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Phenotypic and Carcass Characterization of Hassan Sheep

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ABSTRACT

Background: Hassan sheep is the third most populous breed of the five registered sheep breeds from Karnataka with limited studies on its morphological and carcass characteristics. Hence, the study was undertaken to know the present status of morphological and carcass characteristics of this breed.

Methods: A total of 34 randomly selected flocks were surveyed and the data on various parameters were collected. The morphometrical data was collected on 344 sheep belonging to eight flocks from the breeding tract. The carcass characteristics were documented by slaughtering six male lambs (between nine to twelve months of age).

Result: These sheep had varied coat colours *viz*. complete white (23.3%), white with light brown patches (58.1%) and white with black patches (18.6%) on head and neck region. It was observed that 40.4 per cent of males and only 1.4 per cent of females were horned. Atrophied ears were noticed in 2.3 per cent of these sheep. The average adult body length (cm), height at wither (cm), chest girth (cm), paunch (cm), ear length (cm), tail length (cm) and average adult body weight (kg) were 66.4±0.62, 65.03±1.45, 75.2±1.02, 76.5±1.38, 15.2±0.07, 11.5±0.07 and 32.7±2.03 in males and 63.8±0.85, 61.7±1.38, 71.8±2.32, 74.5±2.60, 15.0±0.34, 11.3±0.08 and 27.8±1.21 in females, respectively. The difference in body weight between males and females increased significantly over the age. The pre-slaughter weight (PSW), hot carcass weight (HCW) and dressing percentage recorded were 20.3±1.42 Kg, 9.5±0.23 kg and 46.80 per cent, respectively.

Key words: Carcass, Characterization, Hassan sheep, Morphometry.

INTRODUCTION

The Hassan sheep is a small to medium-sized sheep breed reared mainly for meat production in and around Hassan district of Karnataka State. It is among the five native sheep breeds of Karnataka recognized by the Indian Council of Agricultural Research (ICAR). The studies on morphological characteristics of this breed are limited (Acharya, R.M., 1982; Anand Jain *et al.,* 2006) and the carcass characteristics of Hassan sheep have not been reported. Hassan is among the highest meat consuming districts of Karnataka state. Sheep and goats are imported from other parts of Karnataka and even from other states to meet the local demand. The meat of local sheep (Hassan breed) is most preferred and region is known for its own non vegetarian dishes made out of local sheep. Therefore, the present study was undertaken to characterize and evaluate Hassan sheep under field conditions for their present status, phenotypic and carcass characteristics.

MATERIALS AND METHODS

In the present study, Hassan district and adjoining talukas of other districts were surveyed and based on the availability of true to breed (animals) four talukas - Arasikere, Hollenarsipura, Chennarayapatna and Tipturu were selected. This research was conducted at Department of Animal Genetics and Breeding, Veterinary College, Hassan (KVAFSU) during the year 2019. A total of 34 randomly selected flocks were surveyed and the data on various parameters including morphological characters were collected as per standard format suggested by National Bureau of Animal Genetic Resources, Karnal. The data collected is based on personal observation and information provided by the farmers.

The morphometric measurements were recorded on 344 sheep belonging to eight randomly selected flocks (two from each taluka). The morphometric measurements were recorded at the early hours of the day before feeding. The body weight and different body measurements (horn length,

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ear length, tail length, height at withers, chest girth, body girth, flank girth, elbow-pin length and poll-tail length) were considered. The body weights of sheep of different age (around 3, 6, 9, 12 and 18 months) from both sexes were documented. The age of sheep was approximated based on dentition and owner's information. The data collected was statistically analysed using R open source software program.

The information on carcass traits from six male lambs (between nine to twelve months of age), belonging to different flocks was recorded as and when they were slaughtered by sheep owners for their own consumption. The sheep owners were given cash incentives to slaughter the animals as per our instructions and for allowing us to take carcass measurements. The lambs were fasted for 12 hours with free access to water before slaughtering. Pre-slaughter weights were recorded and animals were slaughtered under hygienic conditions by Halal method. After slaughter, the head was removed at the atlanto-occipital joint, fore and hind limbs were removed at the carpal and tarsal joints respectively. The animals were skinned; the weight of skin, hot carcass weight, weight of edible offals (liver, heart, testes, diaphragm, kidney and spleen) and weight of inedible offals (blood, lungs, trachea, stomach and intestine) were recorded. The morphometric and carcass measurements and their description are mentioned in the Table 1.

