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Research paper

Quality Characteristics of *Goshtaba* Prepared by Partial Replacement of Animal Fat with Vegetable Oil

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ABSTRACT

The current study was undertaken with an aim to optimize fat content for the development of healthier *Goshtaba* by replacing a of part animal fat with vegetable oil. Four treatments with a total fat content of 20% (animal and vegetable fats in different proportions) were compared among themselves for their effect on the physico-chemical, compositional, colour and sensory quality of *Goshtaba*. The treatments included: M_0 (animal fat: vegetable fat = 20:0), M_1 (animal fat: vegetable fat = 15:5), M_2 (animal fat: vegetable fat = 10:10) and M_3 (animal fat: vegetable fat = 5:15). The results revealed that the quality of control i.e. M_0 was comparable with that of M_1 as well as M_2 when measured in terms of emulsion stability, cooking yield, pH, moisture, protein, fat and ash content with average value for emulsion stability as 90.43 ± 0.29 and 90.50 ± 0.36, cooking yield as 92.53 ± 0.29 and 92.76 ± 0.19, pH as 5.66 ± 0.08 and 5.43 ± 0.04, moisture as 62.30 ± 0.82 and 63.20 ± 0.65, protein as 16.15 ± 0.08 and 16.25 ± 0.10, fat as 18.14 ± 0.85 and 16.87 ± 0.60 and ash as 2.26 ± 0.19 and 2.40 ± 0.15, respectively for M_0 and M_2. The sensory quality of the product was improved up to M_2 level; thereafter it decreased significantly for M_3. The colour parameters like lightness, redness and yellowness were affected with the addition of vegetable fat. Since, the product remained in the acceptable limits up to M_2, it was concluded that 50% of animal fat can be replaced with vegetable fat without affecting the quality of *Goshtaba.*

Keywords: *Fat replacement, Vegetable oil, Goshtaba, Physico-chemical and Sensory quality*

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INTRODUCTION

Goshtaba is a product laden with a very high amount (20-30%) of animal fat. These high animal fat diets are associated with various types of disorders such as obesity, hypertension, cardiovascular diseases and coronary heart diseases (McAfee et al. 2010). According to a study conducted at Sher-e-Kashmir Institute of Medical Sciences, Soura, Srinagar (J&K), *Wazwan* due to its high fat content, is considered to be associated with some higher health risks (Ahmad et al. 2012). Despite this negative image of *Wazwan*, local inhabitants have a unique fondness, craving and love for it because of its high sensory appeal. Since fat is the main reservoir for flavour and texture of meat product, reducing it in meat products leads to a firmer, rubbery, less juicy product, with dark colour (Naga et al. 2009). Thus, a balance needs to be maintained between reducing/replacing the animal fat from the formulation of *Goshtaba* and preserving the sensory quality of the product. The negative effects associated with animal fats can be partially taken care of by replacing them with vegetable oils. Compared with animal fats, vegetable oils are almost free of cholesterol and have a higher ratio of unsaturated fatty acid and antioxidant compounds such as tocopherols (10.8-53.9mg/100gm) (Liu et al. 1991). Fatty acid profiles of meat products can thus be altered desirably by substituting animal fat with vegetable oils.

MATERIALS AND METHODS

Freshly dressed hind leg portions of the mutton carcass (preferably of one year age) were procured from the local market. Deboning was immediately done and the lean meat obtained was used for the preparation of the product. Animal fat used in the experiment was preferably obtained from the carcass of the same kill. Fresh Mutton chunks were minced through 8 mm plate in a meat mincer (MSW-627). Chilled mutton fat was passed once through 8 mm plate of grinder. The required quantit[1]y of coarse ground mutton was placed in the Bowl Chopper (SCHARFEN, Germany) and chopped for 1 minute. To this, 2.5% salt was added and chopping was continued for further 1 minute after which 10% chilled water was added and chopping was continued again for 2 minutes. At this stage, mutton fat along with vegetable oil (Dhara) was added and again chopping was done for 2 minutes. Large cardamom seeds were further added towards the end of chopping and chopping was continued for 1 minute to obtain an emulsion of desirable quality (Samoon and Sharma 1994). The raw emulsion obtained was then moulded in the shape of spherical balls (70 to 80 g). Meat balls were partially cooked for half an hour in boiling water and then left for some time for cooling, to be later cooled in gravy specific for *Goshtaba*. The basic formulation of *Goshtaba* is given in Table 1.

