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Physico-chemical Properties of Mutton Patties Prepared from Munjal and Harnali Breeds of Sheep

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ABSTRACT

Meat obtained from Munjal and Harnali breeds of sheep were used for preparation of patties and were analyzed for quality attribues. The breed effect on the product quality was analyzed to produce a detail picture in reference to the parameters like physicochemical, textural, sensory characteristics. It was found that Munjal and Harnali breeds have no significant ($p \leq 0.05$) effect on physico-chemical and functional properties of patties. The color parameter indicated that L* and a* values have no significant ($p \leq 0.05$) difference but b* values have significant ($p \leq 0.05$) difference. However the Texture Profile Analysis and sensory panel scores indicated a lower quality attributes for the products prepared from the Harnali breed in comparison to Munjal. Hardness, gumminess, chewiness, firmness and toughness of patties have significant ($p \leq 0.05$) difference. The microbial count indicated more than 6 log cfu/gm after 20 days of storage indicating a shelf life of less than 20 day in refrigerated storage.

Keywords: Sheep, Munjal, Harnali, meat patties, physico-chemical properties

In developed countries, the per capita consumption of meat is 88 kg which is much higher compared to the developing nations where the value is only 25 kg (http://www.fao.org). The production and consumption in India is also on the increasing trend. The domestic meat demand is also increasing with the increase in awareness and dispensable income. Meat consumption is often an indicator of the status of a country or an individual.

It has been found that people with a higher social or economic status demand a greater amount of high-quality nutrients specially the protein. In a study Mahajan *et al.* (2015) found that meat is an important and common source of animal protein and the expenditure estimates indicate that 15% in rural areas and 18% in urban areas is devoted to meat out of the total food expenditure. There are different types of meat available to meet out the demand of quality meat. Sheep meat or mutton has been one of the most acceptable meats in the country beyond religious and regional barriers. The concern for the quality meat is also increasing due to growing awareness and health concern. The increased concern for nutritional security of common mass demands a holistic approach to stretch the availability of quality protein sources (Kumar *et al.* 2014). In this age of quality, consumer's preference is also of vital importance as several cross-breeds are being developed which are going to be used for the meat production too. Sheep meat quality is influenced by several factors, and one of them is breed (Hoffman *et al.* 2003; Purchas *et al.* 2002; Safari *et al.* 2001).

Hence it is very important to analyze the meat quality parameters of newly developed breeds. According to Warriss (2000), when most people talk about quality they tend to mean the functional quality that refers to desirable attributes in a product such as yield, technological properties and palatability. Meat composition is an important aspect of meat quality and is normally assessed by chemical analysis of constituents i.e. protein, fat, water and ash (Moran and Wood, 1986). Other quality parameters like shear force value, color can also be analyzed on the instrumental scale to detail the quality attributes in addition

to the subjective analysis by a trained panel. This work examines the quality of meat patties of two breeds where Munjal is the native animal of this area and the Harnali is the cross bred developed in the institute. The influence of breed on the product quality was analyzed to produce a descriptive picture of the physicochemical characteristics and sensory attributes on subjective and objective scale. The prepared product was also subjected to storage stability test. Several studies have been conducted to compare meat quality of sheep but detailed information of these parameters in sheep with respect to breeds is lacking in tropical countries like India. Thus, the aim of this study was to compare the quality attributes of meat patties prepared from two different breeds of sheep.

MATERIALS AND METHODS

Breeds of 18-20 months castrated male reared under similar feeding and managemental conditions were slaughtered and dressed as per the standard procedure in the slaughter house of the department. Carcasses were washed thoroughly and deboned manually after trimming of visible fat and connective tissue. Deboned meat was frozen for 24 hours in a deep freezer (-18°C).

