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Breed Effect on pre and post-slaughter traits in sheep breeds of Karnataka

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Abstract
Ovine genetic resources in India are a major source of livelihood for pastoralists and marginal farmers. India has 65.06 million sheep, while Karnataka rank 2nd in the country with 9.58 million sheep (Livestock census, 2012). As the human population increasing with modernization and necessary nutritive requirement of individuals, leads to increase in the demand of animal products in the last few years which is full of protein source, and mutton is the easiest source of animal protein and do not have any social taboos for consumption. Hence the demand of mutton increased. Although, Karnataka has recognized meat breeds Kenguri and Bannur, and also have some non-descript sheep breeds like Yalaga. The present study showed higher body weight (25.23±0.54, 24.40±0.61 and 19.90±0.58kg), body length (65.89±0.79, 65.84±0.44 and 63.13±0.56cm), body height (70.22±0.78, 68.51±0.47 and 60.40±0.61cm) and chest girth (70.44±0.67, 66.76±0.60 and 69.61±0.60cm) in Yalaga than Kenguri and Bannur breeds of sheep, respectively. Likewise, Yalaga and Kenguri showed similar results and found higher than Bannur sheep for all slaughter traits like head weight (1.91±0.04, 1.86±0.03 and 1.63±0.04kg), skin weight (2.07±0.05, 2.06±0.03 and 1.97±0.05kg), visceral organs weight (3.67±0.09, 3.51±0.07 and 2.93±0.09kg) and dressed weight (12.97±0.40, 12.20±0.45 and 9.44±0.34kg), respectively. Four carcass cuts also showed similar results in Yalaga and Kenguri and found higher than Bannur sheep, except in cut 1 where Kenguri had non-significantly higher values than Yalaga.

Keywords: Breed, Yalaga, Kenguri, Bannur, sheep

Introduction
Increased human population, modernization and necessary nutritive requirements leads to increase in demand of high quality and quantity mutton, which is the easiest source of animal protein and do not have any social taboo. Increased production is one of the primary goals in sheep production, and growth is also a major concern to livestock farmers (Akpa *et al*., 2006) [2]. Hence, it is need of time to produce the sheep breeds of high mutton potential and capacity to convert low quality food to valuable products.

In Indian subcontinent the sheep population is estimated to be about 65.06 million and India rank fifth in the world (Livestock census, 2012) [22]. Sheep are raised profitably with low investment (Bhatia *et al*., 2005, Singh *et al.,* 2006, Suresh 2011, Kumar *et al*., 2013) [4, 19, 3], play an important role in the livelihood of large population of landless labourers, small and marginal farmers and make a valuable contribution to the livelihood of shepherds through sale of wool, meat and animal. It is movable assets of high liquidity and source of household nutrition and income generation (Kumar *et al*., 2013) [3] being reared on minimum or no input especially under harsh agro-climatic conditions (Arora *et al*., 2011) [4]. At the national level indigenous sheep accounts for 230 million kg of mutton, 45.2 million kg of wool (7th largest producer of raw wool) (BAHS, 2006) [6] and 52.3 million kg of skins (FAO, 2002) [11] are produced annually in the country. The diversified germplasm of sheep represented by 40 breeds known at national level is distributed across four agro-ecological regions of the country (Acharya, 1982) [1]. These breeds thriving under zero/low input system have adapted to the local adverse conditions over the years.

In India, Karnataka with a sheep population of 9.58 million rank 3rd (Livestock census, 2012) [22]. Karnataka has a number of recognised sheep breeds, distributed throughout the state *viz*. Kenguri, Ballari, Hassani and Bannur / Mandya.

The distribution, characteristics and management of these four breeds were described by Jain *et al.*, (2005, 2005a, 2006 and 2006a) [15-17]. Majority of the sheep in Karnataka are produced and maintained by poor and landless farmers, under extensive type of rearing with a poor quality feed and management facilities. Around 75% of the country's sheep population is of local non-descript type and do not belong to any of the defined breeds. Non-descript sheep breeds like Yalaga (Dayanand, 2013) [9] and Mouli (Shashikant, 2014) [26] are present in the state which is yet to be recognised. Such populations reported only to some extent are passing through a period of identity crisis. It is, therefore, emphasized at several floras to characterize the non-descript populations both at phenotypic and genotypic levels so that they can be marked as descript breeds before they are lost forever.

