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≪**Research Note**≫

Effect of Incorporation of Chicken Fat and Skin on the Quality of Chicken Sausages

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In order to produce a new dimension towards the development of comminuted meat product, chicken fat and skin (CFS) were used with chicken meat and incorporated at 15, 20 and 25 percent levels to chicken sausage. To substantiate the product qualities obtained after such incorporations, different quality parameters like physico-chemical properties, proximate composition, thiobarbiturate acid (TBA) value, microbial profile and organoleptic qualities from those sausage after cooking were evaluated. It was found that with the increase in amount of added CFS, emulsion stability (ES), emulsifying capacity (EC) of sausage emulsion decreased significantly ($P<0.05$) whereas the extract release volume (ERV), cooking losses increased significantly ($P<0.05$) with increase in CFS level. There were no significant differences in terms of microbial profile and there was a significant ($P<0.05$) difference in some organoleptic qualities like juiciness and overall acceptability. However, from the point of view of overall acceptability of sausage having 20% added skin and fat scored better and incorporation upto 20% is advocated to make maximum profit from such sausages in commercial practices.

Key words : chicken fat, quality, sausage, skin

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Introduction

Comminuted meat products are widely consumed, but, unfortunately their cost, specially for the developing countries is high. To reduce cost, there is increasing interest in using of various meat additives. Though, chicken skin and fat are edible, in some parts of the country, this do not have much consumer appeal in India. Consequently, about 10.2 to 13% of the live weight is wasted in case of adult poultry (Sharma, 1999). It is therefore important to evolve production processes for gainful utilization of these parts. Although some information on the substitution of lean meat by skin, gizzard and heart (Baker *et al.,* 1968), milk protein (Rao *et al.,* 1999) as well as textured soy (Thind *et al.,* 1999) for developing comminuted poultry product is available, but no report seems to be available on the evaluation of the chicken sausage prepared by incorporating different levels of chicken fat and skin. Hence, the present study was undertaken to evaluate the effect of incorporation of different levels of chicken fat and skin on the physico-chemical, proximate composition, thiobarbiturate (TBA) value, microbial profile and sensory qualities of chicken sausages.

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Materials and Methods

Broiler birds of around 8 weeks of age were slaughtered conventionally. After dressing, chilling was done over night at 4±1℃ and then the carcasses were deboned manually. Composition of Stabilized poultry fat are fatty acids- not less than 90 %, moisture- not more than 1%, insoluble matter- not more than 1%, unsaponifiable matter- not more than 2.5%, free fatty acids- not more than 15% (Ockerman and Hansen, 2000). From the carcasses chicken fat and skin were collected during dressing and deboning of carcasses and kept at freezing temperature (4±1℃) till use. The lean meat and the fat and skin were comminuted separately by a meat mincer (Stadler), mixed thoroughly in trays manually and incorporated in three sausage formulations, viz, 85% deboned broiler meat (DBM)+15% chicken fat and skin (CFS)-*T-1* ; 80% DBM+20% CFS-*T-2* ; and 75% DBM+25% CFS-*T-3.* Sodium chloride (2.5%), sodium nitrate (0.01%), sodium nitrite (0.01%), tetra sodium pyrophosphate (0.3 %), cane sugar (1%), L-ascorbic acid (0.08%), blended condiment mixture (4.5%) where onion and garlic were used in the ratio of 3 : 1 respectively and ice (10%) were added to the meat mix and manually mixed for a few minutes. Then, dry spice mix (15%) containing anise 10%, capsicum 8%, caraway 10%, cardamom 5%, cinnamon 5%, cloves 2%, black pepper 10%, turmeric 5%, coriander powder 15%, cumin seed 15% and dried ginger 15% were added and again mixed manually. The sausage batter thus formed was stuffed into goat casing of 20 mm diameter manually. Smoking and cooking of the sausages were conducted as per the method outlined by Sharma (1999) with slight modification. Stuffed raw sausages were suspended from the hooks inside the smoke chamber having a temperature of 68–70℃ and smoking was continued for 8 hours (till the desired colour appeared). These are then steam cooked to core temperature of 80℃ for 20 min. There after cold showering was done for 10 min. About 109 each minced meat, batter and cooked sausage samples in duplicate were homogenized with 50 m*l* distilled water for 10–15 sec in a warring blender and the pH was measured by Systronic digital pH meter, model No. 335. The emulsifying capacity (EC), extract release volume (ERV) (Jay, 1964) of raw minced meat and emulsion stability (ES) (Baliga and Madaiah, 1971) were determined. The cooking loss was estimated by recording the difference between weight, before and after cooking. The proximate composition, i.e. moisture, protein and fat of both minced meat and cooked sausages were determined (AOAC, 1990) and total ash by gravimetric method by heating the sample at 700℃ in muffle furnace for 3 hours. TBA value was determined by the method described by Tarladgis *et al.* (1960) and total plate count (TPC) in the samples were determined by the methods as outlined by Vijayakuma and Biswas (2006). Sensory evaluation of sausages were carried out by a panel of 15 semi-trained judges for colour, flavour, juiciness, texture and overall acceptability using 9 point Hedonic scale (9=most desirable and 1=least desirable) as per the method of Keeton (1983).

