



International Journal of Veterinary Sciences and Animal Husbandry



ISSN: 2456-2912

NAAS Rating (2025): 4.61

VET 2026; 11(1): 175-182

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www.veterinarypaper.com

Received: 02-10-2025

Accepted: 12-11-2025

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A comparative analysis of traditional head meat curry from sheep and goat

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DOI: <https://www.doi.org/10.22271/veterinary.2026.v11.i1c.2951>

Abstract

A study was conducted to standardize and evaluate the quality characteristics of head meat curry from sheep and goat. The head meat curry prepared from sheep and goat were evaluated for physico-chemical characteristics such as cooking yield, proximate composition and sensory evaluation. The goat head meat curry had significant ($p < 0.05$) higher moisture than sheep head meat curry. No significant difference was noticed for percent protein and percent fat. The total ash values of goat head meat curry were significantly ($p < 0.05$) higher than sheep head meat curry. There is no significant difference between cooking yield of sheep head meat curry and goat head meat curry. The sensory properties of goat head meat curry were significantly ($p < 0.05$) higher than sheep head meat curry. Hence the goat head meat curry showed higher sensory properties and higher proximate values indicating its health benefits and had advantage of promoting consuming goat head meat curry in the areas where goat head meat had comparatively lower values than sheep head curry.

Keywords: Head meat curry, nutritive value, health benefits sensory properties, pressure cooking, cooking yield proximate composition and more minerals

Introduction

India has a large number of ethnic groups, diverse traditions, culture and varied food habits. A variety of food products of indigenous taste are being prepared and consumed in India, and these products vary from region to region and place to place. Traditional processing of various meat products with locally available specific ingredients has resulted in the development of products with unique sensory attributes.

The demand for ethnic/heritage meat products is ever growing because of rapid changes in consumer preferences. Traditional meat products are attracting a greater consumer response in India. The traditional meat products are also being processed at fast food corners, restaurants, star hotels etc. and are liked by many for their unique taste. Consumer preferences have also shifted to different custom designed products from stereotype traditional foods supplied in bulk.

In South India a wide variety of traditional meat products are being prepared by the natives of the region which reflect their social and cultural life. There is a wide range of traditional meat products of South India which is due to use of different kinds of meat. The method of preparation varies on the basis of availability of materials, climate, culture and overall knowledge of process and methods.

The processing of traditional food depends on the availability of raw materials, season and local taste preferences which have passed through generations. Head meat curry is popular ethnic meat products of India and are famous for their health benefits. The consumption of this product will provide good strength and support for bones, acts as source of collagen for skin health and joint support and these are being prepared in different parts of South India in different styles depending upon the region.

Materials and Methods

Standardization of Head meat curry

Hygienically processed raw head meat from both sheep and goat species were procured from the local market were utilized in this study.

Spice mix formulation

The spices and their levels in the spice mix formulation used in this study were presented in Table 1.

Spices were cleaned thoroughly without any extraneous materials and were ground individually and sieved to obtain a fine powder. Spice mix was prepared and stored for subsequent use.

Condiments

Green condiments such as ginger and garlic in the ratio of 1:1 were used in this study. The external covers of garlic were peeled off, washed thoroughly under running tap water and made into small pieces. The ginger was washed thoroughly under running tap water and made into small pieces. The cut pieces were ground in a mixer-cum-grinder to the consistency of a fine paste and later it was utilized as per the Formulation given in Table 2 and 3.

Onions were used in this study. The external coverings of onions were peeled off, washed thoroughly under running tap water and made into small pieces. The cut pieces were utilized as per the formulation given in Table 2 and 3.

Table 1: Composition of Spice Mix (gm%)

Spices	Parts/100 g
Cinnamon powder	25
Cardamom powder	25
Cloves powder	25
Shai jeera powder	25
Total	100.00

Procedure for the preparation of Head meat curry (sheep and goat)

Hygienically processed head meat (sheep and goat) was procured from the local market and washed properly. The procedure for the preparation of head meat curry is presented in the form of a flow chart in Figure 1. Head meat curry was formulated with raw head meat (sheep, goat), vegetable oil, chopped onions, spice mix, salt, turmeric, red chili powder, green condiment mix, pepper powder, coriander powder, coconut powder and water constituting the formulation as shown in Table 2.

