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Effect of Cooking Methods on Quality Characteristics of Nuggets and Patties from Sheep, Goat and Rabbit Meat

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ABSTRACT

The effect of cooking methods (moist vs dry heat) on physicochemical and sensory attributes of sheep, goat and rabbit meat products was studied. The cooking yield % was significantly (P<0.05) higher in nuggets (moist heat cooking) than patties (dry heat cooking) in all three species. The nuggets contained more (P<0.05) moisture and less fat than patties. The cooking method did not significantly influence the sensory attributes of sheep and goat meat products. Tenderness and juiciness scores were higher (P<0.05) in nuggets of rabbit meat as compared to patties. The results indicated that yield characteristics of nuggets prepared by moist heat method were better than patties prepared by dry heat. Further, it was concluded that irrespective of species, nuggets rated superior than patties in sensory attributes.

Key words: *Cooking method, mutton product, rabbit meat product, physico-chemical quality.*

INTRODUCTION

Meat from culled sheep / goat is tougher and poor in palatability due to higher collagen content, its cross linkages and objectionable odour (Locker 1980). On the other hand, rabbit meat has very good nutritional value being comparatively high in protein, low in fat, calories and sodium (Sunki et al. 1978). However, due to pet appearance, rabbit meat is not so popular throughout the country. Hence, for effective utilization of culled sheep, goat and rabbit, the right choice would be to convert them into value added and ready to eat meat products.

The quality of ready to eat meat product is closely related to the method of cooking and changes in physical, proximate composition and sensory quality of the product. From a food safety perspective, the cooking of meat is necessary to eliminate any associated food borne pathogens (Nicola and Rosemary 2006). McCormick et al. (1981) observed better flavour and juiciness in pan frying of beef patties than broiling. Berry and Leddy (1984) observed that oven roasting was best for texture profile and frying was best for tenderness and flavour of beef patties. A significant effect of cooking methods was noted on the yield of chicken patties (Nath 1992) and balls (Mandal et al. 1996; Todd et al. 2006). The effect of cooking on quality was also noted in fresh mutton and chevon (Prasad 1989) and rabbit meat (Cyril et al. 1996). Cooking of buffalo meat at 100^0C for 45 minutes improved collagen solubility and tenderness to the same extent as that due to pressure cooking (Vasanthi et al. 2007). Recently, Yarmand and Homayouni (2009) compared the quality of roasted chevon and mutton in conventional oven with microwave cooking. The present study was undertaken to assess the effect of cooking methods on quality of sheep, goat and rabbit comminuted meat products.

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MATERIALS AND METHODS

Malpura sheep, Sirohi goats of about two years of age and White Giant, Soviet Chinchilla rabbits of six months of age were slaughtered by traditional Halal method and the carcasses were manually deboned within 3 hr post mortem. Connective tissue and separable fat were trimmed off. The nuggets and patties formulations consist of lean meat 65%, ice flakes 10%, vegetable oil 10%, maida 5%, spices 1.5%, condiments 3%, common salt 1.8%, sugar 0.5%, tetrasodium pyrophosphate 0.5% and sodium nitrite 100 ppm as common ingredients.

The meat was coarsely ground by mechanical mincer (8 mm plate). The minced meat was pre mixed with salt,

phosphate, ice flakes and nitrites for 2 hr and chopping was continued in a bowl chopper (Sumeet Super, Nasik, India), until a stable emulsion was formed. In the preparation of nuggets, the batter was filled in aluminum moulds and cooked for 25 minutes in cooker without pressure. The meat blocks were allowed to cool and sliced into nuggets of uniform size. For patties preparation, the batter was filled in glass moulds for shaping and cooked in a hot air oven at 150°C for 20 minutes.

Cooking yield was determined as the difference between cooked and raw weight and expressed in percentage. Stability of meat emulsion was determined as per the procedure of Towensend et al. (1968) with some modification. Shear force value of nuggets and patties was determined using Warner Bratzler shear press (GR Electric manufacturing Co. USA).

A press method was used for the estimation of Water holding capacity (WHC) following the method of Trout (1988). One gram of finely ground meat was placed between two filter papers. The filter papers and samples were then placed between two plexi glass screw plates and pressure was applied for one min. The moisture absorbed by the filter papers after removal of the tissue residue was taken as a measure of water holding capacity. The proximate analysis was carried out by AOAC (1984) methods.

The nuggets and patties were cut into 2 cm length pieces and randomly offered to the semi-trained panelists, comprising of seven members. The panelists were asked to score the product in 6 point scale (6= excellent, 1= very poor) for the sensory attributes. Three trials were conducted and the data were subjected to analysis of variance (Snedecor and Cochran 1968) and significant differences were compared by Duncan's multiple range test (Duncan 1955).

RESULTS AND DISCUSSION

The products quality attributes of sheep and goat meat are presented in Table 1. The cooking yield (%)was significantly ($P<0.05$) higher in nuggets (moist heat cooking) than patties (dry heat cooking). This may be attributed to the excessive moisture loss in cooking by dry heat method. Moreover, moisture absorption during steam cooking can not be ruled out for this yield difference. No significant difference was observed in emulsion stability prepared from sheep and goat (data not presented). Keshri et al. (1986) and Mandal et al. (1996) also reported that cooking methods had significant effect on yield of chicken meat and balls.

