB</sup>	10.68 ±0.93 <sup>aB</sup>	10.06 ±0.79 <sup>aB</sup>	10.24 ±0.67 <sup>aB</sup>	8.03 ±0.13 <sup>aA</sup>
	Spent hen	10.65 ±0.80 <sup>aA</sup>	10.71 ±0.89 <sup>aA</sup>	10.23 ±0.90 <sup>aA</sup>	9.64 ±0.95 <sup>aA</sup>	8.3 ±0.42 <sup>aA</sup>

<sup>a-e</sup> Mean ± S.E. with different superscript in same column significantly differ (P < 0.05).

<sup>A-D</sup> Mean ± S.E. with different superscript in same row significantly differ (P < 0.05).

**Table 3. Sensory evaluation of cooked sausages prepared from spent hen and spent duck meat at different storage period.**

Parameters	Nuggets type	Storage period				
		0 day	3 <sup>rd</sup> day	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>st</sup> day
Color	Spent duck	7.67±0.33 <sup>D</sup>	7.33±0.33 <sup>CD</sup>	6.33±0.33 <sup>BC</sup>	6.00±0.58 <sup>B</sup>	4.33±0.33 <sup>A</sup>
	Spent hen	7.67±0.67 <sup>B</sup>	7.67±0.33 <sup>B</sup>	7.33±0.33 <sup>B</sup>	6.33±0.33 <sup>A</sup>	5.00±0.58 <sup>A</sup>
Flavor	Spent duck	8.00±0.58 <sup>C</sup>	6.67±0.33 <sup>BC</sup>	6.67±0.33 <sup>BC</sup>	5.67±0.67 <sup>B</sup>	3.67±0.33 <sup>A</sup>
	Spent hen	7.00±0.58 <sup>BC</sup>	8.00±0.58 <sup>C</sup>	7.00±0.58 <sup>BC</sup>	5.67±0.33 <sup>AB</sup>	4.67±0.88 <sup>A</sup>
Juiciness	Spent duck	7.33±0.33 <sup>C</sup>	7.00±0.58 <sup>C</sup>	6.67±0.33 <sup>BC</sup>	5.67±0.33 <sup>B</sup>	3.33±0.33 <sup>A</sup>
	Spent hen	7.33±0.33 <sup>B</sup>	7.00±0.58 <sup>B</sup>	7.33±0.33 <sup>B</sup>	6.33±0.33 <sup>B</sup>	4.33±0.67 <sup>A</sup>
Tenderness	Spent duck	7.00±0.58 <sup>B</sup>	7.00±0.58 <sup>B</sup>	6.67±0.88 <sup>B</sup>	5.33±0.33 <sup>AB</sup>	4.00±0.58 <sup>A</sup>
	Spent hen	7.67±0.67 <sup>C</sup>	7.33±0.33 <sup>C</sup>	7.00±0.58 <sup>BC</sup>	6.00±0.00 <sup>AB</sup>	5.00±0.58 <sup>A</sup>
Acceptability	Spent duck	8.00±0.00 <sup>C</sup>	7.33±0.33 <sup>C</sup>	6.00±0.58 <sup>B</sup>	5.33±0.33 <sup>B</sup>	3.00±0.00 <sup>A</sup>
	Spent hen	7.33±0.33 <sup>B</sup>	8.00±0.58 <sup>B</sup>	7.33±0.33 <sup>B</sup>	6.00±0.00 <sup>A</sup>	5.00±0.58 <sup>A</sup>

<sup>A-D</sup> Mean ± S.E. with different superscript in same raw significantly differ at (P < 0.05).

Data with same superscript column-wise do not differ significantly (P > 0.05).

value and well acceptability. Thus, better economic return to producers can be ensured by utilizing spent duck and hen through nuggets making, obviously after establishing a good market demand.

## REFERENCES

- Abe HA, Kimura T, Yamuchi K (1996) Effects of collagen on the toughness of meat from spent laying hens. *J Jap Soc Food Sci Tech* 43 (7): 831-834.
- AOAC (1995) Official Methods of Analysis. 16<sup>th</sup> edn. Washington DC: Association of Official Analytical Chemists. 02-99.
- Bawa AS, Jindal V, Thind SS (1988) Effect of packaging and storage on the quality of chicken sausages containing soy flour. *Ind J Meat Sci Tech* 1: 79-83.
- Brahma ML, Narayana Rao PLN, Nath DR (1984) Comparative study of certain qualitative characteristics of duck and hen meat: pH, water holding capacity and palatability characteristics of meat. *Ind Vet J* 61: 978-983.
- BIS (1992) Meat and meat products- chicken sausages specification. IS 13400: 1992.
- Eyas AM (2001) Studies on development of enrobed buffalo meat cutlets. M.V.Sc. thesis, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh, India.
- Greene BA, Cumuze TH (1982) Relationship between TBA numbers and in experienced panelists assessment of oxidized flavor in cooked beef. *J Food Sci* 47: 52-58.
- Lingaiah M, Reddy P (2001) Quality of chicken meat patties containing skin and giblets. *J Food Sci Tech* 38 (4): 400-401.
- Reddy KP, Vijayalakshmi K (1998) Effect of incorporation of skin, gizzard, heart and yolk on the quality of frozen chicken meat sausages. *J Food Sci Tech* 35: 276-278.
- Nag S (1994) Effect of certain extenders on the quality attributes of chicken nuggets. M.V.Sc. thesis, Indian Veterinary Research Institute, Iaznagar, U.P.
- Pearson D (1968) Application of chemical methods for the assessment of beef quality and methods related to protein breakdown. *J Sci Food Agric* 19: 357-363.
- Rao JB, Reddy PK (2000) Influence of binders and refrigerated storage on the quality of chicken meat loaves. *Ind J Poultry Sci* 35: 302-305.
- Sharma BD (1999) Meat and Meat Products Technology. New Delhi: Jaypee Brothers.
- Strange ED, Benedict RC, Smith JL, Swift CE (1977) Evaluation of rapid test for monitoring alterations in meat quality during storage. *J Food Protection* 10: 843-847.
- Trout ES, Hunt NC, Johnson DE, Claus JR, Kastner CL, Kropf DH (1992) Chemical, physical and sensory characterization of ground beef containing 5 to 30% fat. *J Food Sci* 57: 25-29.
- Vonholy A, Holzapfel WH (1991) Proceedings of 37<sup>th</sup> International congress of Meat and Science Technology, 2: 530-566.
- \*Cite this article as:** Rajesh Kumar, Biswas S, Singh V, Ram M (2015) Quality and shelf life evaluation of nuggets prepared from spent duck and spent hen meat. *Explor Anim Med Res* 5(2): 176-182.