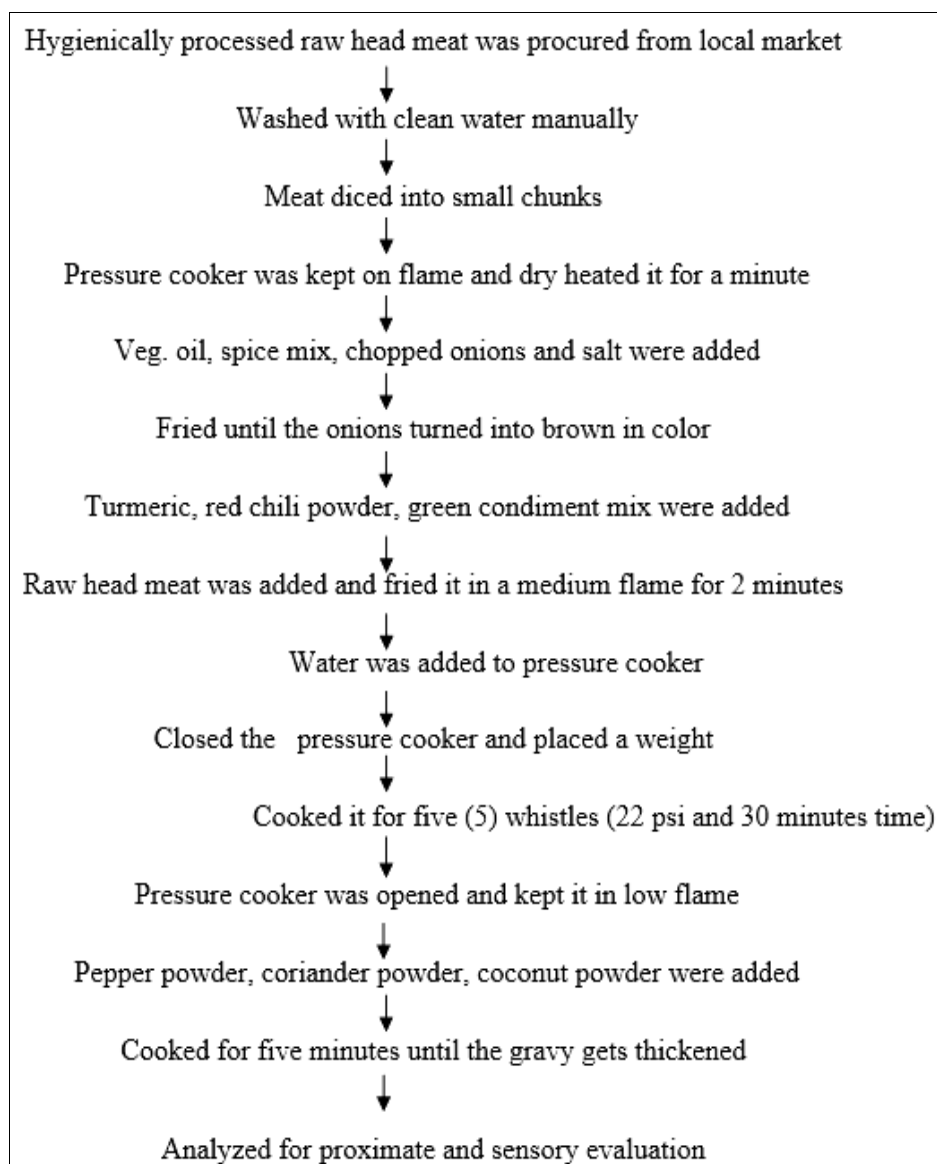


Fig 1: Flow chart for the preparation of Head meat curry (sheep and goat)

Table 2: Formulations of Head meat curry (sheep and goat)

S. No	Ingredients	Grams
1.	Raw Head Meat	1000
2.	Vegetable Oil	30
3.	Spice Mix	8
4.	Chopped Onions	200
5.	Salt	14
6.	Turmeric	2
7.	Red Chilli Powder	2
8.	Green Condiment Mix	20
9.	Pepper Powder	2
10.	Coriander Powder	5
11.	Coconut Powder	20
12.	Water	1000

Determination of physico-chemical characteristics of head meat curry

The head meat curry were subjected to quality analysis viz., physico-chemical characteristics like cooking yield, proximate composition and sensory evaluation. The difference between Head meat curry of sheep and goat and was determined based on the results obtained for the above parameters with greater emphasis being given to organoleptic evaluation.