For preparation of mutton patties deboned meat was minced in an electrical mincer (Mado Primus - MEW-613) (3 mm plate) and sodium chloride (1.6%), sodium tripolyphosphate (0.3%), sodium nitrite (0.015%), spice mix (1.9%), condiments paste (3%), refined wheat flour (2%), water (8%), egg albumen (10%) and groundnut oil (5%) were added to minced meat. Minced meat along with additives was mixed in a bowl chopper for 4 - 6 minutes to prepare a stable emulsion. The emulsion was stuffed in a mould to prepare patties of uniform size and cooked in an electric oven for 25 minutes at 160 ± 5°C temperature (Talukder and Sharma 2010). After cooking, product was cooled to room temperature, packaged in low density polythene bags and stored at refrigerated temperature for further study.

Moisture, protein, fat, ash and crude fibre were measured according to AOAC (1995), pH (Trout *et al.* 1992), emulsion stability (Baliga and Madaiah, 1970), thiobarbituric acid reacting substances (TBARS) (Witte *et al.* 1970), Cooking yield measured by recording the weight of cooked product and initial raw weight. The Texture Profile Analysis was performed as per the procedure outlined by Bourne (1978) using TA*HD* Plus Texture Analyser (Stable Micro Systems, England). Samples of 20×20×15 mm size were compressed to 50% of their original height. A time interval of 5 s was allowed between two compression cycles. Force time deformation curves were obtained with a 50 kg load cell applied at a cross-head speed of 2 mm/s. Warner Bratzler shear press measured on samples of 20×20×15 mm size by Warner Bratzler cutting blade having rectangular notch. Color was measured using a Konica Minolta chroma meter CR-400 (Konica Minolta Sensing, Inc., Japan) with 8 mm aperture and D65 illuminant. The instrument was calibrated with a white standard plate. Color scores were expressed as CIE Lab L* (lightness), a* (redness) and b* (yellowness). Sensory evaluation was carried out by a semi trained panel from the faculty and research fellows of the department. Sensory attributes viz. color and appearance, flavour, texture, tenderness, juiciness and overall acceptability were evaluated using 8 point descriptive scale (where 8 indicate extremely desirable and 1indicates extremely undesirable). Microbial analysis was done at regular interval of 5 days in refrigerated storage as per the APHA (1984). The data obtained were subjected to Duncan's multiple range test at 5 % significance level (Snedecor and Cochran 1989).

RESULTS AND DISCUSSION

Physico-chemical properties

The physico-chemical properties for the mutton patties presented in table 1. Mutton patties from Harnali breed had values on higher side for per cent of moisture, protein and fat i.e. 66.14, 21.05 and 6.52 respectively but have no significant ($p < 0.05$) difference with mutton patties prepared from Munjal breed. Values found were well in the range reported by Rhee *et al.* (1999) in extruded products prepared from lamb. Similarly there was no significant ($p < 0.05$) difference in parameters like crude fiber, pH, TBARS, cooking yield, emulsion stability and water holding capacity, while the quality indicators like pH, TBARS, cooking yield and emulsion stability was found to be higher for the mutton patties prepared from Harnali breed.

The results of chromameter obtained showed that the patties prepared from Munajla and Harnali breed had no

significant ($p \leq 0.05$) difference in L* and a* values but b* values indicating the yellowness in the product was found to be significantly ($p \leq 0.05$) higher for the mutton patties prepared from Harnali breed (Table 1). Lien *et al.* (2001) and Yancey *et al.* (2011) also reported similar observations in pork loin chops and steaks respectively.

