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Research Paper

Standardization and Quality Evaluation of Duck Meat Sausages

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ABSTRACT

Four trials were conducted for standardization of duck meat sausage recipe. In each trial, six desi ducks were slaughtered, dressed conventionally and chilled to an internal temperature of 4±1°C. Out of six dressed duck carcasses, three were deboned manually after partial cooking and remaining deboned without cooking. The partially cooked and raw boneless duck meats were used separately for further processing and development of an ideal recipe. The de-boned meats were minced and mixed with different levels of binders (by replacing 5% and 10% of meat with bengal gram flour (BGF) and soya bean flour (SBF) separately), other ground seasonings and condiments to obtain a uniform batter. The sausages were evaluated for cooking loss, emulsion stability, moisture, crude protein and sensory evaluation. Duck meat sausages incorporated with SBF at 10% level had significantly ($p<0.05$) lesser cooking loss, higher emulsion stability, lesser moisture content and higher crude protein content. The mean organoleptic scores were also significantly ($p<0.05$) higher in duck meat sausages with SBF at 10% level, than others. Similar observations were noted both in raw as well as partially cooked duck meat sausages. Thus, 10% level of incorporation of soya bean flour in the formulation of desi duck meat sausages was found to be optimum, hence can be effectively used to economize the formulation for the production of duck meat sausages.

Keywords : *Duck meat, Sausages, Cooking loss, Emulsion stability, Crude protein*

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INTRODUCTION

Prodigious changes are apparent in the life style and food habits of the present day individuals. As the per capita income increased, demand for processed foods in the form of convenience foods like ready-to-eat, cooked, grilled and take-away is increasing manifold. There is an increasing trend in the consumption of snack foods usually made of plant origin, which are low in nutritive value, that are to be fortified with nutritionally high quality protein such as meat, with an aim of developing low cost, high quality food products (Naveen *et al*. 2006).The deficit in protein supply can be overcome by utilizing resources hither-to unutilized. Products made from such unutilized resources prove to be economical and nutritive too. Ducks are one of such alternative avenues to meet the shortage of protein hunger. Ducks constitute 9% of total poultry population in India and it is about 17.8 million, of which 92 % are desi type (DADF 2012).

Preparation of ground or emulsion type meat products like sausages is a potential solution to achieve efficient and effective utilization of tough duck meat (Bhattacharyya *et al*. 2007). Addition of binders to the sausage batter, which are of vegetable origin, not only reduce the cost of production but also increase the protein content, palatability and nutritive values of the product(Sandroua and Arvanitoyannisa 2000; Badpa and Ahmad 2014). So, the study was carried out to standardize the formulation for desi duck meat sausage by incorporating Bengal gram flour (BGF) and soya bean flour (SBF) at various levels.

MATERIALS AND METHODS

Four trials were conducted for standardization of duck meat sausage recipe. In each trial six desi ducks were slaughtered, dressed conventionally and the carcasses were chilled to an internal temperature of 4±1°C prior to deboning. Out of the 6 ready-to-cook dressed carcasses, 3 were partially cooked in a pressure cooker at 15 lbs pressure for 5 min to facilitate easy de-boning and were manually de-boned. The remaining 3 carcasses were also deboned manually without partial cooking. The de-boned meat obtained was used for conducting trials and developing an ideal recipe. Two extenders namely Bengal gram flour and soya bean flour were added to the above collected raw and partially cooked meat separately at two different levels *viz*. 5 and 10% for each type of meat. The levels of incorporation of binders, by replacing duck meat are presented in Table 1.

The above formulations were made up to 100 parts by adding seasonings and condiments for each formulation. The levels of ingredients incorporated were shown in Table 2.