Dayanand (2013) [9] identified Yalaga as a tall sheep breed with good morphological characters; adult body weight (54.78±0.96kg), adult body height (86.29±0.49cm), adult body length (83.44±0.68cm) and adult chest girth (92.32±0.77cm), indicative of good mutton production. The native tract of Yalaga is Bagalkote district with a good population size in state. Kenguri, a tall breed of Northern Karnataka, famous for its meat potential and found in districts of Raichur, Koppal and Yadgir. Good morphological characters at adult age; body weight (52.6±0.86kg), body height (81.5±0.43cm), body length (74.7±0.45cm) and chest girth (89.4±0.54cm; Jain *et al*., 2013), population of 4.3 lakh in the country (Livestock census, 2012) [22]. Bannur / Mandya is an established and well known mutton breed of Karnataka, located in Mandya and Mysuru, Tumkur, Chamrajnagar and Bengaluru rural districts. It is a short, stocky in body built and relatively small in body size with compact and square type shape with well sprung ribs attached with thick muscles with body weight as 37.21±0.85kg, body length as 60.17±0.49cm, body height as 53.8±0.56cm and chest girth as 68.1±0.63 at adult age group (Jain *et al*., 2014).

Present study involves three breeds of sheep namely Yalaga, Kenguri and Bannur. Statistical analysis used to conclude the best mutton breed among them based on the higher pre and post-slaughter traits value.

Materials and Methods

Location and Animals

Present study was conducted at Karnataka Meat and Poultry Marketing Corporation (KAMPCO), Bruhath Bengaluru Mahanagar Palike, Bengaluru and various mutton shops found at Bengaluru, where the farmers brought their animals Bannur, Kenguri and Yalaga for slaughter.

Data collection and Statistical analysis

Data for the present study was collected from 60 male animals each of Yalaga, Kenguri and Bannur, with the age group of 6-9 month. For our investigation, pre-slaughter traits such as body weight (BW), body height (BH), body length (BL) and chest girth (CG) and carcass traits like dressed weight (DW), head weight (HW), skin weight (SW) and visceral organs weight (VW) were recorded. The age of the animal was estimated from its dentition pattern and varied from 6 to 8 milk teeth (FAO, 2012).

The BW (The fasted live weight, in kilograms) was recorded using a weighing scale and remaining three traits like BH (The height from the bottom of the front foot to the highest point of the shoulder between the withers, in centimetres), BL (The horizontal distance from the point of shoulder to the pin bone, in centimetres) and CG (The circumference of the body immediately behind the shoulder blades in a vertical plane, perpendicular to the long axis of the body, in centimetres) were recorded with a measuring tape after making the animal to stand squarely on an even ground.

Slaughter traits were measured after the sacrifice of animals. The jugular vein was severed with a sharp knife for sheep sacrifice; head was removed at occipito atlantal joint after complete discharge of blood. De-skinning was done and visceral organs (heart, kidney, lungs, trachea, liver and gut) were separated from the carcass. The remaining muscle and bone portion of the carcass was dressed weight. The dressed weight was further divided in to four cuts such as cut 1, cut 2, cut 3 and cut 4 (kg) by cutting at particular site. The weight was recorded in kilograms using digital weighing machine.

The effect of breed was tested using one-way analysis of variance using SAS.9.3 (2013), generalized linear model procedure. The three breeds differ in their morphometric traits, so it is difficult to conclude the best mutton producer with a higher values of pre-slaughter and slaughter traits. So the percentage data will be transformed to Arcsine value before subjecting for analysis of variance. The Arcsine transformation was done to percentage values before ANOVA.

$$X = \text{ASINH}(\text{Sqrt}(Y))$$

Where, X= Arcsine transformed value, Y= is a proportion value of the original data.

Results and Discussion

Statistical analysis to study the breed effect on different pre-slaughter and slaughter traits has revealed the following results.

Pre-slaughter traits

The study revealed that Yalaga sheep was showing significantly ($p< 0.01$) higher body weight, body height, body length compared to Bannur sheep and it was non-significant with Kenguri sheep for the same traits. With respect to chest girth, although Yalaga sheep is having highest measurements it was non-significantly differing from Bannur but significantly differ ($p<0.01$) from Kenguri. Means ±S.E for different pre-slaughter traits in three sheep breeds are presented in Table 1.

