Effect of season on goat meat composition under field and farm rearing conditions

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Abstract

Goat meat is one of the most widely consumed meats in the world. The increasing economic importance of goat production in the world can be attributed to the increase in demand for its meat. This is because goats are widely distributed and well adapted to various environmental conditions and scarce feed resources. They are also able to utilize marginal land to produce high-quality animal protein products. The study was conducted at the Central Institute for Research on Goats, Makhdoom, Mathura, under the Nutrition Feed Resources and Products Technology Division, for the study of farm rearing conditions. Field samples were collected from different villages. The average values of moisture percentages in summer, rainy and winter is 75.19±0.15, 75.21±0.13 and 76.49±0.21, respectively. Protein content in summer, rainy and winter is 19.89±0.03, 19.96±0.14 and 19.20±0.12, respectively. Fat percentages in summer, rainy and winter are 3.049±0.03, 2.899±0.02 and 2.661±0.02, respectively and Ash percentages are 1.874±0.05, 1.930±0.03 and 1.655±0.03. The chemical quality of goat meat, in general, was slightly better in goats reared under field conditions than in farm conditions.

Introduction

Goat meat being high quality protein source is the choicest meat in domestic market. It is leaner than other red meats and its fat has desirable fatty acids. The goat was domesticated as early as 6-7 BC, as evidenced by archaeological remains collected in western Asia. It has since played a significant socio-economic role in the evolvement of human civilization around the world. It is particularly important in the tropics and subtropics where it is used as a major source of meat, milk, fibre, skin and manure in many traditional societies. It is also used as a readily cashable source of investment. There is a tendency to keep goats as a stock of wealth and sell them proportionally less when their number rises (Seleka, 2001). Goats as mixed feeding opportunists are able to adapt to seasonal and geographical changes and utilize low-quality rangelands to produce high-quality animal protein, which is extremely important (Lu, 1987). Goats have become important livestock in arid and semi-arid regions of the world because of their characteristics of versatility in harvesting forage and their ability to survive adverse foraging conditions. As opportunistic foragers, goats are able to maintain a

relatively high-quality diet, even under diverse conditions, and at times they prefer shrubs over other types of range plants (Ramirez, 1999). One of the most important products from goats is meat. The majority of goats worldwide are regarded as meat type, with only about 5% of goats being classified as dairy type (Thompson, 2006). On average, the income from dairy systems (particularly in Europe) tends to be higher than that from meat systems due to favorable market prices for milk products and a greater dependence on subsidies in the meat extensive systems (Rancourt et al., 2006). However, the importance of the goat as a meat-producing animal is increasing as its meat is becoming accepted in many new markets in societies that have not previously consumed goat meat. Over the past several decades, specialized meat-goat breeds have been developed, among which the Boer goat is the most notable. The breed has been developed from a genetic pool of native African, Indian, European and Angora goats, and active selection has been carried out within the breed over the past half century. Other specialized meat-goat breeds such as Kalahari have followed the Boer goat. More recently, Tianfu goats in China have emerged as a new breed with excellent performance for meat production and reproduction efficiency, and they are easily adapted to the local environment (Wang et al., 2009). Some of the factors that make the goat a successful meat-producing animal, especially under extensive systems, include: the ability to graze and utilize poor forages; the ability to walk long distances; short generation intervals and high reproductive rates; high turnover rates of investment (low-risk investment); smaller carcasses, which are conveniently marketed, preserved or consumed over short periods of time; the feasibility of herding by children and women due to the flock instinct; and their ability to stand droughts (Lebbie, 2004). The Jakhrana breed is found in the North- West arid and semi-arid regions mainly in eastern

Rajasthan. The breed drives its name from the Jakhrana village in Alwar district where it is found in its purest form. They are large animals compare than other breed of goat. They coat is predominantly black with white spots on the ears and the muzzle is short and lustrous. The face line is straight, with a narrow and slightly bulging forehead.
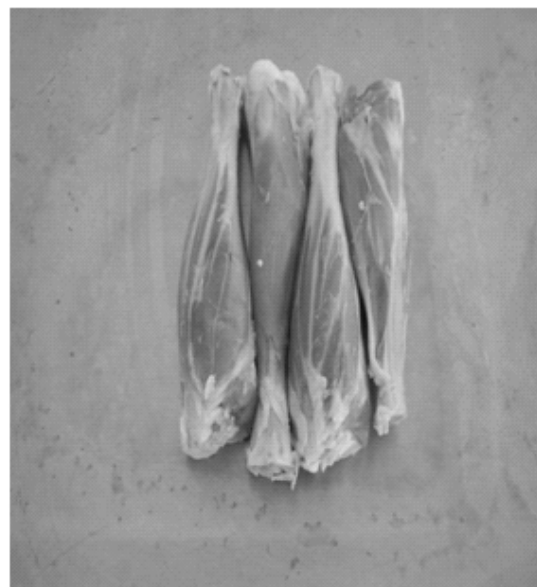