Analysis of Head meat curry (sheep and goat)

Physico-chemical characteristics

Cooking yield

Cooking yield was estimated by recording the difference between the pre and post cooking weights of head meat curry expressed in percentage.

$$\text{Cooking yield \%} = \frac{\text{Weight of sample after cooking}}{\text{Weight of sample before cooking}} \times 100$$

Proximate composition

The per cent moisture, crude protein and crude fat were estimated as per the procedures outlined by AOAC (1994).

Organoleptic/ Sensory evaluation

The head meat curry of sheep and goat were subjected to sensory evaluation on a 9 point hedonic scale (Annexure-II) by trained panel of five judges.

Results

Cooking yield of Head meat curry from sheep and goat

The Mean $\pm$ S.E values of cooking yield of head meat curry from sheep and goat were presented in Table 3.

The overall Mean $\pm$ S.E values of cooking yield of head meat curry of sheep was 81.01 ± 0.75 and goat is 81.96 ± 0.95 respectively. There was no significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had higher (non-significantly) cooking yield values when compared to sheep head meat curry.

Table 3: Mean $\pm$ S.E of cooking yield of Head meat curry from sheep and goat

Parameter	SHMC	GHMC
Cooking yield	81.01^{NS}	81.96^{NS}

NS: Non-significant

SHMC: Sheep Head meat curry

GHMC: Goat Head meat curry

Sensory quality of head meat curry from sheep and goat

The Mean $\pm$ S.E values of head meat curry from sheep and

goat were presented in Table 4.

The Mean $\pm$ S.E values of colour scores of head meat curry of sheep is 8.36 ± 0.05 and goat is 9.33 ± 0.04 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher colour scores when compared to sheep head meat curry.

The Mean $\pm$ S.E values of flavour scores of head meat curry of sheep is 8.36 ± 0.02 and goat is 9.53 ± 0.01 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher flavour scores when compared to sheep head meat curry.

The Mean $\pm$ S.E values of juiciness scores of head meat curry of sheep is 8.63 ± 0.02 and goat is 9.41 ± 0.03 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher juiciness scores when compared to sheep head meat curry.

The Mean $\pm$ S.E values of tenderness scores of head meat curry of sheep is 8.70 ± 0.01 and goat is 9.10 ± 0.01 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher tenderness scores when compared to sheep head meat curry.

The Mean $\pm$ S.E values of mouth coating scores of head meat curry of sheep is 8.53 ± 0.01 and goat is 9.33 ± 0.01 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher mouth coating scores when compared to sheep head meat curry.

The Mean $\pm$ S.E values of overall acceptability scores of head meat curry of sheep is 8.66 ± 0.01 and goat is 9.46 ± 0.01 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher overall acceptability scores when compared to sheep head meat curry.

Table 4: Mean $\pm$ S.E of sensory quality of head meat curry from sheep and goat

Parameter	SHMC	GHMC
Colour	$8.63 \pm 0.02^{\text{b}}$	$9.33 \pm 0.04^{\text{a}}$
Flavour	$8.36 \pm 0.02^{\text{b}}$	$9.53 \pm 0.01^{\text{a}}$
Juiciness	$8.63 \pm 0.02^{\text{b}}$	$9.41 \pm 0.03^{\text{a}}$
Tenderness	$8.70 \pm 0.01^{\text{b}}$	$9.10 \pm 0.01^{\text{a}}$
Mouth Coating	$8.53 \pm 0.01^{\text{b}}$	$9.33 \pm 0.01^{\text{a}}$
Overall Acceptability	$8.66 \pm 0.01^{\text{b}}$	$9.46 \pm 0.01^{\text{a}}$

SHMC: Sheep Head meat curry

GHMC: Goat Head meat curry

Percent moisture of Head meat curry from sheep and goat

The Mean $\pm$ S.E values of Per cent moisture of head meat curry from sheep and goat are presented in Table 7.

