

# SHELF LIFE AND SENSORY QUALITY OF VALUE ADDED CARABEEF NUGGETS UNDER FREEZER STORAGE

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## ABSTRACT

*A study was conducted with the objective of assessing the microbiological and organoleptic properties of low value meat (25%) incorporated buffalo meat nuggets during frozen storage (-18°C) for a period of 180 days. Binders like Refined Wheat Flour (7%), Soy Flour (3%), Whole Egg (1%) and Liquid Whey (3%) were incorporated in treatment samples, while control was prepared with skeletal meat alone incorporating Refined Wheat Flour @ 5%. Results of the study revealed that the control nuggets had the lowest anaerobic (3.37±0.05) count (AC) and highest sensory scores for appearance (6.93±0.04) and flavour (6.74±0.05). Juiciness scores (6.44±0.05) and overall acceptability (7.18±0.54) was rated highest in RWF incorporated nuggets; while the LW incorporated nuggets had the highest tenderness scores (6.65±0.10) with lowest Total viable (3.81±0.06) count (TVC) and Yeast and Mould (4.07±0.01) count (YMC). Microbial and the organoleptic scores decreased on storage, however, vacuum packed nuggets had better scores of sensory and shelf life. It is concluded that in addition to value addition in terms of vacuum packaging, utilisation of by product of paneer (liquid whey) and utilisation of low value meat in nuggets had shelf stability in terms of microbial quality as well highest acceptability up to 180 days of frozen condition.*

**Key words:** Carabeef nuggets, microbial and organoleptic qualities, freezer storage.

Good emulsion type nuggets can be prepared by incorporating skeletal meat alone but the cost of production of nuggets will be too high. Cost effective production is possible by incorporation of low valued edible offal like heart, tongue and cheek meat along with skeletal meat. Buffalo meat can be processed into a novel, appealing, convenient and ready-to-eat nuggets, having good acceptability by addition of plant binders. Non-meat ingredients, such as flour, starch, soya protein, egg, whey protein and fat,

play a significant role in the modification of the functional properties of a meat product, such as emulsification, water- and fat-binding capacity and textural properties (Gujral *et al.*, 2002).

However, processed meat needs protection from microbiological contamination, oxidation, dehydration, discolouration and loss of aroma to maintain the quality of the product till it reaches the consumer (Mondry, 1996). This could be achieved by packaging technology which enhances

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the product appeal to the consumer and facilitates easy distribution, storage and marketing of meat products. Traditional packages can delay microbial spoilage and discolouration of the product only to a limited extent. Hence, there is a need for Indian meat industry to adopt newer packaging technologies like vacuum packaging to enhance the shelf life and sensory quality of the product. Thus, with the above facts, it has been contemplated to study the effect of packaging methods, binders and storage period on microbiological and organoleptic qualities of value added buffalo meat nuggets during frozen storage at -18°C.

### MATERIALS AND METHODS

Buffalo lean meat, cheek meat, heart meat, tongue and fat obtained from the spent buffaloes slaughtered at the Chennai Corporation Slaughterhouse, were packed in clean polyethylene bags and transported in a ice packed thermocol box to the Department of Meat Science and Technology, Madras Veterinary College, Chennai. Excess connective tissue, cartilage and bone from meat and offal were trimmed off and were chopped into pieces and stored at -20°C till usage.

Control emulsions were prepared with inclusion of skeletal meat alone and refined wheat flour (RWF) at the level of 5%. Treatment samples were prepared with the formulation consisting of 75% skeletal meat and 25% low value meat and offal meat (cheek meat, heart meat and tongue in the ratio 50:25:25) with each binders viz. Refined Wheat Flour (RWF-7 %), Soy Flour (SF-3 %), Whole Egg (WE-1 %) and Liquid Whey (LW-3 %) included as per the findings of Dushyanthan *et al* (2008). The spice mix formulation (per cent W/W) used in this study was prepared using coriander(20), anise(15), black pepper(13), red chillies(15), cumin(10), dried ginger(10), cinnamon(5), cloves(5), turmeric(5) and cardamom(2).