Preparation of *Yakhni* and cooking of *Goshtaba*

"*Yakhni*" is the gravy in which meat balls were processed to get *Goshtaba* as the finished product. For preparing *Yakhni*, two parts of fresh curd was homogenized with 1 part of water (by weight) with a stirrer, transferred to a thick bottomed stainless steel vessel and heated rapidly over high heat on a gas stove for 10-15 minutes. During heating, curd was constantly stirred until it reached the boiling point. Vegetable oil was added to it and boiling was continued for 10 minutes. Then, garlic paste was added followed by other spices i.e. large cardamom, small cardamom, cinnamon, cloves, dried ginger powder and aniseed powder, respectively. Fried leek paste was added at the end. Boiling was continued until the added oil floated back. At this stage, the remaining water was added and *Yakhni* was cooked further for 10-15 minutes, to obtain a desirable consistency.

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Table 1: Basic formulation of *Goshtaba*

S. No.	Name of the ingredient	Percentage			
		M_0	M_1	M_2	M_3
1	Lean meat	80.00	80.00	80.00	80.00
2	Animal fat	20.00	15.00	10.00	5.00
3	Vegetable fat	0.00	5.00	10.00	15.00
	Total		**100.00**		
	To the above, following ingredients will be added (on weight basis)				
4	Common Salt	2.50	2.50	2.50	2.50
5	Chilled water/Ice Flakes	10.00	10.00	10.00	10.00
6	Large Cardamom Seeds	0.20	0.20	0.20	0.20

The partially cooked meat balls were transferred to the boiling *Yakhni* and cooked for 30 minutes. *Goshtaba* with *Yakhni* so obtained was cooled to room temperature and then kept under chilled conditions in a refrigerator until subjected to analysis (Hussain 2011). The combined recipe for *Goshtaba* and *Yakhni* is summarized in table 2.

Table 2: Combined recipe for *Goshtaba* and *Yakhni*

Ingredients	Quantity (g)
	Goshtaba
Meat balls	1000.00
Water	1000.00
Curd (Dahi)	1000.00
Vegetable oil	100
Large cardamom (Badi Ilaichi)	2.50
Small cardamom (Chotti Iliachi)	1.00
Cinnamon (Dalchini)	3.50
Cloves (Laung)	0.50
Dried ginger (Sonth) powder	6.00
Aniseed (Saunf) powder	8.00
Garlic (Lehsun) paste	10.00
Fried Leek (Pran) paste	50.00
Common salt	10.00

Analytical procedures

The emulsion stability of the raw samples was determined as per the method of Baliga and Madaiah (1970) with slight modifications. The cooking yield was expressed in percentage. The pH of samples was determined by the method of Trout et al. (1992) by using combination glass electrode digital pH meter (Model CP 901, Century Instruments Ltd., India). Moisture, protein, fat and ash content were determined by AOAC methods (AOAC 1995). The colour of all the samples was measured by using a Hunter colour lab (Model Colour Flex; Hunter Associates Laboratory, VA, USA) with an 8 mm aperture set for illumination D45/10 standard observer angle (AOAC 1990).