The overall Mean $\pm$ S.E values of Percent moisture of head meat curry of sheep is 70.79 ± 2.03 and goat is 77.98 ± 0.51 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher percent moisture values when compared to sheep head meat curry.

Percent protein of Head meat curry from sheep and goat

The Mean $\pm$ S.E values of percent protein of head meat curry from sheep and goat are presented in table 5.

The overall Mean $\pm$ S.E values of percent protein of head meat curry of sheep is 10.34 ± 0.38 and goat is 11.96 ± 0.26 respectively. There was no significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had higher Percent Protein values non-significantly when compared to sheep head meat curry.

Per cent Fat of Head meat curry from sheep and goat

The Mean $\pm$ S.E values of Percent Fat of head meat curry from sheep and goat are presented in Table 5.

The overall Mean $\pm$ S.E values of Percent Fat of head meat curry of sheep is 6.09 ± 0.18 and goat is 5.94 ± 0.11 respectively. There was no significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where sheep head meat curry had higher Percent Fat values non-significantly when compared to goat head meat curry.

Total Ash of Head meat curry from sheep and goat

The Mean $\pm$ S.E values of Total Ash of head meat curry from sheep and goat are presented in table 5.

The overall Mean $\pm$ S.E values of Total Ash of head meat curry of sheep is 2.32 ± 0.91 and goat is 5.91 ± 0.56 respectively. There was a significant difference between overall Mean $\pm$ S.E of sheep head meat curry and goat head meat curry where goat head meat curry had significantly ($p < 0.05$) higher Total ash values when compared to sheep head meat curry.

Table 5: Mean $\pm$ S.E of proximate composition of Head meat curry from sheep and goat

Parameter	SHMC	GHMC
Moisture	70.79 ± 2.03^b	77.98 ± 0.51^a
Crude Protein	10.34 ± 0.38^{NS}	11.96 ± 0.26^{NS}
Crude Fat	6.09 ± 0.18^{NS}	5.94 ± 0.11^{NS}
Total Ash	2.32 ± 0.19^b	5.91 ± 0.56^a

NS: Non-significant

SHMC: Sheep Head meat curry

GHMC: Goat Head meat curry

Discussion**Standardization of head meat curry from sheep and goat****Cooking yield (%)**

The mean per cent cooking yield of head meat curry from sheep and goat were non-significant ($p < 0.05$) where head meat curry from goat had higher cooking yield values than head meat curry and paya from sheep. Lower cooking yield in sheep head meat curry can be attributed to greater degree of shrinkage of muscle fibers and protein coagulation in muscle cooked at high temperature in pressure cooking (Raj Narayan *et al.* 2015) [26]. Meat products with a high cooking yield tend

to be more juicy and tender than products with low cooking yield (Das *et al.* 2014) [8].

The results obtained in this study were in agreement with the reports of Babikerl *et al.* 1990 [5], Kandeepan *et al.* (2010) [13] in buffalo meat keema and buffalo meat curry, Raj Narayan *et al.* (2015) [26] in goat meat curry.

Sensory / Organoleptic evaluation**Colour**

The results of the present study indicated that overall mean colour scores of goat head meat curry were significantly ($p < 0.05$) higher than sheep head meat curry. The higher color scores for goat head meat curry might be due to darker red color of goat meat than lamb (Babikerl *et al.* 1990) [5]. Similarly, Pophiwa *et al.* (2017) [25] revealed that goat meat is darker than other types of red meat. The results were in agreement with Murshed *et al.* (2014) [21] who compared carcass and meat quality of black Bengal goat and indigenous sheep of Bangladesh, Sharma *et al.* (2018) [30] in meat nuggets prepared from different food animals and Hye-Jin Kim *et al.* (2019) [10] in nutritional and anti oxidative properties of black goat meat cuts.