The basic formulation consists of meat at 90 per cent level and fat at 10 per cent level (with

5% replacement using sunflower oil). The frozen meat, offals and fat were cut into chunks of 4-6 cm thickness, weighed and minced separately using 4.5 mm plate in a meat mincer (Omas, Model No. 169789, Electrolux Food Service, Itlay). Emulsion was prepared by adding the ingredients like salt (1.5%), sodium nitrite (0.012%), sodium tri poly phosphate (0.3%), spice mix (1.8%), Onion- Garlic paste (4%) and each one binder added in sequence during the process of chopping of meat and fat in bowl chopper (Model MTK 662, Maschinen fabric, Germany). The temperature of the emulsion was maintained at 10-12°C by addition of slushed ice @ 10%. The emulsion was stuffed into a moulded box having a dimension of 25cmx10cm breadth and cooked in a temperature and time programmed cooking vat at 80°C for 30 minutes so that internal temperature of 72°C was attained in the product. The loaves were then cooled at room temperature, cut into nugget cubes of 1” and packed in sterile Pet/Poly pouches (thickness- 62µ, oxygen transmission rate - 140 to 150cc/sq. m/24 hrs/ atmosphere) under aerobic and vacuum packaging (Komet Double Chamber vacuum packaging machine) methods.

The packaged samples were stored at -18°C and analysed for microbiological parameters (TVC, AC and YMC) as per APHA, (1984) and organoleptic characteristics (Odour Scores and Taste Panel Scores) at intervals of 30 days for a period of 180 days. The experiment was replicated six times for statistical analysis and the data thus obtained were analysed as per the method out lined by Snedecor and Cochran (1994).

### RESULTS AND DISCUSSION

The mean ± SE values with ANOVA of microbiological and organoleptic characteristics for control and treatment samples stored at -18°C are presented in Tables 1 and 2. Highly significant (P<0.01) differences were noticed in TVC between the packaging methods, between binders and

between storage periods while highly significant ( $P<0.01$ ) differences were noticed between the interaction of methods and binders. Nuggets packed under vacuum, and those incorporated with LW and stored upto 180 days had the lowest TVC. Similar results were reported by Muthulakshmi *et al* (2009) and Dushyanthan *et al* (2015) in buffalo meat sausages. Regarding anaerobic count highly significant ( $P<0.01$ ) differences were noticed between the binders and between storage periods and highly significant ( $P<0.01$ ) differences were noticed between the interaction of methods and binders and between the interaction of binders and storage period. Control nuggets stored upto 180 days had the lowest anaerobic count. Regarding YMC highly significant ( $P<0.01$ ) differences were noticed between the methods, between the binders and between the storage periods. Nuggets packed under vacuum, incorporated with LW stored upto 180 days had the lowest YMC. These results were in accordance with Anand *et al.* (1991), Muthulakshmi *et al.* (2009) and Dushyanthan *et al* (2015).

The above findings clearly showed that nuggets packed under vacuum and incorporated with Liquid Whey (LW) had the lowest TVC and YMC. Marginal decrease in all the microbial parameters with increase in storage period was recorded as observed by Muthulakshmi *et al* (2009) and Dushyanthan *et al* (2015) in chicken sausages.

Highly significant ( $P<0.01$ ) differences were noticed in odour scores between packaging methods and between storage periods. Nugget packed under vacuum and those stored upto 30 days had the highest odour scores. Similar results were observed by Anand *et al.* (1991) in chicken patties, Muthulakshmi *et al.* (2009) and Dushyanthan *et al* (2015) reported decreasing odour score with increase in storage period in buffalo meat sausages. Highly significant ( $P<0.01$ ) differences were noticed in appearance scores between the packaging methods, between the