Sensory evaluation

A 7 member semi trained judges consisting of scientists and post graduate scholars from Division of Livestock Products Technology evaluated the samples for the sensory attributes of appearance, flavor, juiciness, texture, binding, saltiness, mouth coating and overall acceptability using 8-point descriptive scale (where 8= excellent and 1= extremely poor) (Keeton 1983). The test samples were presented to the panelists after assigning suitable codes. The samples were warmed in a microwave oven for 20 seconds before serving to the sensory panelists. Water was served for rinsing the mouth between the samples. Data were analyzed statistically on SPSS-16.0 software by applying Analysis of Variance (Snedecor and Cochran 1994).

RESULTS AND DISCUSSION

The values obtained for the effect of animal fat replacement on the physico chemical and compositional quality of *Goshtaba* are reported in Table 3. It is evident that as the animal fat percentage was replaced by vegetable oil, emulsion stability and cooking yield was found to increase although with statistically non-significant difference (P>0.05) and reached to maximum at M_2 treatment. Similar trend of results was observed by Koo et al. (2009) when they reported the cooking loss values of patties processed with vegetable oil were significantly lower than those of patties processed with pork fat. Apeksha et al. (2020) reported an increasing trend in emulsion stability and cooking yield by the addition of whey protein concentrate (WPC) in low fat functional pork nuggets. Asuming-Bediako et al. (2014) and Rather et al. (2016) also reported that the difference in emulsion stability using animal fat and vegetable oil is small during processing. The pH values of *Goshtaba* was less than 6 in all the treatments. This might be due to low pH of *Yakhni* (Curd curry) used in its preparation. Similar trend for pH values was seen by Hussain (2011) in *Goshtaba*.

Table 3: Effect of animal fat replacement on the physio-chemical and compositional quality of *Goshtaba* (Mean ± S.E.)

Parameters (on % basis except pH)	Treatments			
	M_0	M_1	M_2	M_3
ES	90.43 ± 0.29^{bc}	90.49 ± 0.35^{bc}	90.50 ± 0.36^{b}	87.28 ± 0.42^{a}
Cooking Yield	92.53 ± 0.29^{bc}	92.03 ± 0.58^{b}	92.76 ± 0.19^{b}	87.74 ± 0.21^{a}
pH	5.66 ± 0.08	5.60 ± 0.12	5.43 ± 0.04	5.50 ± 0.13
Moisture	62.30 ± 0.82^{ab}	64.03 ± 0.64^{b}	63.20 ± 0.65^{ab}	62.33 ± 0.31^{b}
Protein	16.15 ± 0.08	16.02 ± 0.07	16.25 ± 0.10	16.07 ± 0.04
Fat	18.14 ± 0.85	17.61 ± 0.56	16.87 ± 0.60	16.58 ± 0.52
Ash	2.26 ± 0.19	2.30 ± 0.15	2.40 ± 0.15	2.52 ± 0.19

Mean ± S.E with different superscripts differ significantly

Compositional quality in terms of protein, fat and ash percentages was not affected with the use of vegetable fats. Protein content was found to be significantly highest and fat content was found to be lowest in M_2 treatment. Nutritional improvements with replacement of animal fat for vegetable oil were also observed by Delgado-pando et al. (2011) and Rodriguez-Carpena et al. (2012) in pork products. The use of vegetable oil in meat products not only help in increasing unsaturated fatty acids but also reduces cholesterol content (Vural and Javidipour 2002; Kayaardi and Gok 2003; Gok et al. 2011). Decrease in moisture content in M_3 treatment led to increase in firmness of the product, a phenomenon that was quantified by tasters in sensory evaluation as well. Thomas et al. (2020) reported that the incorporation of sticky rice flour and jackfruit seed flour at 3.5% level in the formulation had no significant effect on any of the physico-chemical, microbiological and sensory parameters of pork nuggets.

The values obtained for effect of animal fat replacement on the sensory quality of *Goshtaba* are reported in table 4. The sensory parameters (appearance, flavor, juiciness, texture, binding, saltiness and overall acceptability) in *Goshtaba* were not affected upto 50% replacement of animal fat with vegetable fat, but thereafter decreased significantly (P<0.05) in M_3. Our findings were matching with the studies of Kayaardi and Gok (2003) and Yildiz-Turp and Serdaroglu (2008) who found that replacing beef fat with vegetable oils improved the quality characteristic of sausages.