Flavour

Flavour is a complex sensation involving odour and taste. Flavour is important both aesthetically and physiologically for improving the secretion of digestive juices. Many types of heat induced reactions of cooking leads to the production of meat flavours. Meat flavour is thermally derived, since uncooked meat has little or no aroma and only a blood-like taste. Only after cooking and a series of thermally induced complex reactions that occur between the many different non-volatile compounds of the lean and fatty tissues does meat become flavoursome (Calkins and Hodgen, 2007; Mottram, 1998) [7]. Hundreds of compounds contribute to the flavour and aroma of meat and are very complex attributes of meat palatability. Many of these compounds are altered through storage and cooking, making meat flavour an incredibly complex topic (Calkins and Hodgen, 2007) [7]. The main reactions during cooking, which result in aromatic volatile production, are the Maillard reactions between amino acids and reducing sugars, and the thermal degradation of lipid. In general, amino compounds condense with the carbonyl group of a reducing sugar in the presence of heat. This produces glycosylamine, which is rearranged and dehydrated to form furfural, furanone derivatives, hydroxyketones and dicarbonyl compounds (Calkins and Hodgen, 2007) [7]. The broad array of flavour compounds found in meat includes hydrocarbons, aldehydes, ketones, alcohols, furans, triphenes, pyrroles, pyridines, pyrazines, oxazoles, thiazoles, sulphurous compounds and many others. Sulphurous compounds occur at low concentrations, but their very low odour thresholds make them potent aroma compounds and important contributors to the aromas of cooked meat. Generally, flavour and aroma are two complex attributes of meat affected by species, age, fatness and type of tissue, locality, gender, diet and method of cooking (Calkins and Hodgen, 2007; Muchenje *et al.*, 2009; 2010) [7, 19, 20].

The results of the study indicated that overall mean flavour scores for head meat curry from goat were significantly ($p < 0.05$) higher than head meat curry from sheep. The higher flavour scores for goat head meat curry might be due to its less strong flavor (mild) in goat meat than in lamb (Babikerl *et al.* 1990) [5]. Further Schonfeldt *et al.*, (1993) [27] studied about the flavour and tenderness related quality characteristics of goat and sheep meat and reported that sheep meat had a

more intense aroma, it was more tender, contains less fibrous tissue residue and the species flavour and was more pronounced (typical) than that of Angora and Boer goat meat. The results were in agreement with Murshed *et al.* (2014) ^[21] in comparison of carcass and meat quality of black Bengal goat and indigenous sheep of Bangladesh, Sharma *et al.* (2018) ^[30] in meat nuggets prepared from different food animals and Hye-Jin Kim *et al.* (2019) ^[10] in nutritional and anti oxidative properties of black goat meat cuts.

Juiciness

Juiciness in meat products has two organoleptic components. The first is the impression of wetness during the first few chews, due to rapid release of meat fluid, and the second is the sustained juiciness due to stimulatory effect of fat on salivation. Juiciness is said to be an important factor in the eating quality of meat. The main factor determining the juiciness of meat is the end-point temperature. The higher the end-point temperature, the higher is the cooking loss and the lower the juiciness (Aaslyng *et al.*, 2003). Generally, juiciness of meat is directly related to the intramuscular lipids and moisture content of the meat (Muchenje *et al.*, 2008a) ^[17]. The results of the study indicated that overall mean juiciness scores for head meat curry from goat were significantly ($p < 0.05$) higher than head meat curry from sheep. The reason for higher juiciness scores in goat head meat curry was due to high water retention and optimum fat content present in the product (Sharma *et al.* 2018) ^[30]. Further Schonfeldt *et al.*, (1993) ^[27] studied about the flavour and tenderness related quality characteristics of goat and sheep meat and reported that in general, Angora goat meat was found to be juicier than Boer goat meat. Drip loss increased significantly with increased animal age. With increasing fatness of carcasses, the juiciness of the cooked cuts decreased and the expressible moisture content of the meat increased. The results were in agreement with Raj Narayan *et al.* (2015) ^[26] in goat meat curry, Sharma *et al.* (2018) ^[30] in meat nuggets prepared from different food animals.

Tenderness

Tenderness in meat products is rated as the most important attribute by the average consumer and appears to be sought at the expense of flavour or colour. Tenderness is a quality of meat gauging how easily it is chewed or cut. Tenderness is a desirable quality, as tender meat is softer, easier to chew, and generally more palatable than harder meat. Consequently, tender cuts of meat typically command higher prices. The tenderness depends on a number of factors including the meat grain, the amount of connective tissue, and the amount of fat. Tenderness can be increased by a number of processing techniques, generally referred to as tenderizing or tenderization.