binders and between the storage periods. Control nuggets packed under vacuum and stored upto 30 days had the highest appearance scores. Highly significant ( $P<0.01$ ) differences were recorded in flavour scores between different binders and between storage periods. Control and WE incorporated nuggets and stored upto 30 days had the highest flavour scores. Highly significant ( $P<0.01$ ) differences were noticed in juiciness scores between the packaging methods and between the storage periods. Nuggets packed under vacuum and stored upto 30 days had the highest juiciness scores. Highly significant ( $P<0.01$ ) differences were observed in tenderness scores between the methods and between the storage periods. Nuggets packed under vacuum and stored upto 30 days had the highest tenderness scores. Highly significant ( $P<0.01$ ) differences were noticed in overall acceptability scores between the packaging methods, between the binders and between the storage periods. Vacuum packed nuggets; incorporated with RWF and those stored upto 30 days had the highest overall acceptability scores.

Organoleptic characteristics can assess the real quality of the as finally one decides on the odour and taste of the product primarily. In this study it can be noted that nuggets packed under vacuum had the highest organoleptic scores. The control nuggets recorded the highest odour, appearance and flavour scores. Declining trend of sensory scores with storage was recorded in the present study as observed by Nath *et al.* (1995) in chicken patties, Prabhakar Reddy *et al.* (2004) in emu meat patties and sausages, Muthulakshmi *et al.* (2009) and Dushyanthan *et al* (2015) in buffalo meat sausages. This decrease in the organoleptic scores might be due to the biochemical changes in the product i.e., break down of proteins, fat and other components (Manish Kumar and Sharma, 2003 and Kalaikannan *et al.*, 2007).

It can be concluded that nuggets packed under vacuum had maintained better

microbiological and organoleptic qualities during storage. Nuggets incorporated with LW had better microbiological characteristics whereas control nuggets had better organoleptic characteristics. The shelf life of the nuggets was safe upto 180 days under frozen condition.

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**Table - 1 Mean ( $\pm$  SE) of Microbiological and Organoleptic Characteristics of buffalo meat nuggets packed under different packaging methods, different binders incorporated and different storage periods at -18° C**