Shear force value was almost similar for nuggets and patties from both sheep and goat. Though, Dreeling et al. (2000) reported that Warner Bratzler peak energy

Table 1: Effect of cooking method on quality attributes of sheep and goat meat product

Traits	Nuggets		Patties	
	Sheep	Goat	Sheep	Goat
Physical propertiesPhysical properties				
Cooking yield %	92.48^{a}±0.64	93.15^{a}±0.62	83.25^{c}±1.55	87.50^{b}±0.63
Shear force value (kg/cm^2)	0.24±0.09	0.41±0.13	0.33±0.10	0.33±0.11
WHC %	67.81^{a}±0.69	64.02^{a}±1.92	41.74^{c}±1.80	51.27^{b}±1.45
Proximate Composition				
Moisture %	66.67^{a}±0.45	66.26^{a}±0.54	52.11b±1.60	54.65^{b}±0.62
Fat %	9.62^{b}±0.54	10.32^{b}±0.55	15.05^{a}±0.83	14.79^{a}±0.24
Protein %	8.75±0.59	10.91±0.53	11.49±0.41	12.27±0.38
Sensory Scores				
Colour	5.25±0.48	4.25±0.48	4.50±0.50	4.00±0.71
Odour	4.75±0.25	4.25±0.48	4.50±0.29	4.25±0.48
Tenderness	4.50±0.29	3.75±0.48	4.50±0.29	4.00±0.58
Juiciness	4.25±0.63	4.50±0.29	4.00±0.71	3.75±0.48
Overall palatability	5.00±0.41	4.50±0.64	4.50±0.50	4.00±0.58

Means with different superscripts in a row differ significantly ($P<0.05$)

and cohesiveness (measured by texture profile analysis) were significantly affected by cooking method in low fat beef burgers. Water holding capacity was significantly ($P<0.05$) higher in nuggets as compared to patties.

Moisture content was significantly higher ($P<0.05$) in nuggets than patties (Table 1). However, the fat content showed a reverse trend while there was no species difference in moisture and fat content. This moisture variation could also be attributed to cooking yield. There was no significant difference in sensory attributes of nuggets and patties from sheep and goat meat whereas, in general, nuggets were preferred more by the panelists than the patties.

Table 2 shows the quality attributes of nuggets and patties from White Giant and Soviet Chinchilla rabbits. In rabbit meat product also, the effect of cooking method had similar influence on cooking yield as observed in sheep and goat meat product. Cyril et al. (1996) also reported that dry heat cooking caused highest cooking loss in rabbit meat as compared to water bath cooking (moist heat). Water holding capacity was significantly lower ($P<0.05$) in patties as compared to nuggets. No significant breed difference was obtained in proximate composition of nuggets or patties. However, there was significantly ($P<0.05$) more moisture and less fat in nuggets as compared to patties.

Cooking method had little influence on sensory colour and odour score of rabbit meat product (Table 2). However, tenderness was rated significantly lower ($P<0.05$) in patties than nuggets. Similar findings were obtained by Cyril et al. (1996) in rabbit meat. There was also more ($P<0.05$) juiciness in moist heat cooking (nuggets) than dry heat cooking (patties). This may be attributed to the higher moisture retention in moist heat cooking method. The overall palatability was superior in nuggets than patties.

The results indicated that irrespective of species, the yield characteristics of nuggets prepared by moist heat method are better than patties cooked by dry heat method. Further, it may be concluded that in sensory attributes especially juiciness and overall palatability, nuggets rated superior than patties. Overall, cooking method had a significant influence on the quality characteristics of sheep, goat and rabbit emulsion type meat product.

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Table 2: Effect of cooking method on quality characteristics of rabbit meat product

Traits	Nuggets		Patties	
	White Giant	Soviet Chinchilla	White Giant	Soviet Chinchilla
Physical properties				
Cooking yield %	$92.65^{a}\pm0.78$	$90.79^{a}\pm0.83$	$78.07^{b}\pm1.24$	$82.73^{b}\pm0.99$
Shear force value (kg/cm^2)	0.43±0.10	0.38±0.10	0.47±0.08	0.39±0.06
WHC %	$51.94^{b}\pm1.12$	$62.38^{a}\pm1.45$	$43.42^{c}\pm0.63$	$42.98^{c}\pm1.54$
Proximate Composition				
Moisture %	$63.62^{a}\pm0.64$	$63.31^{a}\pm0.17$	$54.99^{b}\pm0.86$	$50.00^{b}\pm0.70$
Fat %	$10.07^{b}\pm0.12$	$9.09^{b}\pm0.37$	$13.73^{a}\pm0.38$	$15.29^{a}\pm0.57$
Protein %	12.83±0.98	11.97±0.62	14.55±0.61	12.14±0.53
Sensory scores				
Colour	4.40±0.24	4.20±0.37	3.80±0.20	4.20±0.37
Odour	4.00±0.55	4.20±0.37	3.00±0.31	3.20±0.20
Tenderness	$4.60^{a}\pm0.40$	$4.20^{a}\pm0.20$	$3.40^{b}\pm0.24$	$3.40^{b}\pm0.24$
Juiciness	$4.60^{a}\pm0.51$	$4.00^{a}\pm0.31$	$3.20^{b}\pm0.37$	$3.20^{b}\pm0.20$
Overall palatability	$4.60^{a}\pm0.24$	$4.40^{a}\pm0.51$	$3.20^{b}\pm0.37$	$3.40^{b}\pm0.24$

Means with different superscripts in a row differ significantly ($P<0.05$)

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