*Pakistan J. Zool., pp 1-6, 2024.* **DOI**: https://dx.doi.org/10.17582/journal.pjz/20231128090338

# Influence of Cannon Bone Circumference on Some Body Size Traits in Harnai Sheep Breed of Balochistan

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## ABSTRACT

The excessive increase in demand for small ruminant meat is a result of both population growth and depletion of natural resources. One of the most significant economic characteristics that enhances an animal's capacity to withstand excessive body weight, strenuous activity, wounds, and injuries is the cannon bone circumference. It also influences the characteristics of body size, which ultimately affects body weight and carcass production. This study examined the relationship between the cannon bone circumference and several dimensions of the body, such as live body weight, body height, and body length Balochistani sheep breeds. Eight months old Harnai sheep, 40 male and 40 female, were chosen at random from the Langove Sheep Farm District in Naseerabad, Balochistan, for this purpose. The result showed that the average cannon bone circumference in Harnai male was 8.12cm and 7.30cm in female, statistically significant between male and female of Harnai breed. The body weight was higher ($P<0.05$) in male (28.50kg) compared to female (23.10kg). The average body height was 69.34cm and 61.46cm in male and female, which was significantly higher in male compared to female. The body length was 73.91cm and 64.51cm in male and female respectively. The Harnai male had larger ($P<0.05$) body length compared the female. The cannon bone circumference has strong positive influence on body weight, body height and body length of Harnai sheep ($P<0.05$). The genetic correlation in Harnai male for cannon bone circumference vs body weight, cannon bone circumference vs body height, cannon bone circumference vs body length was 0.725, 0.615, 0.657 and for body weight vs body height, body weight vs body length, it was 0.713, 0.541 whereas 0.497 for body height vs body length; In contrast, the Harnai female showed values of 0.685, 0.585, 0.515 for the cannon bone circumference in relation to body weight, 0.625, 0.546, and 0.435 for the cannon bone circumference in relation to body height, and 0.685, 0.585, 0.515 for the cannon bone circumference in relation to body length. In conclusion, the body weight, body height, and body length of the Balochistani Harnai sheep breed are considerably influenced by the males' significantly larger cannon bone circumference.

**Article Information**
**Received 28 November 2023**
**Revised 20 December 2023**
**Accepted 11 January 2024**
**Available online 01 April 2024**
**(early access)**

**Authors' Contribution**
**HAK, BK and SKK: Conceptualization; BK: methodology and investigation; SKK: software; BK and ZK: validation; ZAN: formal analysis; HAK: resources and supervision; AAM and HAK: data curation; BK and SKK: writing—original draft preparation; HAK and BK: writing—review and editing; SA, BK and HAK: visualization.**

**Key words**
**Cannon bone, Genetic correlation, Harnai, Body length, Traits, Balochistan**



## INTRODUCTION

Sheep are one of the most important species of livestock kept by rural families for their livelihood in the majority of traditional agricultural production systems. Sheep are raised as livestock so that their meat, milk, and various dairy products, including yoghurt, cheese, and butter, can be harvested. A person's ability to support a substantial amount of weight is significantly influenced by the size of their cannon bones. Live body weight (LBW), commonly known as an animal's weight while it is still alive, has a substantial impact on a variety of traits, particularly those that are important from a commercial standpoint (Ambhore *et al*., 2003). In remote places with little access to resources for breeders, it is feasible, more effective, simpler, and less expensive to estimate an animal's live weight based on its body measurements (Nsoso *et al*., 2003). Unfortunately, farmers often overlook this important information about body weight assessment since there are not enough scales available. Subsequently, farmers are forced to rely their judgements on subjective evaluations of the physical well-being of their livestock, which may result in errors in judgement and animal care (Moaeen-ud-Din *et al*., 2006).