RESULTS AND DISCUSSION

A. Breeding tract

The breed gets the name from its breeding tract Hassan district. The breeding tract extends from 12°13´ to 13°33´ North latitudes and 75°33´ to 76°38´ East longitudes. Hassan district has a total area of 6826.15 km². The Hassan breed is spread across Hassan, Tumkuru, Mandya and Mysore districts of Karnataka. The typical specimens of this breed are observed in Arasikere, Holenarsipura and Tipturu talukas (parts of Central dry and Southern dry zones of the state). The average temperature ranges between 28.2-38.9°C (Max) and 19.5-24.8°C (Min). Maximum humidity (percent) is observed during the period from October to January and annual rainfall in the region varies from 80 to 140 cm.

Status of breed

As per All India Livestock Census for the period from 1987 to 2019, the average (geometric mean) growth rate of sheep population in Karnataka is 21.67 per cent, higher than Indian average of 12.77 per cent. However, the growth of sheep population during the same period in Hassan district is just 2.38 per cent showing almost stagnation. According to Breed survey report (2012), population of Hassan sheep was 8.61 lakh of which 1.57 lakh were of graded type. Further, it has been observed that the Hassan sheep are not only decreasing in number but the breed characteristics are getting diluted. The probable reason for dilution is that the sheep from Sira (Tumkuru) and Hiriyuru (Chitradurga) are migratory and they will be crossing the breeding tract of Hassan sheep during November to April and hence the probable chance of crossbreeding. Some shepherds with intention to improve the performance of their sheep have introduced Rambouillet rams and recently Dorper rams were also being used by some shepherds. Shepherds involving in cross breeding are of the opinion that Hassan sheep having black head is better indigenous sheep for crossing

Table 1: Definitions of different Morphometric and Carcass measurements in sheep.

Measurements	Description
Morphometric measurements	
Adult Weight	Weight of the live sheep of greater than 36 months of age.
Body length	Oblique distance from the point of the shoulder to the pin bone (Point of buttock).
Height at wither	From the highest point of wither vertically to the ground.
Chest girth	Circumference of chest just behind the point of elbow.
Paunch girth	Circumference of body measured just before the hind legs.
Ear length	From base of the ear to the tip on lateral surface.
Tail length	Length of tail from base of tail to tip of tail.
Carcass measurements	
Carcass Weight	Hot or un-chilled weight of the carcass after slaughter and the removal of the head, skin,intestinal tract and internal organs.
Carcass length	Measured by a flexible measuring tape from the caudal edge of the last sacral vertebra to the dorso-cranial edge of the atlas.
Carcass width	Widest carcass measurement at the ribs using a calliper.
Length of Hind limbs	Measured from the middle of the lump at the proximal end of the tibia to the distal end of the tarsus.
Chest depth	The greatest depth, measured by tape for measuring cavities at the horizontal level of the hanging carcass.
Body length	Measured from the point where the gambrel is inserted through the Achilles tendon to the point just anterior to the point of humerus.
Shoulder width	Measured at the level of the scapula from one lateral surface to the other.
Thorax circumference	Measured using a tape held horizontally around the thorax at the level of the caudal portion of the scapula.

with Dorper rams, as black head is the typical morphological feature of Dorper sheep. Further, Kenguri sheep from Northern Karnataka region is gaining popularity in the Hassan sheep breeding tract because of its rapid growth performance as compared to Hassan sheep (Naveen kumar *et al*., 2013).