The average body weight of Yalaga (25.23±0.54kg) at 6-9 months of age was heavier than other South Indian sheep breeds like Deccani with 19.65±0.70 kg (Kulkarni and Deshpande, 1986a) [21], Coimbatore with 18.58±0.23 kg (Kandasamy *et al*., 2006) [19], Madras Red with 18.61±0.02 kg (Devendran *et al*., 2008) [10], Mecheri with 17.90±0.25 kg (Jagatheesan *et al*., 2003) [13] and Vembur with 18.66±0.26 kg (Chandran, 1998) [7]. However, Munjal sheep with 27.64±0.57 kg (Poonia, 2004) [24] and Madgyal sheep with 25.72±0.25 kg (Waghmode *et al*. 2008) [29] were heavier than Yalaga sheep.

The body height of Yalaga, Kenguri and Bannur sheep at 6 to 9 months age was 70.22±0.78cm, 68.51±0.47cm and 60.40±0.61cm, respectively. In the present study, Yalaga sheep was taller compared to earlier reports in Bannur sheep (53.64±0.20 cm, Nagaraja *et al*., 1996) [23], Coimbatore (57.69±0.37cm, Kandasamy *et al*., 2006) [19] and Mecheri (61.54±0.29 cm, Jagatheesan *et al*., 2003) [13]. However, Yalaga was smaller than Muzaffarnagari (75.97±0.86cm, Das and Hariprasad, 2007) [8].

In the present study, Yalaga sheep was showing similar length as that of Kenguri and longer body length compared to

Bannur. However, Yalaga (65.89±0.79 cm) sheep when compared to earlier reports in Muzaffarnagari sheep (83.07 ± 1.35cm, Das and Hariprasad, 2007) [8] was smaller in length. However, Yalaga sheep was longer than Coimbatore (58.5±0.39cm, Kandasamy, 2006) [19], Mecheri (52.46±0.19 cm, Jagatheesan *et al*., 2003) [13] and Bannur sheep (59.20±3.94cm, Nagaraja *et al*., 1996) [23].

Compared to earlier reports, Yalaga (70.44±0.67cm) showed the wider chest girth at 6 to 9 months of age than Bannur (66.09±4.02cm, Nagaraja *et al*., 1996) [23], Coimbatore (64.39±0.51cm, Kandasamy, 2006) [19] and Mecheri sheep (64.5±0.37cm, Jagatheesan *et al*., 2003) [13]. However, Muzaffarnagari sheep (79.67±0.02cm, Das and Hariprasad, 2007) [8] found to have higher chest girth than Yalaga.

Slaughter traits

One-way analysis of variance among breeds was observed the non-significant difference between Yalaga and Kenguri for all the slaughter traits under study. However, both Yalaga and Kenguri have showed significantly ($p< 0.01$) higher weight in all slaughter traits compared to Bannur, except skin weight in which Bannur was non-significantly lower. The Mean ±S.E values of slaughter traits have been given in Table 2.

The weight of different slaughter traits expressed in percentage. The percentage data was transferred to Arcsine value before subjecting to analysis of variance. One-way analysis of variance among breeds has showed the non-significant difference between Yalaga and Kenguri for SW, DW, Cut 1, Cut 2 and Cut 3 and showed significant ($p< 0.01$) difference for HW, VW and Cut 4 traits under study. Similarly, Yalaga and Bannur sheep showed non-significant difference for HW, VW, Cut 2, Cut 3 and Cut 4 traits. However, showed significant ($p< 0.01$) difference for SW, DW and Cut 1 traits. Comparatively, Yalaga showed higher percentage of DW, Cut 2 and Cut 4 than Kenguri and Bannur sheep breeds.

Many researchers studied head weight in terms of percentage and found the higher percentage in Garole (12.00±0.20) and Malpura (9.39±0.14, Sen and Karim, 2009) [25, 28] than Yalaga (7.65±0.12). However, lower head percentage in Chokla (7.20±0.15, Sureshkumar and Karim, 2009) [25, 28] compared to Yalaga (7.65±0.12) sheep.