Fig. 1: Jakhrana goat carcass

The breed looks similar to the Beetal, the major difference being that the Jakhrana is taller. The ear is medium and the udder is large, with conical teats. Bucks of Jakhrana are an important source of meat and next generation goats. Farmers generally feed them natural pasture and stall feeding. This breed is well known for its milk and meat potential averaging a daily yield between 2 to 5 liters. According to the 18th livestock Census 2007, the number of Jakhrana goat in the country is 1,953,046 fairly widespread in the states of Rajasthan and Haryana. In some countries, such as Korea, goat meat has been used for its medicinal properties (Son, 1999). There are 18 countries with the highest goat populations in the world, with a range between 1 and 17% of the total world goat population. The top four countries are all from Asia, with 45% of the total world goat population. China and India have the largest goat populations, constituting approximately 32% of the total world goat population. With Pakistan and Bangladesh included, the Indian subcontinent has a sizeable goat population amounting to approximately 28% of the total world goat population. Meat breeds in India have a mature weight ranging from 19-37 kg at 15-18 months of age in contrast to large breeds that weigh 58-60 kg, while dwarf breeds weigh 15-25 kg at the same age (Taneja, 1982).

Methodology

The study was conducted at the central institute for research on goats, Makhdoom, Mathura, under the nutrition feed resources and products technology division, for the study of farm rearing conditions. Field samples were collected from different villages. The Jakhrana breed meat samples were available in different villages of Mathura, India (27° 10´N, 78-° 002´E and 169 m above MSL). Geologically the Institute land falls under Jamuna alluvial is semi arid. Temperature ranges between 6° C in winter to as high 45° C in summer. Annual average rainfall is a period of 50 -60 days. Monsoon arrives in mid July and remains active till mid September (Agnihotri, M. K.

and Rjkumar, V. 2007). The methodology used was an adaption from Bourbouze (1995) and Alvarez Funes and Paz Motola (1997), with the following phases: (i) sample selection and construction of the data – gathering instrument, and (ii) information treatment and statistical processing, including the review and selection of variables for the analysis of types, application of multivariate statistical techniques and analysis of variance and contingency tables. Experimental goats and management: - The breeds of goat used for the study were the Jakhrana. It was a total of 12 samples under field and farm rearing conditions. Farm goats managed at C.I.R.G. farm and field samples were collected from different villages.

Sample collection and analysis: - A total of 36 meat samples were collected from field and farm rearing condition 12 summer (field 6 and farm 6), Rainy 12 (field 6 and farm 6) and Winter 12 (field 6 and farm 6) meat samples from each breed. The leg and the shoulder of each half carcass were separated, deboned and ground to prepare two composite samples from each organ. Meat samples were ground in a grinder and kept at -20°C until analysis. Moisture and protein content was determined according to the method of Association of Official Analytical Chemists (AOAC, 2000). Total Fat Content (TF) was extracted in Soxhlet Extraction Unit as described by AOAC (2000). Ash percentage was determined by gravimetric method as described by AOAC (2000) using muffle furnace.

Information treatment and statistical analysis: - The field and farm data were introduce into an excel matrix after checking for missing and abnormal data. Composition between the different quantities variable was performed using ANOVA table and RBD (atd" 5&1%) for analysis of meat samples.

Results and Discussion

The results on moisture in the meat of Jakhrana goat breed under field and farm rearing conditions in different seasons are presented in Table. Perusal of

data presented in the Table revealed that the moisture content in Jakhrana goat meat under field and farm rearing condition in different seasons i.e. summer, rainy and winter was found to be 75.26±0.16 and 75.11±0.15, 75.25±0.14 and 75.18±0.12 and 76.57±0.21 and 76.42±0.20 per cent, respectively. Data presented in above table suggested that the moisture content was higher in field rearing samples as compare to farm samples. But this variation was insignificant. The statistical analysis of these data revealed that effect of seasons on moisture content in meat was significantly different under field and farm rearing samples at 1 % level of significance. It is also observed that moisture per cent was found highest in winter season than summer and rainy season goat meat under field as well as farm rearing samples. It is evident from the above Table that protein content in the meat of Jakhrana goat breed under field and farm rearing condition in summer, rainy and winter seasons was 19.883±0.16 and 19.90±0.19, 19.93±0.11 and 19.99±0.16 and 19.17±0.09 and 19.228±0.15 per cent, respectively. It is observed from the above observations that similar protein content was found in field and farm rearing samples

in all seasons. It is also observed from the above table that lowest protein content was found in winter season whereas highest in rainy seasons under field and farm rearing conditions. The analysis of variance table also revealed that effect of season was significantly different in Jakhrana goat meat at 1 % level of significance.