	TVC	AC	Y&MC	Odour	Appear	Flavour	Juiciness	Tenderness	Overall Accept
AP	4.27 $\pm$ 0.02	4.00 $\pm$ 0.03	4.16 $\pm$ 0.01	6.99 $\pm$ 0.03	6.44 $\pm$ 0.02	6.46 $\pm$ 0.03	5.86 $\pm$ 0.05	5.97 $\pm$ 0.06	6.31 $\pm$ 0.05
VP	4.02 $\pm$ 0.03	4.01 $\pm$ 0.03	4.09 $\pm$ 0.01	7.03 $\pm$ 0.03	6.45 $\pm$ 0.04	6.38 $\pm$ 0.03	6.09 $\pm$ 0.05	6.00 $\pm$ 0.07	6.35 $\pm$ 0.05
Control	4.03 $\pm$ 0.04	3.37 $\pm$ 0.05	4.08 $\pm$ 0.02	7.08 $\pm$ 0.05	6.93 $\pm$ 0.04	6.74 $\pm$ 0.03	5.93 $\pm$ 0.06	6.29 $\pm$ 0.17	6.34 $\pm$ 0.04
RWF	4.45 $\pm$ 0.02	4.06 $\pm$ 0.02	4.12 $\pm$ 0.01	6.92 $\pm$ 0.15	6.41 $\pm$ 0.02	6.35 $\pm$ 0.03	6.44 $\pm$ 0.05	6.30 $\pm$ 0.11	7.18 $\pm$ 0.04
WE	4.23 $\pm$ 0.02	4.29 $\pm$ 0.03	4.16 $\pm$ 0.01	7.18 $\pm$ 0.06	6.37 $\pm$ 0.05	6.33 $\pm$ 0.07	5.95 $\pm$ 0.06	5.48 $\pm$ 0.06	5.71 $\pm$ 0.05
SF	4.22 $\pm$ 0.02	4.20 $\pm$ 0.01	4.20 $\pm$ 0.01	7.09 $\pm$ 0.16	6.38 $\pm$ 0.03	6.36 $\pm$ 0.04	5.90 $\pm$ 0.09	5.21 $\pm$ 0.10	6.76 $\pm$ 0.04
LW	3.81 $\pm$ 0.06	4.11 $\pm$ 0.02	4.07 $\pm$ 0.01	6.87 $\pm$ 0.03	6.15 $\pm$ 0.04	6.31 $\pm$ 0.05	5.65 $\pm$ 0.06	6.65 $\pm$ 0.10	5.65 $\pm$ 0.06
30 Days	4.36 $\pm$ 0.03	4.21 $\pm$ 0.06	4.19 $\pm$ 0.01	7.37 $\pm$ 0.04	6.87 $\pm$ 0.05	6.94 $\pm$ 0.04	6.58 $\pm$ 0.06	6.61 $\pm$ 0.10	6.69 $\pm$ 0.07
60 Days	4.23 $\pm$ 0.04	4.12 $\pm$ 0.04	4.16 $\pm$ 0.01	7.21 $\pm$ 0.03	6.56 $\pm$ 0.05	6.58 $\pm$ 0.03	6.31 $\pm$ 0.06	6.34 $\pm$ 0.10	6.52 $\pm$ 0.08
90 Days	4.19 $\pm$ 0.04	4.03 $\pm$ 0.05	4.14 $\pm$ 0.01	7.16 $\pm$ 0.02	6.47 $\pm$ 0.05	6.43 $\pm$ 0.03	6.15 $\pm$ 0.06	6.07 $\pm$ 0.10	6.41 $\pm$ 0.08
120 Days	4.08 $\pm$ 0.05	3.90 $\pm$ 0.06	4.11 $\pm$ 0.01	7.05 $\pm$ 0.03	6.36 $\pm$ 0.04	6.33 $\pm$ 0.03	5.89 $\pm$ 0.06	5.90 $\pm$ 0.10	6.29 $\pm$ 0.09
150 Days	4.04 $\pm$ 0.05	3.90 $\pm$ 0.06	4.10 $\pm$ 0.01	6.87 $\pm$ 0.04	6.28 $\pm$ 0.04	6.18 $\pm$ 0.04	5.55 $\pm$ 0.06	5.62 $\pm$ 0.09	6.13 $\pm$ 0.10
180 Days	3.97 $\pm$ 0.05	3.88 $\pm$ 0.05	4.06 $\pm$ 0.03	6.51 $\pm$ 0.05	6.16 $\pm$ 0.05	6.04 $\pm$ 0.05	5.37 $\pm$ 0.06	5.38 $\pm$ 0.09	5.94 $\pm$ 0.10

**Table 2 Analysis of variance for Microbiological and Organoleptic Characteristics of buffalo meat nuggets packed under different packaging methods, different binders incorporated and different storage periods at -18° C**

Sources of Variance	df	Mean Sum of Squares									
		TVC	AC	YMC	Odour	Appear	Flav	Juici	Tender	OA	
Between methods	1	5.67**	0.01	0.44**	4.25**	1.41**	3.26	23.63**	40.53**	3.97**	
Between binders	4	4.14**	9.90**	0.22**	0.16	8.03**	1.81**	0.18	1.01	1.29**	
Between storage periods	5	1.19**	1.10**	0.14**	3.35**	3.44**	1.20**	0.79**	2.52**	1.01**	
Between methods X binders	4	2.52**	0.51**	0.03	0.38	1.75	0.42	4.89	0.65	0.25	
Between methods X storage periods	5	0.13	0.17	0.01	0.20	0.26	0.09	0.13	0.15	0.17	
Between binders X storage periods	20	0.16	0.16**	0.01	0.89	0.11	0.02	0.01	0.78	0.15	

\*\* - High significant (P<0.01) \* - Significant (P<0.05)