The Yalaga sheep (2.07±0.05 kg) has shown lower skin weight compared to Malpura with 2.08±0.20kg, (Shinde *et al*., 2008) [27]. Skin weight as a percentage of body weight was studied and it was found to be higher in Bannur (10.07±0.16) than Kenguri (8.97±0.06) and Yalaga sheep (8.29±0.17). Similar to the present study, many researchers studied skin weight in terms of percentage and was found the higher results than Yalaga (8.29±0.17) sheep in Chokla (9.45±0.55), Malpura (9.69±0.43, Sureshkumar and Karim, 2009) [25, 28] and Muzaffarnagari sheep (9.43±0.78%, Arun *et al*., 2007) [5] under intensive management.

Yalaga (3.67±0.09kg) was showing significantly ($p< 0.01$) higher visceral organs weight compared to Kenguri (3.51±0.07kg) and Bannur sheep (2.93±0.09kg). Effect of breed as a percentage of visceral organs weight on slaughter body weight was studied and it was higher in Bannur (14.79±0.22) than Yalaga (14.61±0.21) and Kenguri (11.95±0.14) breeds of sheep.

Statistical analysis showed the effect of breed as percentage of dressed weight on slaughter body weight was studied and it showed non-significant difference in Yalaga (50.89±0.62) and Kenguri (49.06±0.28). However, Yalaga had significantly ($p< 0.01$) higher DW compared to Bannur (46.93±0.50) sheep.

Similar to the present study, different researchers had found lower DW in Kenguri (9.30±0.39 kg, Appannavar *et al*., 2010) [3], Garole (3.61±0.43kg), Malpura (8.09±0.26kg, Sen and Karim, 2009) [25, 28] and Chokla (11.0±0.42kg, Sureshkumar and Karim, 2009) [25, 28], and found the higher DW in Malpura (14.6±0.71kg, Karim *et al*., 2002) [25, 28] and Muzaffarnagari sheep (15.78±0.49 kg and 19.33±1.38 kg, Arun *et al*., 2007) [5] at 6 and 9 months age respectively, than the Yalaga sheep.

The weight of cut 1 in present study was higher in Yalaga (3.89±0.12kg) than the Kenguri (4.03±0.15kg) and Bannur (2.64±0.12kg) breeds of sheep at 6-9 months age. Statistical analysis for percentage of cut 1 on slaughter body weight revealed significantly ($p\leq 0.01$) higher values in Kenguri (15.90±0.09) than Yalaga (15.27±0.18) and Bannur (13.21±0.54).

The weight of cut 2 in the present study was higher in Yalaga (2.59±0.08kg) than the Kenguri (2.20±0.08 kg) and Bannur (1.89±0.07 kg) breeds of sheep at 6-9 months age. Statistical analysis for percentage of cut 2 on slaughter body weight revealed non-significant difference in Bannur (9.39±0.10), Kenguri (9.42±0.05) and Yalaga (10.18±0.12) sheep. However, Yalaga showed higher values than Kenguri and Bannur breeds of sheep.

The weight of cut 3 in the present study was higher in Yalaga (1.30±0.04 kg) than Kenguri (1.22±0.05) and Bannur (0.95±0.03kg) breeds of sheep at 6-9 months age. Statistical analysis for percentage of cut 3 on body weight studied and it has revealed significantly ($p< 0.01$) similar values in Yalaga (5.09±0.06) and Kenguri (5.40±0.03), and non-significant in Bannur (4.69±0.05) sheep. However, Kenguri was showing higher values than Yalaga and Bannur sheep.

The weight of cut 4 in the present study was higher in Yalaga (5.19±0.16kg) than Kenguri (4.76±0.17kg) and Bannur (4.06±0.15kg) breeds of sheep at 6-9 months age. Statistical analysis for percentage of cut 4 on slaughter body weight was studied and it has revealed the significantly ($p< 0.01$) lower cut 4 values in Kenguri (18.35±0.10) than both Yalaga and Bannur sheep breeds. Although, Yalaga (20.36±0.25) and Bannur (20.18±0.21) sheep are differing non-significantly.

The effect of breed on different cuts could not be compared as the cuts differed for different studies. These cuts are non-scientific and practised in and around the Bengaluru by the butchers of mutton shops and slaughter house.

Table 1: Mean ± S.E of different pre-slaughter measurements in Bannur, Kenguri and Yalaga breeds of sheep

Pre-slaughter trait	Bannur	Kenguri	Yalaga
Body weight (kg)	19.90±0.58^{b}	24.40±0.61^{a}	25.23±0.54^{a}
Body length (cm)	63.13±0.56^{b}	65.84±0.44^{a}	65.89±0.79^{a}
Body height (cm)	60.40±0.61^{b}	68.51±0.47^{a}	70.22±0.78^{a}
Chest girth (cm)	69.61±0.60^{a}	66.76±0.60^{b}	70.44±0.67^{a}

Means with similar superscript within a row differs non-significant.