The Physico-chemical, proximate composition, TBA value, microbial profile of three types of sausages were studied by one way ANOVA and means were compared for significant differences by Duncan's multiple range test (Snedecor and Cochran, 1994). Data relating to Sensory evaluation of three types of sausages were of non-parametric in nature and the analysis of these data was performed by means of Kruskal Wallis test using SPSS software. Mann-Whitney test for Juiciness and Overall acceptability was performed to find out the differences among *T-1, T-2* and *T-3.*

Results and Discussion

Physico-chemical parameters of sausages are shown in Table 1. Results show a significant ($P<0.05$) difference in the values of minced meat, sausage emulsion and cooked sausages of *T-1, T-2* and *T-3* treatments. The pH of the sausage emulsion was slightly higher than that of minced meat. This may be due to the presence of tetra sodium pyrophosphate in the former (Krishnan *et al.,* 1989). The pH of the cooked sausage containing 25% added CFS, i.e. *T-3* was significantly ($P<0.05$) lower than *T-1* and *T-2.* Results indicate that as the percentage of added fat and skin levels increased, pH of the cooked sausages decreased gradually. This is also in agreement with the report of Fogg and Horrison (1975) who reported the pH values were reduced slowly as fat levels increased.

As the added CFS levels increased, EC and ES were decreased significantly ($P<0.05$). Greater collagen present in CFS may have caused decrease in EC and ES. Kondaiah *et al.* (1987) reported higher EC and ES of meat when it contained lower collagen with the increment in added CFS levels, the cooking losses and ERV also increased significantly ($P<0.05$). This variation may be due to release of higher amount of fluid during cooking (Padda *et al.,* 1985). However, this also agreed well with the findings of Price *et al.* (1963) and Jay (1964) who noticed increases in ERV as the fat levels increased.

The results depicted in Table 2 showed that moisture, total fat and protein of minced meat differed significantly ($P<0.05$) as the added CFS levels increased. In the present study composition of the stabilized fat was fatty acid- 96%, Moisture- 1%, insoluble matter- 1% and unsaponifiable matter- 2%. The gradual reduction of moisture content of minced meat with increased added fat levels was also noticed by Padda *et al.* (1985) in the chevon patties. A significant ($P<0.05$) increase in total fat levels of minced meat may be due to the addition of chicken fat and skin at increased level in the chicken sausage formulation over and above the lean. Baker *et al.* (1969) has found the similar trend in the content of chicken frankfurter by adding different levels of fat. The protein content of the minced meat was inversely proportionate to the added CFS levels. This is quite obvious, since, meat is the only source of protein in the emulsion and as fat was increased, meat content was decreased. The results also showed a similar trend in cooked sausages. The moisture content of the cooked sausages were lower than the moisture content of the minced meat and as the added CFS levels increased, the moisture content of the cooked sausages decreased significantly ($P<0.05$). These trends are in agreement with the reports of Trout *et al.* (1992), who found the reduction of moisture content of cooked patties with increased levels of fat from 5 to 30% in ground beef patties. Total fat and protein contents of the cooked

Table 1. **Physico-chemical quality of chicken sausages (Mean±SE)**

Quality parameters	Categories of sausages		
	T-1	*T-2*	*T-3*
pH of raw minced meat	6.1 ±0.05	6.0 ±0.03	6.0 ±0.03
pH of sausage emulsion	6.2 ±0.03	6.2 ±0.06	6.2 ±0.06
pH of cooked sausage	$6.4^{a}\pm0.09$	$6.2^{a}\pm0.06$	$5.7^{b}\pm0.08$
Emulsifying capacity (EC) (m*l* oil/0.75 g meat)	$69.4^{a}\pm0.03$	$62.5^{b}\pm0.09$	$53.8^{c}\pm0.06$
Extract Release Volume (ERV) of minced meat (m*l*)	$25.5^{a}\pm0.30$	$28.7^{b}\pm0.26$	$31.5^{c}\pm0.38$
Emulsion Stability (ES) (ml fat released/100 g)	$1.2^{a}\pm0.06$	$3.1^{b}\pm0.05$	$4.2^{c}\pm0.06$
Cooking loss (%)	$13.7^{a}\pm0.19$	$19.8^{b}\pm0.17$	$25.6^{c}\pm0.19$

Means bearing different superscripts differ significantly ($P<0.05$) among three types of sausages.