The two main components to meat tenderness are myofibrillar (muscle) and connective tissue (collagen) components (Xazela *et al.*, 2011) ^[34]. Factors such as fat content, muscle fibre composition, electrical stimulation, aging regime and cooking also can affect tenderness (Muchenje *et al.*, 2008b) ^[17]. The results of the study indicated that overall mean tenderness for head meat curry from goat were significantly ($p < 0.05$) higher than head meat curry from sheep. Higher tenderness scores in goat head meat curry can be attributed to the cooking methods used in this study. Shija *et al.* (2013) ^[29] studied on chemical composition and meat quality attributes of indigenous sheep and goat and reported that goat meat tends to be less tender, with higher shear force values and

collagen content. The cooking methods may be responsible for increased tenderness scores of head meat curry of goat meat. This may be strengthened by the results of the work done by Boccard (1973) ^[6] who found higher correlations between collagen solubility and tenderness with moist-heat cooking methods, than with dry cooking methods. The explanation was given that as more water molecules are introduced between the collagen chains, more collagen can swell and be removed, and hence the more tender the meat. Higher tenderness scores in goat head meat curry and paya may also be attributed to lesser shrinkage of muscle fibers when cooked at high temperature in pressure cooking and compatibility of goat for head meat curry preparation (Sharma *et al.* 2018) ^[30]. The results were in agreement with Raj Narayan *et al.* (2015) ^[26] in goat meat curry, Sharma *et al.* (2018) ^[30] in meat nuggets prepared from different food animals.

Mouth Coating

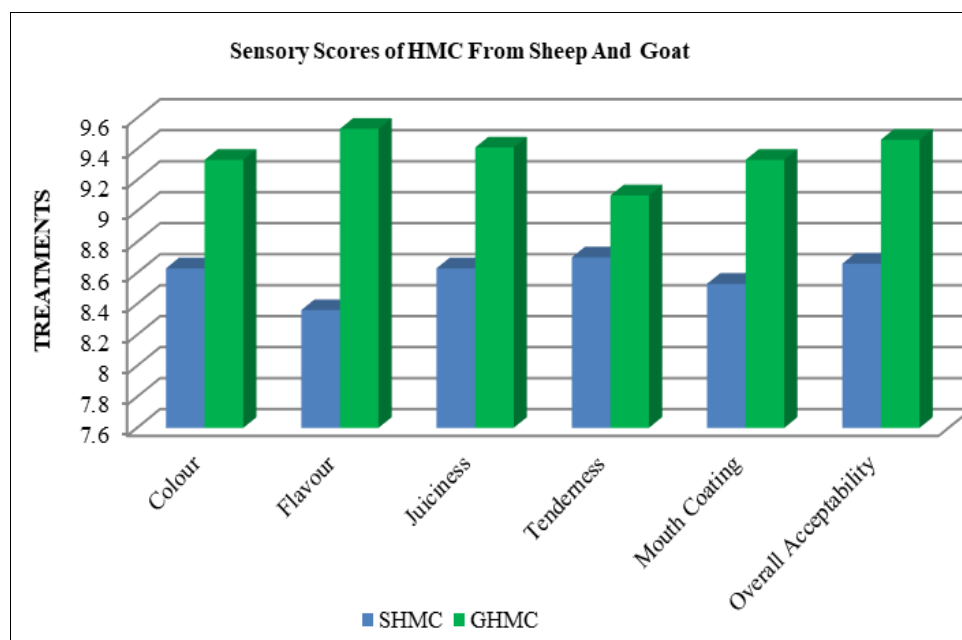
Mouth coating is defined as moisture, fat coating the oral cavity after swallowing. Mouth coating can be measured as the feeling of oiliness or coating of fat left on the palate and on the inside of the mouth immediately after swallowing the sample (Magoro *et al.*, 2012) ^[14].

The results of the study indicated that overall mean mouth coating scores for head meat curry from goat were significantly ($p < 0.05$) higher than head meat curry and paya from sheep. The higher mouth coating scores of goat head meat curry than that of sheep head meat curry and paya may be due to the fatty acid content of sheep meat. The fatty acids in adipose tissue of lamb are oleic, palmitic, stearic, linoleic, myristic and palmitoleic. This six fatty acids account for 90% of the fatty acids in the depot fat of ruminants. A greater proportion of stearic acid in lamb fat than in other meats results in a higher melting point and undesirable mouth coating properties of lamb and mutton fat (Pearson and Dutson 1995) ^[24]. The results were in agreement with Murshed *et al.* (2014) ^[21] in comparison of carcass and meat quality of black Bengal goat and indigenous sheep of Bangladesh.