B. Breed morphology

The representative photographs of Hassan sheep breed have been given in Fig 1 to 4. As per information from the shepherds and actual observation, Hassan breed of sheep is a small to medium sized sheep. The average flock size observed was 38 (17-58) and composed of 7.9 per cent (102) rams, 63.2 per cent (817) ewes and 28.9 per cent (373) lambs. The average flock size in various sheep breeds of Karnataka includes 16 in Mandya (Anand Jain *et al*., 2005), 87 in Kenguri (Anand Jain *et al*., 2006a) and 135 in Bellary sheep (Anand Jain *et al*., 2006b), indicating Hassan and Mandya are reared in limited numbers probably as they are not taken too far distance for grazing. The coat colour was usually complete white, but these sheep also had white with light brown patches and white with black patches. The black or brown patches were observed on head and on different parts of the body. On an average, in a flock, the proportion of different coat colours included complete white (23.3%), white with light brown patches (58.1%) and white with black patches (18.6%) on head and neck region. The coat colour pattern resembles nondescript sheep seen in districts surrounding Hassan, except that brown and black patches are more pronounced in Hassan breed. Majority of the Hassan sheep observed were polled, on an average, among the adult sheep 40.2 per cent (41) of males and 1.7 per cent (14) of females are horned. The size and shape of the horns varied, adult rams had relatively large horns, whereas young males and females had small and irregular shaped horns. Horn scurs were observed in few females (3) but not in males. Anand Jain *et al.* (2005 and 2006) have reported that both male and female of Mandya sheep and females of Hassan sheep as polled and about 30-40 per cent were horned in Hassan male sheep. Ears were of moderate length and drooping. Atrophied ears were noticed in 2.3 per cent (21) of adult Hassan sheep. Gao *et al.* (2018) through genome wide association studies have established involvement of several novel genes for ear length, thus role of these genes in ear atrophy in the breed needs to be studied. Fleece of these sheep was coarse and white to dull white in colour, devoid of fleece on limbs and belly.

C. Breed morphometry

The morphometry of 344 adult Hassan sheep (36 rams and 308 ewes) as mean ± standard error for body length (cm), height at wither (cm), chest girth (cm), paunch (cm), ear length (cm), tail length (cm) and average body weight (kg) in males and females are presented in Table 2. The body weight, chest girth and height at withers were significantly higher in males than females, indicating height and chest girth as important morphometric variables affecting body

Fig 1: Hassan Breeding Ewe with Lamb.

Fig 2: Hassan Breeding Flock.

Fig 3: Hassan Breeding Ram.

Fig 4: Survey of Hassan Sheep Breed.

Table 2: Morphometry of adult male and female Hassan sheep.

Morphometry	Male (36)	Female (308)	P values
Adult weight (kg)	32.70±2.03	27.8±1.21	0.02
Body length (cm)	66.40±0.62	63.8±0.85	0.11
Height at wither (cm)	65.03±1.45	61.7±1.38	0.04
Chest girth (cm)	75.20±1.02	71.8±2.32	0.04
Paunch (cm)	76.50±1.38	74.5±2.60	0.19
Ear length (cm)	15.20±0.37	15.0±0.34	0.53
Tail length (cm)	11.50±0.23	11.3±0.18	0.22
Birth weight (Kg)	2.40±0.32 (12)	2.20±0.32 (14)	0.26
Body weight at 3 months	10.80±0.41 (16)	9.10±0.61 (15)	0.12
Body weight at 6 months	15.80±0.93 (20)	14.00±1.02 (18)	0.05
Body weight at 9 months	19.60±1.03 (19)	17.20±0.92 (18)	0.04
Body weight at 12 months	23.60±1.12 (10)	20.60±1.03 (15)	0.04
Body weight at 18 months	28.60±1.02 (7)	24.50±2.37 (12)	0.02

weight and sexual dimorphism with respect to body weight. Among sheep breeds of Karnataka, sexual dimorphism with respect to morphometry was more in Kenguri sheep (Yadav *et al.,* 2013). Non significant difference was noticed between sexes with respect to body length, Paunch, ear length and tail length. The body weights steadily and significantly increased in males than in females from the age of 6 months. The adult body weight of Hassan sheep in males and females recorded in this study were similar to that reported by Anand Jain *et al.* (2005) and more than that reported by Acharya (1982). Among the Karnataka sheep breeds, adult body weight (kg) was highest in Kenguri sheep followed by Ballery, Mandya and Hassan sheep (Anand Jain *et al*., 2005, 2006, 2006a and 2006b). Siddalingswamy *et al*. (2019) have reported that two lesser known sheep breeds (Yalaga and Mouli) in northern Karnataka region whose morphometry and adult body weights were higher than Kenguri sheep breed.