Preparation of duck meat sausages: The deboned duck meat was initially minced in a meat mincer, with a 4 mm diameter sieve. The minced meat was then thoroughly mixed with different levels of extenders, (by replacing 5 and 10% of meat

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Table 1: Levels of incorporation of binders by replacing duck meat

	Treatments							
	T1		T2		T3		T4	
Sausage ingredients(%)	Raw	Partially cooked	Raw	Partially cooked	Raw	Partially cooked	Raw	Partially cooked
Duck meat	70	70	65	65	70	70	65	65
Bengal gram flour	5	5	10	10	—	—	—	—
Soya bean flour	—	—	—	—	5	5	10	10
Vegetable fat	20	20	20	20	20	20	20	20
Total	95	95	95	95	95	95	95	95

with bengal gram flour and soya bean flour separately) and other ground seasonings and condiments, to prepare a uniform batter. After processing, each formulations were stuffed with a sausage stuffer into sheep casings of diameter 14 - 18 mm and were linked to lengths of 1 ½ - 2 inches. The sausages were cooked for 30 min, so as to attain an internal temperature of 72 ± 1°C. Cooking loss, emulsion stability and proximate principles like moisture and crude protein were studied to assess the quality as well as nutritive value of the sausages.

Table 2: Levels of incorporation of seasonings, condiments and additives in duck meat sausage formulations

S. No	Ingredients	Percentage of duck meat
1	Common salt	2
2	Onion, ginger and garlic paste (raw)	10
3	Spice mixture	2.5
4	Mono sodium glutamate	0.1
5	Sodium nitrite	0.01
6	Citric acid	0.05

Cooking loss: Cooking loss of both raw and partially cooked duck meat sausages were derived (Boles and Swan 1996) by recording the differences in pre and post cooking weights and expressed as percentage.

***Emulsion stability*:** Emulsion stability of duck meat sausages was estimated as per Mandal *et al.* (2001), by taking twenty grams of sausage batter, placed in a polythene bag and heated to 80°C for 20 min in a water bath. The cookout was drained and the cooked mass weighed to determine the weight loss and expressed as percentage.

***Proximate principles*:** The percent moisture and crude protein of duck meat sausages were estimated according to the standard techniques laid down by AOAC (1990).

***Organoleptic evaluation*:** The sausages prepared in all the four trials were cooked and subjected to sensory evaluation by a 5 member semi-trained taste panel, on a 9 point hedonic scale from 1 to 9 (1 = Extremely poor ; 9 = Excellent).

The data of results obtained from four trials with raw and partially cooked meat separately, were subjected to appropriate statistical analysis as per the conventional methods of Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The observations pertaining to percent cooking loss, emulsion stability, moisture and crude protein are presented in Table 3.

Cooking loss: The overall mean percent cooking loss of duck meat sausages were recorded comparatively lesser at 10% level of extender as compared to 5% level in the present study. This might be due to the moisture binding effect of extenders used. A significant reduction in cooking loss in restructured chicken steaks, with an increase in the level of textured soy protein from 0 to 30%, was reported by Bhoyar *et al.* (1996). Lower cooking losses may also be due to optimum absorption of moisture from the emulsion during cooking and also due to the water binding capacity of the respective flours (Reddy and Rao 1996). The lower cooking losses with addition of extenders recorded in this study corroborated well with the reports of Singh and Verma (2000) in refrigerated chicken patties with incorporation of textured soy protein and Chandralekha *et al.* (2012) in chicken meat balls added with BGF, soy flour and corn flour at different levels. The mean percent cooking loss were significantly higher ($p<0.05$) in duck meat sausages prepared with raw duck meat as compared to partially cooked duck meat. This might be due to the initial loss of moisture in partially cooked duck meat sausages. The duck meat sausages prepared by replacing both raw and partially cooked duck meat at 10% level with SBF recorded significantly lesser ($p<0.05$) mean percent cooking loss than the sausages prepared with 5% SBF, 5% and 10% BGF.

Emulsion stability: The higher emulsion stability observed in the present study is mainly due to the binding of moisture or

fat by extender added into the product. The emulsion stability of duck meat sausages incorporated with 10% SBF recorded significantly higher ($p<0.05$) value than the sausages prepared with 5% SBF, 5% and 10% BGF. This might be also due to gelation of starch, which enhances the emulsion binding of proteins (Puolanne and Puusuen 1983). These results also corroborate the findings of Reddy *et al.* (1999) in mutton sausages and Dushyanthan *et al.* (2008) in buffalo meat nuggets utilizing different binders.