Overall acceptability

Overall acceptability is the composite feeling of acceptance based on colour, flavour, juiciness and tenderness. More often consumer perceptions on the acceptability of meat is linked to socio-cultural factors, especially in the developing countries. Although, goat meat and its products are also of satisfactory eating quality, factors such as gender, tribe and age tend to affect acceptability of chevon from one community to the next (Mahanjana and Cronje, 2000; Dyubele *et al.*, 2010) ^[15, 9]. Found the sensory acceptability of chevon from indigenous South African goats is an acceptable meat in the market and can be as acceptable as mutton, provided that the meat is from young goats of about a year to two years old.

The results of the study indicated that mean overall acceptability scores for head meat curry from goat were significantly ($p < 0.05$) higher than head meat curry from sheep. The higher overall acceptability of goat head meat curry was attributed to higher color, flavor, juiciness, tenderness and mouth coating scores. The results were in agreement with Murshed *et al.* (2014) ^[21] in comparison of carcass and meat quality of black Bengal goat and indigenous sheep of Bangladesh, Raj Narayan *et al.* (2015) ^[26] in goat meat curry and Sharma *et al.* (2018) ^[30] in meat nuggets prepared from different food animals.



Proximate composition

Per cent moisture

The results of the study revealed that the per cent moisture of head meat curry from sheep differ significantly ($p < 0.05$) with head meat curry from goat where head meat curry and paya from goat had more moisture than sheep head meat curry. This may be due to goat meat is characterised by higher moisture content (Shija *et al.* 2013) [29]. The higher moisture content of goat meat might be due to the relative lower proportion of intramuscular fat in sheep. This was similar to the statement of Stankov *et al.* (2002) [32] who reported that the decrease in moisture content in meat has been due to increase in fat content. The results were in agreement with Babikerl *et al.* (1990) [5], James and Berry (1997) [11], Tshabalala *et al.* (2003) [33], Sen *et al.* (2004) [28], Mushi *et al.* (2008) [22], Shija *et al.* (2013) [29], Murshed *et al.* (2014) [21] in carcass and meat quality in goat.

Per cent protein

Globally consumers have become more health conscious and now exert strong influence regarding the acceptability of certain foods. Over and above considering the sensory attributes, nutritional value and convenience factors associated with meat, currently consumers demand lean meat with less saturated fatty acids, which has been demonstrated to have less negative impacts on health compared to fatty meat rich in saturated fatty acids. Besides being a good source quality protein for human consumption, chevon has a low fat and cholesterol content, has a higher concentration of desirable and unsaturated fatty acids, which are known to have beneficial health effects in the human body.

The results of the study revealed that the per cent protein of head meat curry from sheep differ non-significantly ($p < 0.05$) with head meat curry from goat where head meat curry and paya from goat had more protein than sheep head meat curry. This may be due to the sarcoplasmic protein concentration of the goat meat was significantly ($p < 0.001$) greater than that of lamb while the myofibrillar concentration was similar in the two species (Babikerl *et al.* 1990) [5].

The results were in agreement with Babikerl *et al.* (1990) [5], Tshabalala *et al.* (2003) [33], Shija *et al.* (2013) [29], Niedziolka and Lendzion (2006) [23], Mushi *et al.* (2008) [22], Murshed *et al.*

al. (2014) [21] in composition and meat quality attributes of sheep and goat.

Per cent fat

The results of the study revealed that the per cent fat of head meat curry from sheep differ non-significantly ($p < 0.05$) with head meat curry from goat where head meat curry and from goat had less fat than sheep head meat curry. The lower per cent fat in goat head meat curry and paya is due to the goat meat is characterized by low intramuscular fat and higher moisture content (Shija *et al.* 2013) [29].

The results were in agreement with Babikerl *et al.* (1990) [5], James and Berry (1997) [11], Mahgoub and lodge (1998) [16], Tshabalala *et al.* (2003) [33], Niedziolka and Lendzion (2006) [23], Mushi *et al.* (2008) [22], Shija *et al.* (2013) [29], Murshed *et al.* (2014) [21] in carcass and meat quality in goat.