Body measurements and live weights taken from moving animals have been used extensively for a wide range of purposes, including experimental work and

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0030-9923/2024/0001-0001 $ 9.00/0

selection methods. These measurements were made while the animals were still alive (Cam *et al*., 2010). Due to the precision of functions that predict liveweight or growth characteristics based on live animal data, businesses that deal in livestock production may gain a sizable financial advantage (Afolayan *et al*., 2006). Knowing an animal's live weight is crucial, especially in large-scale production systems, for both financial and genetic reasons Wool-producing sheep are the most common breed of sheep kept as livestock on large farms. Determining weight is an important issue, both from the viewpoint of those who breed sheep and those who purchase them from the market. On the other hand, sheep breeders keep a steady number of sheep in their flocks by occasionally selling off their older animals and getting new male and female lambs from different breeds. The practice of letting a merchant set a price range for an animal is problematic because, in the lack of more comprehensive information, breeders are unable to determine the value of their animals. There is a clear correlation between an animal's mass and its physical size. After calculating the live weight to the closest kilogramme from this vantage point, it is possible to assess whether or not it should be put up for sale. However, various phenotypic metrics can be applied to evaluate the cattle industry's productivity. It is useful to define performance in terms of physical metrics in a variety of contexts. Studies in the scientific literature have proposed connections between physical characteristics and performance features (Janssens and Vandepitte, 2004; Atta and El-Khidir, 2004).

The Harnai breed of lambs is renowned for their thick, meaty tails, premium meat, and luxurious wool. In various areas of the Balochistan province's districts of Loralai, Quetta, Sibi, and Zhob, they can be found. Their bodies are completely white in color, while their heads and ears are either black or brown with a few white spots. A medium (32.5 micron) diameter of wool yields 2.6 kilogram. Their tails are rather short but quite rounded, and their bodies are quite little and closely packed. These farms are accumulating data to be utilized in developing selection procedures with which to assess the growth, reproduction, and wool performance of Harnai lambs as well as to create selection methods with the intention of using genetic modification to increase the productivity (yield quality) of Harnai breeds (Afzal and Naqvi, 2004). The use of body measurements that are linear in nature to determine the live body weight of sheep, goats, and cattle has been the subject of numerous published studies. The length of the fore cannon bone was included in the linear measurements, which was a first for any sheep inquiry; in contrast, the great majority of the other authors were not given nearly as many linear measures to handle as this one did additionally (Mekonnen and Biruk, 2004; Abdelhadi and Babiker, 2009; Oke and Ogbonaya, 2011; Mahieu *et al*., 2011). This study was conducted to verify whether other variables used in determining live body weight in the Balochistan Harnai sheep breed as well as to demonstrate the utilization of cannon bone circumference as a linear measurement of the body.

## MATERIALS AND METHODS

*Study site and animal management*

This study focused on the Harnai breed growing regions in the Balochistan province's Naseerabad division. In this area, sheep are most frequently raised using a semi-intensive technique. Animals were fed during the day in plains for natural pasture feeding and were kept overnight. In terms of what the sheep need in terms of nutrients, the natural grass is insufficient. Additionally, seasonal green feed, wheat straw, and concentrates were given to the animals.

*Experimental design*

The 80 animals came from the Langove Sheep Farm in the Naseerabad district. The 40 male and 40 female Harnai sheep were chosen at random. The Harnai breed animals were sorted into two groups, A and B, with the age of the chosen animals being 8 months. Age was calculated using the dental formula proposed by Abegaz and Awgichew (2009). The data was gathered for body weight in kilograms (kg), front limb cannon bone circumference in centimeters (cm), height in centimeters (cm), and length in centimeters (cm).

The cannon bone circumference (cm) was measured from the place at the rear of the knee to the ergot in the sheep. Body weight was taken using digital weighing machine. For body height (cm): It is ideal to use a specialized measuring stick with two arms, one of which is held vertically and the other at a right angle to it, to take measurements of body height (in cm). The first thoracic vertebra at the base of the neck, the front of the chest, or the point of the nose was used to measure body length.

*Statistical analysis*

Using software on a computer known as Statistics for Students Edition (SXW), Version 8.1, the data so gathered was tabulated and statistically analyzed after the study is over (Copyright 2005, Analytical Software, USA). Using Becker's recommended methodology, the genetic correlation between cannon bone circumference and body size traits was calculated using the formula as suggested by (Becker, 1985).