Moisture: The lesser moisture content observed in the present study might be due to the low moisture content of the extender added to the product. Reduction in moisture content upon addition of extender has been demonstrated by Cosenza *et al.* (2003) in cabrito smoked sausages. The moisture content of duck meat sausages prepared with raw duck meat was significantly ($p<0.05$) higher than the moisture content of duck meat sausages prepared with partially cooked duck meat (Table 3). This is evidently due to the loss of moisture during partial cooking. The duck meat sausages prepared by replacing both raw and partially cooked duck meat at 10% level with SBF recorded significantly lesser ($p<0.05$) mean moisture content than with extenders at other levels. Similar results were reported by Yang *et al.* (2009) in duck meat sausages supplemented with cereal flours.

Table 3: Percent cooking loss, emulsion stability, moisture and crude protein (Mean ± S.E.) content of duck meat sausages incorporated with different levels of extenders

Parameters (%)	Raw meat sausages				Partially cooked meat sausages			
	Soya flour		Bengal gram flour		Soya flour		Bengal gram flour	
	5%	10%	5%	10%	5%	10%	5%	10%
Cooking loss	$29.76^{a}\pm1.1$	$24.75^{b}\pm0.9$	$32.82^{c}\pm1.2$	$27.38^{d}\pm1.0$	$25.85^{e}\pm1.0$	$21.63^{f}\pm0.9$	$28.42^{g}\pm0.9$	$23.38^{h}\pm1.1$
Emulsion stability	$85.28^{a}\pm1.0$	$93.63^{b}\pm0.9$	$76.77^{c}\pm0.8$	$84.67^{d}\pm1.4$	$88.73^{e}\pm1.3$	$95.26^{f}\pm1.0$	$81.62^{g}\pm0.9$	$89.54^{h}\pm1.3$
Moisture	$61.25^{a}\pm1.0$	$56.72^{b}\pm0.9$	$63.25^{c}\pm1.1$	$58.26^{d}\pm1.0$	$57.47^{e}\pm0.8$	$53.84^{f}\pm0.8$	$59.06^{g}\pm0.9$	$55.78^{h}\pm1.0$
Crude protein	$21.33^{a}\pm0.8$	$26.43^{b}\pm0.7$	$15.96^{c}\pm0.6$	$21.21^{d}\pm0.4$	$25.36^{e}\pm0.8$	$30.54^{f}\pm0.6$	$20.02^{g}\pm0.6$	$25.08^{h}\pm0.6$

Means bearing the same superscript for each parameter, row-wise, does not differ significantly ($p>0.05$)

Crude protein: The higher crude protein content of duck meat sausages might be due to the protein contributed by the extender added at different levels. These results were congruent with the findings of Biswas *et al.* (2011). The crude protein content of duck meat sausages prepared with partially cooked duck meat was significantly ($p<0.05$) higher than the sausages prepared with raw duck meat. This can be attributed to the presence of lesser moisture content in partially cooked sausages, which reflected in yielding comparatively higher crude protein. The mean crude protein of duck meat sausages incorporated with 10% SBF recorded significantly higher ($p<0.05$) value than the sausages with 5% SBF, 5% and 10% BGF.

Organoleptic evaluation: The mean organoleptic scores of duck meat sausages prepared with raw duck meat was significantly ($p<0.05$) higher than the sausages prepared with partially cooked duck meat (Table 4). This might be due to the loss of certain favorable organoleptic characters due to repeated heat treatment during partial cooking. It was observed that SBF in duck meat sausages had more browning on deep fat frying which might have imparted superior colour scores for sausages. This is in agreement with Chowdhury *et al.* (1994), Bhoyar *et al.* (1996) and Serdaroglu and Degirmencioglu (2004). Addition of SBF to duck meat sausages might have incorporated the flavor precursors in duck meat and these escapes during high temperature cooking to carry the flavor compounds like alcohols and esters having appreciable odor and taste. Bhoyar *et al.* (1996) and Serdaroglu *et al.* (2005) also reported similar flavor scores for their products which further strengthened the results of the present study. Significantly ($p<0.05$) higher juiciness scores were observed in duck meat sausages incorporated with SBF at 10 per cent level. This might be due to binding of more water by SBF than BGF at different levels. SBF added at 10 per cent level in duck meat sausages, had optimum water binding that made the product highly tender than BGF. The results are in confirmation with that of Reddy *et al.* (1999).