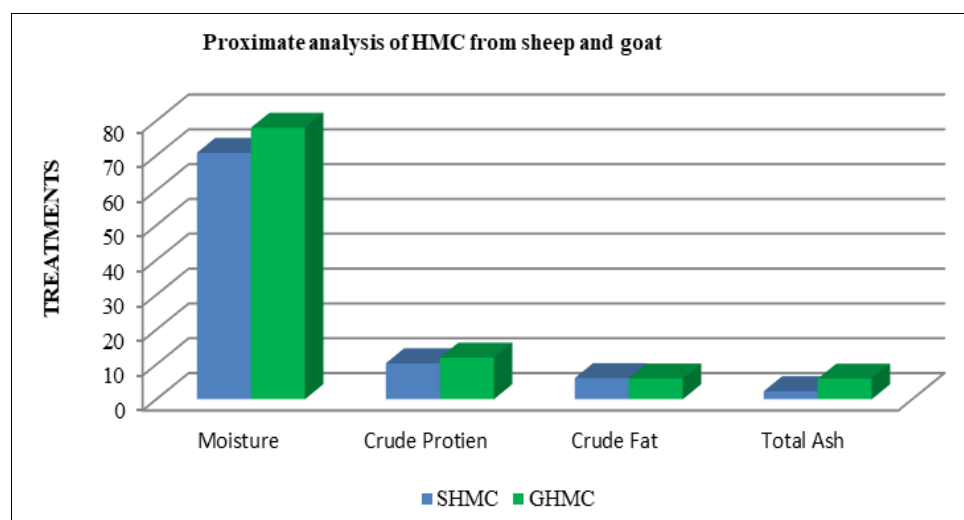
Total ash

Goat meat is a rich source of various minerals. Chemical ash, which comprises ~3.5% of total body weight, represents the inorganic material and is composed mainly of minerals. The ash content of goat meat is influenced by several factors including breed, age, sex, litter size and cooking method. There are about 90 natural elements in the body, of which only about 40 are essential. Some of the elements, the trace elements, are present in the animal body in small proportions (≤ 50 mg/kg of dry matter). Others, which are found in larger quantities, are known as macroelements and comprise the major elements of ash. The most common macroelements in the body include calcium, phosphorus, potassium, sodium and magnesium. The major trace elements are iron, copper, zinc, selenium and manganese, plus several others (cobalt, cadmium, lead, nickel and vanadium). Factors that affect the mineral concentration in animal tissues include species, type of tissue, muscles, sex, age, breed, diet and cooking method.

The results of the study revealed that the total ash of head meat curry from sheep differ significantly ($p < 0.05$) with head meat curry from goat where head meat curry from goat had more total ash than sheep head meat curry. The higher total ash in goat head meat curry and paya is due to goat meat contained little fat and therefore relatively higher proportions of protein and minerals (Tshabalala *et al.*, 2003) [33]. The results were in agreement with James and Berry (1997) [11],

Tshabalala *et al.* (2003) ^[33], Niedziolka and Lendzion (2006) ^[23], Mushi *et al.* (2008) ^[22], Alamin (2019) ^[2] in meat quality

traits of indigenous lambs and goat kids from extensive production system.



Conclusion

The physico chemical properties of head meat curry such as cooking yield, proximate composition and sensory evaluation revealed that goat head meat curry has more cooking yield, sensory scores, proximate values of ash are higher were significantly higher which will help in also supports gut health, boosts the immune system, and promotes skin health. Other benefits include providing protein for muscle strength and potentially aiding in weight loss due to its high protein content. This will inturn will fetches more income to the producers and had advantage of promoting consuming goat head meat curry in the areas where goat head meat had comparatively lower values than sheep head curry.

Conflict of Interest

Not available.

Financial Support

Not available.

Reference

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How to Cite This Article

Gupta RSD, Rao BE, Nagamallika E, Babu AJ, Nath DN. A comparative analysis of traditional head meat curry from sheep and goat. *International Journal of Veterinary Sciences and Animal Husbandry.* 2026;11(1):175-182.

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