## RESULTS

In terms of their body weight, height, length, and cannon bone circumference, Harnai ram and ewe differ significantly from one another, according to the study's findings (Table II).

Table I shows that the cannon bone circumference of male Harnai sheep was non-significantly (8.12 cm) larger than that of their females, which was 7.30 cm on average. The cannon bone circumference of Harnai male and female sheep differed substantially (P<0.05). This indicated that male Harnai sheep are heavier than their female counterparts.

**Table I. Body measurements of Harnai sheep.**

| Body measurements | Mean±SEM | P-value |
|---|---|---|
| **Cannon bone circumference (cm)** | | |
| Male | 8.12±0.31 | 0.03 |
| Female | 7.30±0.17 | |
| **Body weight (kg)** | | |
| Male | 28.50±0.54 | 0.02 |
| Female | 23.10±0.30 | |
| **Body height (cm)** | | |
| Male | 69.34±0.20 | 0.04 |
| Female | 61.46±0.15 | |
| **Body length (cm)** | | |
| Male | 73.91±0.33 | 0.04 |
| Female | 64.51±0.57 | |

**Table II. Genetic correlation among cannon bone circumference and body size traits in Harnai male and female.**

| Genetic correlation | Body weight | Body height | Body length |
|---|---|---|---|
| **Male** | | | |
| Cannon bone circumference | 0.725* | 0.615* | 0.657* |
| Body weight | | 0.713* | 0.541* |
| Body height | | | 0.497* |
| **Female** | | | |
| Cannon bone circumference | 0.685* | 0.585* | 0.515* |
| Body weight | | 0.625* | 0.546* |
| Body height | | | 0.435* |

*Correlation is significant at the 0.01 level P-value.

The body weight of male Harnai sheep was significantly bigger (28.50±0.54kg) than the body weight of their females, i.e., (23.08±0.30kg) on average. The body weight of male and female Harnai sheep varied significantly (P<0.05). This indicated that male Harnai sheep are heavier than their female counterparts.

Male and female Harnai sheep showed significantly different average body heights (P<0.05), with the males' average body height being 69.34 cm and the females' average body height being 61.64 cm.

The average body length of male and female Harnai sheep varied significantly (P< 0.05), with male Harnai sheep having a much longer average body length (73.91 cm) than female Harnai sheep (64.51 cm). This suggests that, anatomically speaking, Harnai males were larger than Harnai females.

The genetic correlation in Harnai male for cannon bone circumference vs body weight, cannon bone circumference vs body height, cannon bone circumference vs body length was 0.725, 0.615, 0.657 and for body weight vs body height, body weight vs body length, it was 0.713, 0.541 whereas 0.497 for body height vs body length; However in Harnai female, it was 0.685, 0.585, 0.515 for cannon bone circumference vs body weight, cannon bone circumference vs body height, cannon bone circumference vs body length and for body weight vs body height, body weight vs body length, it was 0.625, 0.546 and 0.435 for body height vs body length. In conclusion, the Harnai male have significantly higher cannon bone circumference hence greatly influence body weight, body height and body length of Harnai sheep breed of Balochistan.

## DISCUSSION

The averages of the Harnai breed (cannon bone circumference, body height, body length, and weight) were examined. The differences between the cannon bone circumference (cm), body height (cm), body length (cm), and body weight (kg) were significant (p>0.05). However, even among that group, the male had greater mean body weight values than the female. Although it was not statistically significant in any of the study's age groups, several earlier studies had found that sex had a substantial impact in body weight (Banerjee, 2016; Barragan, 2017; Afolayan *et al*., 2006; Chacon *et al*., 2011; Chiemela *et al*., 2016; Dauda, 2018). Due to normal hormonal fluctuations, males tend to have larger physical characteristics than females, which may account for the males' higher mean numerical LBW values (Banerjee, 2016). Use of male sheep for breeding purposes when they are young (1-2 years) and their sale or slaughter during celebrations when they are 2 to 3 years of age may account for the decline the number of male sheep observed on this study as the ages advance. Chiemela *et al*. (2016) reported a similar outcome