Table 1: Physico-chemical and functional properties of mutton patties prepared from Munjal and Harnali breed (n=6, Mean ±SD)

Parameters	P-Munjal	P-Harnali
Moisture	65.80±0.48	66.14±0.91
Protein	20.42±0.90	21.05±0.68
Fat	6.14±0.37	6.52±0.42
Ash	2.94±0.04	2.93±0.04
Crude fiber	0.33±0.06	0.31±0.04
pH	6.14±0.05	6.19±0.06
TBARS	0.73±0.20	0.77±0.18
Cooking yield	89.71±0.83	90.26±1.01
Emulsion stability	93.28±0.77	94.55±0.88
Water holding capacity	51.33±1.26	50.50±0.87
Color attributes		
L*	50.01±3.37	49.91±3.64
a*	12.83±0.75	12.46±0.63
b*	15.94±1.41 ^{b}	17.72±1.07 ^{a}

P-Munjal = mutton patties prepared from Munjal breed, P-Harnali = mutton patties prepared from Harnali breed

Means with different superscripts within a row for a particular parameter differ significantly ($p < 0.05$).

Textural and sensory properties

The instrumental observation made through the texture profile analysis indicated significantly ($p \leq 0.05$) higher values in the patties prepared from the Harnali breed for the parameters like hardness, springiness, cohesiveness, gumminess and chewiness where the values for hardness, gumminess and cohesiveness significantly ($p \leq 0.05$) differed (Table 2). This indicated a lower quality attributes for the products prepared from the Harnali breed. Similar results were observed for the Warner Blatzler shear force values, where the firmness and toughness values were significantly higher, 11.88 N and 106.38 N sec respectively for the patties prepared from Harnali. Similar results were also observed in different meat products by Dominguez *et al.* (2002) and Verma *et al.* (2009).

The sensory scores for the patties from both breeds indicated findings similar to textural properties (Table 2). The scores for sensory parameters indicated higher values for the patties prepared from the Munjal breeds in comparison to the Harnali. The values for parameters like texture, juiciness, tenderness and overall acceptability showed significantly ($p \leq 0.05$) higher values for the mutton patties from Munjal breed than Harnali breed. Hence both the objective and subjective analysis of the mutton patties indicated that Harnali breed has inferior product quality characteristics than the Munjal.

Storage study

In the storage (4±1°C) study of the mutton patties, the oxidative stability as well as microbial analysis was done (Table 3). The TBARS values indicating the oxidative potential of the product was found to be in the range of 0.15 mg malonaldehyde/kg to 2.11 mg malonaldehyde/kg over the 20th days of storage period, where the increase in the values after every five days of storage was found significant ($p \leq 0.05$) in patties from both the breeds but the values had no significant ($p \leq 0.05$) difference on the same day in TBARS values of patties. This was in agreement with the findings of other workers [Kumar and Tanwar (2011); Sudheer *et al.* (2010) and Bhat *et al.* (2011)], they also found a similar increase in TBARS values upon storage of different meat products. A similar trend was found when the patties were subjected for Standard Plate Count (SPC) to study the shelf life of product in refrigerated storage.

The SPC was found in the range of about 2 logcfu/gm on the 0 day and it was more than 6 log cfu/gm on 20th days of storage indicating a shelf-life of less than 20 day in refrigerated storage. Although the count had significant ($p \leq 0.05$) difference after every 5 days of storage but the count between the both patties had no significant ($p \leq 0.05$) difference on the same day of storage. Chidanandaiah *et al.* (2009), Kumar and Tanwar (2011) and Bhat *et al.* (2011) observed a similar increase in plate count while studying different meat products stored at refrigeration temperature A similar observation was made for the psychrotrophs but the range of count was around 1 logcfu/gm on 0th day which increased to more than 3logcfu/gm after 20th days

Table 2: Texture profile analysis, Warner Bratzler shear press and sensory properties of mutton patties prepared from Munjal and Harnali breed (Mean ± SD)