D. Carcass Characteristics

Hassan shepherds sell their male lambs between 9-12 months of age. All the young female lambs born were retained and older females (60 months of their age) are disposed off. Hence, in the present study male lambs between 9 to 12 months were taken to study carcass characteristics.

Carcass measurements

Various carcass measurements recorded are presented in Table 3. There were no earlier reports with regard to carcass measurements in Hassan sheep for comparison. Naveen kumar *et al.* (2018) has reported carcass measurements in Mandya breed male lambs of around six months age. However, the values of carcass measurements as compared with other sheep breeds (Shinde *et al*., 2008; Karim *et al*., 2002; Mule *et al*., 2013) indicate that carcass measurements depends on slaughter age and size of the animals. The different carcass measurements indicate the individual breed characteristics, keeping in view the body conformation of the different breeds.

Carcass weight and dressing percentage

In the present study, the pre-slaughter weight (PSW), hot carcass weight (HCW) and dressing percentage recorded were 20.3±1.42 Kg, 9.5±0.23 kg and 46.8 per cent, respectively. The dressing percentage is similar to that reported in Mandya male lambs (Naveen kumar *et al.,* 2018) and was within the range of 45 to 50 per cent as reported in most of the sheep breeds of India and much lower than in the exotic breed like Dorper (62.86±1.68 %), which was bred for higher body weight.

Table 3: Average carcass measurements of Hassan male lambs.

Pre slaughter weight (Kg)	20.3 ± 1.42
Carcass weight (Kg)	9.5 ± 0.63
Dressing Percentage (%)	46.8
Carcass length (cm)	68 ± 4.8
Length of hind limbs (cm)	37 ± 2.5
Chest depth (cm)	59 ± 4.2
Body length (cm)	97 ± 5.8
Shoulder width (cm)	27 ± 2.4
Thorax circumference (cm)	63 ± 4.1
Carcass width (cm)	14 ± 1.8
Small intestine length (cm)	1650 ± 22.5
Large intestine length (cm)	450 ± 8.3

Table 4: Average weight of non carcass components (g).

Non carcass components	Average weight (g)
Blood	922 ± 28.4
Head	1820 ± 46.3
Fore limbs	435 ± 24.2
Skin	3180 ± 148.4
Hind Limbs	458 ± 32.6
Testicles	196 ± 14.0
Gut (Empty)	1480 ± 48.1
Spleen	168 ± 12.2
Liver	495 ± 10.2
Kidney	168 ± 7.8
Lungs and trachea	468 ± 24.8
Heart	232 ± 9.4

Table 5: Average weights of primal cuts and their meat bone content (g).

Cuts	Meat (g)	Bone (g)	Total (g)
Loin	730 ± 12.2	240 ± 3.3	970 ±19.3
Rump	796 ± 8.5	214 ± 4.9	1010 ± 22.6
Rack	770 ± 21.3	540 ± 3.8	1310 ± 28.2
Fore limbs + Shoulder + Neck	2680 ± 29.4	1400 ± 14.2	4080 ± 32.1
Hind limbs	1892 ± 22.2	214 ± 3.2	2106 ± 33.2

Non-carcass components

The mean values of weight of different non-carcass components in Hassan ram lambs are presented in Table 4. The results as per cent to pre slaughter weight were similar to the earlier reports with respect to non-carcass components in Mandya (Naveen kumar *et al.,* 2018), Kheri lambs (Karim *et al.,* 2007), Chokla and Avikalin yearlings (Sureshkumar and Karim, 2008) and Malpura ram lambs (Shinde *et al.,* 2008).

Carcass cuts

The weights of primal cuts and their meat to bone composition of Hassan ram lambs as observed in the present study are presented in Table 5. The total meat to bone ratio observed are in concurrence with findings of other Indian sheep breeds.

CONCLUSION

The present investigation identified the distinctive morphological features of Hassan sheep and also reported the average morphometric measurements, which could help in comparing with other breeds of the Karnataka state. Hence, further studies on molecular characterization needs to be carried out so that this unique germplasm could be utilized to a better extent in sheep breeding programs. The various carcass characteristics were also studied and the values were comparable with other sheep breeds of the state, further studies on sensory evaluation of meat of this breed would provide scientific evidence for the tastier meat.

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