Table 4: Effect of animal fat replacement on the sensory quality of *Goshtaba* (Mean±S.E.)

Parameters	Treatments			
	M_0	M_1	M_2	M_3
Appearance	6.76 ± 0.21^{b}	7.20 ±0.14^{bc}	7.61 ± 0.13^{c}	5.77 ± 0.17^{a}
Flavour	6.93 ± 0.22^{b}	7.11 ± 0.19^{b}	7.46 ± 0.11^{b}	5.78 ± 0.15^{a}
Juiciness	6.93 ± 0.22^{b}	7.15 ±0.14^{bc}	7.49 ± 0.13^{c}	5.64 ± 0.23^{a}
Texture	6.92 ± 0.27^{b}	6.80 ±0.13^{bc}	6.49 ± 0.11^{c}	5.15 ± 0.16^{a}
Mouth Coating	7.08 ± 0.21^{b}	7.10 ± 0.22^{b}	6.53 ± 0.15^{b}	6.20 ± 0.26^{a}
Binding	6.87 ± 0.30^{b}	7.34 ±0.16^{bc}	7.73 ± 0.10^{c}	5.46 ± 0.25^{a}
Saltiness	7.06 ± 0.16^{bc}	7.17±0.16^{abc}	7.20 ± 0.11^{c}	6.40 ± 0.25^{a}
Overall Acceptability	6.88 ± 0.20^{b}	7.30 ±0.14^{bc}	7.56 ± 0.11^{c}	6.21 ± 0.21^{a}

Mean ± S.E with different superscripts differ significantly.

The values of colour in terms of lightness (L^*), redness (a^*) and yellowness (b^*) measured in *Goshtaba* are shown in Table 5. The values were affected by the replacement of animal fat with vegetable oil with lightness (L^*) and yellowness (b^*) showing an increasing trend with decreased in the redness (a^*) value. These results are in agreement with the Apeksha et al. (2020) who observed decrease in values of redness with the addition of whey protein concentrate (WPC) in low fat functional pork nuggets. Similar results were also found by Yasarlar et al. (2007) for turkish meat balls incorporated with cereal bran. Youssef and Barbut (2011) found that pre-emulsified oil (using soy protein isolate) resulted in a significant reduction in redness of comminuted beef product. Several other studies have confirmed less redness in meat products prepared with soy ingredients (Gao et al. 2015; Kang et al. 2016; Lee et al. 2017; Rindhe et al. 2018).

Table 5: Effect of animal fat replacement on colour parameters of *Goshtaba* (Mean±S.E.)

Parameters	Treatments				
	T_0	T_1	T_2	T_3	Total
	44.97 ± 0.08^{a}	45.64 ± 0.44^{a}	50.64 ± 0.057^{b}	50.98 ± 0.18^{b}	48.06 ± 0.84
	0.28 ± 0.01^{b}	0.26 ± 0.01^{ab}	0.26 ±0.01^{ab}	0.25 ± 0.01^{a}	0.27 ± 0.01
b*	15.67 ± 0.03^{a}	17.98 ± 0.33^{b}	18.11 ± 0.52^{b}	22.46 ± 0.57^{c}	18.56 ± 0.76

Mean ± S.E with different superscripts differ significantly.

CONCLUSION

The quality parameters of *Goshtaba*, an emulsion based meat product of famous Kashmiri *wazwan* remained within the acceptable limits up to M_2 treatment i.e. when 50% of animal fat was replaced with vegetable fat. The *goshtaba* so developed was perceived well and better appreciated by the sensory panelists. Therefore, it can be concluded that the *Goshtaba* having partially replaced animal fat with vegetable oil can successfully be introduced for commercial uptake.

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