Means with dissimilar superscript within a row differ significant at $p< 0.01$

Table 2: Mean ± S.E of different slaughter trait in Bannur, Kenguri and Yalaga breeds of sheep

Slaughter trait (kg)	Bannur	Kenguri	Yalaga
Head weight	1.63±0.04^{b}	1.86±0.03^{a}	1.91±0.04^{a}
Skin weight	1.97±0.05^{b}	2.06±0.03^{a}	2.07±0.05^{a}
Visceral organ weight	2.93±0.09^{b}	3.51±0.07^{a}	3.67±0.09^{a}
Dressed weight	9.44±0.34^{b}	12.20±0.45^{a}	12.97±0.40^{a}
Cut 1	2.64±0.12^{b}	4.03±0.15^{a}	3.89±0.12^{a}
Cut 2	1.89±0.07^{b}	2.20±0.08^{a}	2.59±0.08^{a}
Cut 3	0.95±0.03^{b}	1.22±0.05^{a}	1.30±0.04^{a}
Cut 4	4.06±0.15^{b}	4.76±0.17^{a}	5.19±0.16^{a}

Means with similar superscript within a row differs non-significant.
Means with dissimilar superscript within a row differ significant at $p< 0.01$

Table 3: Mean ±S.E of slaughter traits for percentage data in Bannur, Kenguri and Yalaga breeds of sheep

Slaughter trait (kg)	Bannur	Kenguri	Yalaga
Head weight (HW)	8.26±0.11^{a}	5.63±0.08^{c}	7.65±0.12^{a}
Skin weight (HW)	10.07±0.16^{a}	8.97±0.06^{b}	8.29±0.17^{b}
Visceral organ weight (HW)	14.79±0.22^{a}	11.95±0.14^{b}	14.61±0.21^{a}
Dressed weight (DW)	46.93±0.50^{a}	49.06±0.28^{b}	50.89±0.62^{b}
Cut 1	13.21±0.54^{a}	15.90±0.09^{b}	15.27±0.18^{b}
Cut 2	9.39±0.10^{a}	9.42±0.05^{a}	10.18±0.12^{a}
Cut 3	4.69±0.05^{a}	5.40±0.03^{a}	5.09±0.06^{a}
Cut 4	20.18±0.21^{a}	18.35±0.10^{c}	20.36±0.25^{a}

Means with similar superscript within a row differs non-significant.
Means with dissimilar superscript within a row differ significant at $p< 0.05$

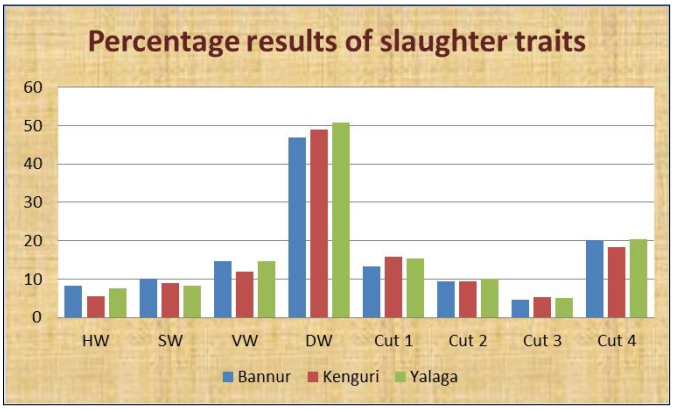

Fig 1: Diagrammatic representation of different slaughter traits in Bannur, Kenguri and Yalaga breeds of sheep

Conclusion

The study concludes that, compared to both mutton breeds of Karnataka *viz*. Kenguri and Bannur, Yalaga sheep had higher values among all pre-slaughter traits. However, slaughter traits were also having similar values in Yalaga and Kenguri, and more than Bannur sheep. Interestingly, percentage wise also Yalaga showed superior results than the rest two breeds of sheep. Hence, Yalaga said to be a mutton breed and having capacity to produce to more meat than Kenguri and Bannur breeds of sheep.

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