	Texture profile analysis (n=6)					Warner Bratzer shear press (n=6)	
	Hardness (N)	**Springiness**	**Cohesiveness**	**Gumminess**	**Chewiness**	**Firmness (N)**	**Toughness (Nsec)**
P-Munjal	55.54±3.51 ^{b}	0.84±0.01 ^{a}	0.65±0.02 ^{a}	35.94±2.67 ^{b}	30.05±2.32 ^{b}	10.37±0.83 ^{b}	97.06±4.40 ^{b}
P-Harnali	64.92±3.92 ^{a}	0.85±0.02 ^{a}	0.67±0.03 ^{a}	43.00±1.81 ^{a}	36.72±2.17 ^{a}	11.88±0.91 ^{a}	106.38±4.10 ^{a}
	Sensory scores (n=18)						
	Color	**Flavor**	**Texture**	**Juiciness**	**Tenderness**	**Overall acceptability**	
P-Munjal	7.42±0.51 ^{a}	7.50±0.52 ^{a}	7.71±0.45 ^{a}	7.63±0.38 ^{a}	7.75±0.45 ^{a}	7.67±0.39 ^{a}	
P-Harnali	7.33±0.49 ^{a}	7.54±0.50 ^{a}	7.29±0.45 ^{b}	7.25±0.40 ^{b}	7.29±0.45 ^{b}	7.33±0.39 ^{b}	

P-Munjal = mutton patties prepared from Munjal breed, P-Harnali = mutton patties prepared from Harnali breed

Means with different superscripts within a column for a particular parameter differ significantly ($p < 0.05$).

Table 3: Microbiological quality and TBARS value of mutton patties during refrigerated storage (4±1°C) (n=6, Mean ±SD)

Treatment	0 Day	5th Day	10th Day	15th Day	20th Day
	TBARS (mg malondehyde/kg)				
P-Munjal	0.16±0.07 ^{E}	0.62±0.19 ^{D}	1.17±0.10 ^{C}	1.49±0.26 ^{B}	2.03±0.26 ^{A}
P-Harnali	0.15±0.06 ^{E}	0.56±0.17 ^{D}	1.22±0.12 ^{C}	1.45±0.20 ^{B}	2.11±0.23 ^{A}
	Standard plate count (log cfu/g)				
P-Munjal	2.01±0.36 ^{E}	3.16±0.30 ^{D}	4.12±0.33 ^{C}	5.06±0.28 ^{B}	6.12±0.31 ^{A}
P-Harnali	1.94±0.34 ^{E}	3.23±0.26 ^{D}	4.22±0.42 ^{C}	5.26±0.40 ^{B}	6.03±0.28 ^{A}
	Psychrotrophic count (log cfu/g)				
P-Munjal	0.99±0.25 ^{D}	1.31±0.34 ^{D}	2.07±0.24 ^{C}	2.64±0.32 ^{B}	3.11±0.29 ^{A}
P-Harnali	1.11±0.32 ^{D}	1.37±0.37 ^{D}	2.18±0.30 ^{C}	2.73±0.27 ^{B}	3.22±0.30 ^{A}
	Yeast and mold count (log cfu/g)				
P-Munjal	0.81±0.28 ^{D}	1.03±0.22 ^{D}	1.55±0.23 ^{C}	2.10±0.29 ^{B}	2.47±0.35 ^{A}
P-Harnali	0.87±0.34 ^{D}	1.10±0.39 ^{DC}	1.49±0.26 ^{C}	2.17±0.34 ^{B}	2.58±0.36 ^{A}

P-Munjal = mutton patties prepared from Munjal breed, P-Harnali = mutton patties prepared from Harnali breed

Means with different superscripts within a row for a particular parameter differ significantly ($p < 0.05$).

of storage. A similar increase in psychrotrophic count during storage has been reported by Yadav and Sharma (2008). The yeast and mold count depicted overall a similar trend and no significant difference ($p \leq 0.05$) was found on 0th day and 5th day but later on during storage period showed significant ($p \leq 0.05$) difference. On the same day during storage period there was no significant ($p \leq 0.05$) difference between mutton patties

CONCLUSION

The effect of sheep breed on mutton patties quality has been studied and found a significant change in sensory

and instrumental texture properties as a function of breeds. Physico-chemical and functional properties were not influenced significantly due to breeds although a difference in parameters has been seen. Mutton patties have a shelf life of 15 days at refrigerated storage.

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