The data laid down in the Table indicated that the fat content in meat of Jakhrana goat breed under field and farm rearing conditions in summer, rainy and winter seasons was found to be 3.05±0.03 and 3.050±0.02, 2.92±0.02 and 2.88±0.01 and 2.65±0.02 and 2.673±0.01 per cent, respectively. It is clear from the above table that there was no any variance in fat percentage was observed under field and farm rearing samples in all seasons. The ANOVA table revealed that effect of season on fat content in meat was significantly different under field as well as farm rearing conditions at 1 % level of significance. It is also observed from the above analysis that higher fat content was found in summer season meat and lowers in winter season under field as well as farm rearing conditions.

Table 1. Effect of seasons on the percentage of meat components of Jakhrana goats under field and farm rearing conditions.

Sl. No.	Component of Jakhrana goat meat		Field	Farm	Overall average	Test of significance	Table value (t) 5%	1%
1.	MOISTURE	(I) SUMMER	75.260±0.16 (6)	75.111±0.15 (6)	75.19±0.15 (12)	0.361[NS]	2.179	3.055
		(II) RAINY	75.250±0.14 (6)	75.178±0.12 (6)	75.21±0.13 (12)	0.296[NS]		
		(III) WINTER	76.565±0.21 (6)	76.415±0.20 (6)	76.49±0.21 (12)	0.683[NS]		
2.	PROTEIN	(I) SUMMER	19.883±0.16 (6)	19.90±0.19 (6)	19.89±0.03 (12)	0.663[NS]	2.179	3.055
		(II) RAINY	19.928±0.11 (6)	19.987±0.16 (6)	19.96±0.14 (12)	0.741[NS]		
		(III) WINTER	19.165±0.09 (6)	19.228±0.15 (6)	19.20±0.12 (12)	1.034[NS]		
1.	FAT	(I) SUMMER	3.048±0.03 (6)	3.050±0.02 (6)	3.049±0.03(12)	0.766[NS]	2.179	3.055
		(II) RAINY	2.917±0.02 (6)	2.880±0.01 (6)	2.899±0.02 (12)	0.914[NS]		
		(III) WINTER	2.648±0.02 (6)	2.673±0.01 (6)	2.661±0.02 (12)	0.636[NS]		
1.	ASH	(I) SUMMER	1.810±0.04 (6)	1.938±0.05 (6)	1.874±0.05 (12)	1.631[NS]	2.179	3.055
		(II) RAINY	1.905±0.02 (6)	1.955±0.04 (6)	1.930±0.03 (12)	0.711[NS]		
		(III) WINTER	1.622±0.03 (6)	1.688±0.02 (6)	1.655±0.03 (12)	0.916[NS])		

Note: Figure in parenthesis indicated number of samples. + = Significant at 5% level of significance, ++ = Significant at 1% level of significance

NS = Non Significant

Perusal of data presented in the Table indicated that the ash content of Jakhrana goat breed meat under field and farm rearing condition in summer, rainy and winter seasons was found to be 1.81±0.04 and 1.94±0.05, 1.91±0.02 and 1.96±0.04 and 1.62±0.03 and 1.69±0.02 per cent, respectively. It is observed from the above table that ash content in goat meat was higher in farm rearing conditions than field rearing conditions in all seasons but it was insignificant. The analysis of variance table revealed that effect of season on meat content in Jakhrana goat breed meat significant at 1 % level of significance. The results obtained on meat composition from present investigation in the meat samples of Jakhrana goat breed under field and farm rearing conditions are fully corroborated with the findings of Arun K Das, V Rajkumar (2010) who reported there were no significant differences between breeds and muscles in meat chemical composition among three Indian goat breeds. Barbari (10), Jamnapari (6) and Marwari (4) male goat kids were reared under semi-intensive management system and slaughtered at 13 month to study the differences if any, in the meat quality traits. pH and sensory attributes of Longissimus dorsi (LD) and Semimembranosus (SM) muscles were assessed for comparative meat quality evaluation. This study is a way to learn about the improvement of content in milk composition between different seasons under field and farm rearing condition. Therefore it provides a chance to separate the specific content from the milk as particular purpose at a time.

Table 2. ANOVAs for the effect of season on goat meat under field and farm rearing conditions.

Contents for the source of variance	Variance ratio		F- Value table	
	Field	Farm	5%	1%
Moisture	5.612[++]	6.0031[++]	3.30	5.33
Protein	8.118[++]	9.024[++]	3.30	5.33
Fat	11.326[++]	14.261[++]	3.30	5.33
Ash	6.032[++]	6.756[++]	3.30	5.33

Conclusion

The chemical quality of goat meat, in general, was slightly better in goats reared under field conditions than in farm conditions.

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