While comparing the effect of incorporation of SBF and BGF, at two different levels on the overall acceptability of duck meat sausages, it became clear that SBF at 10 per cent level had significantly ($p<0.05$) higher scores for overall acceptability. This might be due to the fact that the formulation had scored significantly ($p<0.05$) higher scores for colour, flavour, juiciness, tenderness and there-by also the overall acceptability.

The findings of the present study were well in agreement with the reports of Singh and Verma (2000) in refrigerated chicken patties with textured soy protein. The Duck meat sausages prepared by replacing both raw and partially cooked duck meat at 10% level with SBF recorded significantly higher ($p<0.05$) mean organoleptic scores than the duck meat sausages prepared with 5% SBF, 5% and 10% BGF. These findings also correlate with the results of Muthia *et al.* (2010).

Table 4: Organoleptic scores of duck meat sausages incorporated with different levels of extenders

	Raw meat sausages				Partially cooked meat sausages			
Sensory	**Soya flour**		**Bengal gram flour**		**Soya flour**		**Bengal gram flour**	
Parameters (%)	**5%**	**10%**	**5%**	**10%**	**5%**	**10%**	**5%**	**10%**
Colour	$6.25^{a}\pm0.41$	$7.58^{b}\pm0.25$	$6.00^{c}\pm0.35$	$5.54^{d}\pm0.25$	$6.05^{e}\pm0.41$	$7.32^{f}\pm0.25$	$5.78^{g}\pm0.35$	$5.22^{h}\pm0.25$
Flavour	$7.00^{a}\pm0.35$	$7.25^{b}\pm0.41$	$5.58^{c}\pm0.25$	$5.25^{d}\pm0.35$	$7.42^{e}\pm0.35$	$7.46^{f}\pm0.41$	$5.63^{g}\pm0.25$	$5.02^{h}\pm0.35$
Juiciness	$6.75^{a}\pm0.41$	$7.75^{b}\pm0.22$	$5.57^{c}\pm0.25$	$5.25^{d}\pm0.22$	$6.53^{e}\pm0.41$	$7.24^{f}\pm0.22$	$5.51^{g}\pm0.25$	$5.11^{h}\pm0.22$
Tenderness	$7.06^{a}\pm0.41$	$7.58^{b}\pm0.43$	$6.00^{c}\pm0.35$	$5.75^{d}\pm0.22$	$6.84^{e}\pm0.41$	$7.16^{f}\pm0.43$	$5.84^{g}\pm0.35$	$5.43^{h}\pm0.22$
Overall acceptability	$7.35^{a}\pm0.25$	$7.75^{b}\pm0.22$	$5.75^{c}\pm0.41$	$5.54^{d}\pm0.25$	$7.21^{e}\pm0.25$	$7.33^{f}\pm0.22$	$5.54^{g}\pm0.41$	$5.24^{h}\pm0.25$

Means bearing the same superscript for each parameter, row-wise, does not differ significantly ($p>0.05$)

CONCLUSION

Duck meat sausages prepared with 10% soy bean flour as an extender by replacing duck meat, has the desirable characters like lesser cooking loss, higher emulsion stability, higher crude protein content and comparatively lesser moisture content, apart from high acceptability of the consumers as evident from the organoleptic evaluation. Hence, it can be concluded that the desi duck meat sausage can be commercially exploited without compromising with various quality attributes when extended with soya bean flour at 10% level.

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