Table 2. **Proximate composition, TBA values and microbial profile of different categories of chicken sausage (Mean±SE)**

Minced Meat	Categories of sausages		
	T-1	*T-2*	*T-3*
Moisture (%)	64.5^{a} ±0.27	63.1^{a} ±0.33	60.5^{b} ±0.30
Total fat (%)	13.7^{a} ±0.22	15.3^{b} ±0.17	17.7^{c} ±0.25
Protein (%)	20.1^{a} ±0.21	19.8^{a} ±0.16	19.3^{b} ±0.17
Ash (%)	1.2 ±0.06	1.2 ±0.05	1.2 ±0.06
Cooked sausage	*T-1*	*T-2*	*T-3*
Moisture (%)	62.9^{a} ±0.36	58.7^{b} ±0.24	53.4^{c} ±0.30
Total fat (%)	15.8^{a} ±0.29	20.3^{b} ±0.24	25.7^{c} ±0.22
Protein (%)	20.4^{a} ±0.16	20.2^{a} ±0.16	19.2^{b} ±0.17
Ash (%)	1.2^{a} ±0.06	1.3^{b} ±0.08	1.4^{c} ±0.06
TBA value (mg/kg)	0.146^{a} ±0.003	0.162^{a} ±0.003	0.232^{b} ±0.009
TPC (log cfu/g)	3.47 ±0.003	3.48 ±0.009	3.51 ±0.001

Means bearing different superscripts differ significantly ($P<0.05$) among three types of sausages.

sausages were higher than the total fat and protein contents of the minced meat and it also showed a significant ($P<0.05$) difference from *T-1* to *T-3*. This may be due to reduction in moisture content during cooking. This is in collaboration with the findings of Keeton (1983) on pork patties. Ash% remained almost constant in raw meats, but differed significantly ($P<0.05$) in cooked sausages among *T-1, T-2* and *T-3* treatments. The possible reason might be the variation in% cooking losses of sausages subjected to different treatments. So, this incorporation of chicken fat and skin enhances the presence of fat per unit of such sausages. This could be an attributing factor for better acceptability with higher satiety value of these sausages.

The results in Table 2 also revealed that as the CFS level increased, the TBA values of the sausages also increased gradually. However, there was no significant ($P>0.05$) difference between *T-1* and *T-2* treatments, but they differ significantly ($P<0.05$) from *T-3* treatment. This signified that the sausages having higher% of fat were prone to higher lipid oxidation at a specific period of study. The similar observations in terms of TBA values in chicken meat were also made by Reddy and Vijayalakshmi (1998). However, the TBA values of *T-1* and *T-2* were much lower than the critical limit, i.e. 0.69 to 2.0 mg/kg (Greene and Cumuze, 1982).

The TPC value of cooked sausages prepared with different levels of added CFS were more or less same and statistically non-significant ($P>0.05$) justifying the comments of Young *et al.* (1991) that the shelf life of ground chicken influenced by bacterial spoilage was unaffected by fat content. Moreover, the values were also much lower than the critical limit of TPC, i.e. log 4.00 cfu/g in cooked meat products (Bureau of Indian Standard, 1992) establishing the fact that such products are microbiologically stable for safe consumption.

The sensory studies of chicken sausages depicted in Table 3 and Table 4 revealed that all the quality attributes of the products were quite acceptable and the difference between the treatments being marginal. However, sausages containing 15% CFS were rated better as compared to other two treatments so far juiciness of the products. The other parameters such as colour, flavour and texture for different products were found to be by and large same. However, when overall acceptability of the products were taken into consideration, *T-1* and *T-2* were found to better than that of *T-3*.

In conclusion, considering the blooming growth of fast food industries, chicken sausage needs to be produced in higher quantum. As revealed in the present study, even up to 20% level of CFS can be incorporated in preparation of sausage without any adverse effect in terms of physico-chemical, proximate composition, TBA value, microbial profile and sensory qualities. Therefore, such observation would be conclusive for making such effort of chicken sausage preparation more productive and economic. This in turn, will help chicken broiler industries also

Table 3. **Sensory qualities of three types of sausages**

Parameters		Mean Rank	Chi Square Value	Sig. Level
Colour	*T-1*	26.1	3.644	0.162
	T-2	24.57		
	T-3	18.33		
Flavour	*T-1*	23.4	0.024	0.988
	T-2	22.8		
	T-3	22.8		
Juiciness	*T-1*	**28.47**	8.119	0.017
	T-2	**21.7**		
	T-3	**18.33**		
Texture	*T-1*	24.67	0.711	0.701
	T-2	23.17		
	T-3	21.17		
Overall acceptability	*T-1*	**28.03**	7.436	0.024
	T-2	**24.37**		
	T-3	**16.6**		

Table 4. **Mann-Whitney Test for Juiciness and Overall acceptability**

Parameters		Mean Rank	Mann Whittney value	Sig. Level
Juiciness	*T-1* Vs. *T-2*	17.80 13.2	78.00	0.027
	T-1 Vs. *T-3*	18.67 12.33	65.00	0.008
	T-2 Vs. *T-3*	16.50 14.50	97.50	0.417
Overall acceptability	*T-1* Vs. *T-2*	16.77 14.23	93.50	0.373
	T-1 Vs. *T-3*	19.27 11.73	56.00	0.009
	T-2 Vs. *T-3*	18.13 12.87	69.00	0.049

to be sustainable commercially.

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