in highland sheep of the Tigrey region, North Ethiopia. According to Essien and Adesope (2003), the variation in body weight and linear body measurement between same-sex individuals with different agroecologies may be caused by the non-genetic factors and also location. However, the findings of this study were consistent with those made by Fatanzi *et al*. (2017) and Goe *et al*. (2010), who found that location played the largest role in the variation of animals' linear body measurements and body weight. The better body weight and linear body measurement of "Wenya-dega" compared to "Dega" may be attributable to the sheep's different dietary, geographic, and managerial needs. The acquired result is consistent with the findings of Oke and Ogbonnaya (2011) and Hilal *et al*. (2016), who found that the age and location of an animal's upbringing had an impact on its linear body measurement (LBM) (Kianzad, 2004). Miserani *et al*. (2002) revealed that, in contrast to this finding, the location effect had a very low significance in the morphological attributes and had a more significant impact on the flocking effect, which was nested within the location effect. The mature ram and ewe sheep found in the agroecology of "Wenya-dega" weighed 29.38 kg and 25.13 kg, respectively. This outcome is consistent with the body weight of the Menz and Afar sheep breeds (Mwacharo *et al*., 2006). According to Otoikhanai *et al*. (2008), a significant variance in growth performance between areas may work to the local sheep's genetic benefit if long-term selection efforts are made. Rams for the "Wenyadega" agroecology had greater scrotum circumferences than rams for the "Dega" agroecology. The nutritional value of the feed may be to blame for this. In the paper by Putra and Ilham (2019), it was stated that providing high quality and quantity of feed could promote testicular growth, which serves as a measure of scrotum circumference. Two out of six factors in the 13–24-month age group (male and female combined) had a significant correlation. The CD, HG, BDL, and LBW all had very high positive correlations (r (30)= 0.77, p0.01, r (30)= 0.66, p0.01, and r (30)= 0.49, p0.01) with each other. This indicates that sheep between the ages of 13 and 24 months with relatively high CD, HG, or BDL were likely to have high LBW. The CBL ($p<0.05$; $r = 0.17$).

In a similar vein, Salako (2006) found that the proportion of female sheep rose with age and that, as a result, females outnumbered males (rams and castrates) in all age groups with the exception of those between 6 and 11 months. This is due to the fact that breeding rams are often chosen after 12 months, when they have reached sexual maturity. Almost all females are retained for breeding, while most rams who have not been selected for breeding are either castrated or slaughtered. All body dimensions increased as the animal grew older, from the 0PPI age group to the 3PPI age group. This is to be expected and has been confirmed by multiple researchers who observed that the size and shape of sheep increased with age, reaching their pinnacle of development or maturity, and that age also had a significant impact on body weight and other linear body dimensions (Salako and Ngere, 2002; Santos *et al*., 2008; Singh *et al*., 2009; Sowande and Sobola, 2008). The reported value of BL in sheep from the Jamuna River basin, Barind region, and coastal regions was 41.5, 43.4, and 45.9 cm, respectively (Thiruvenkadan, 2005). According to Vatankhah *et al*. (2004), the measured BL for rams and ewes from the Jamuna River basin, Barind, and coastal regions of sheep was 64.42, 65.70, and 67.60 cm and 62.67, 62.20, and 63.48 cm, respectively. This investigation revealed an anomaly: Barind ewes were longer than rams despite being lighter. Waldron (2003) discovered that Barind ram and ewes had BLs of 48.70 and 46.38, respectively. Regardless of gender, the mean rump height (RH) was 52.70 ± 2.90 cm, with rams measuring 53.83 ± 1.78 cm and ewes 52.58±2.98 cm.



## CONCLUSIONS

It was observed that Harnai male have significantly higher Cannon bone circumference than female with significant influence on body weight, body height, and body length. Whereas genetic correlation among Cannon bone circumference and other body size traits was strongly positive.

The similar research on the Harnai sheep breed may be carried out using a different management strategy from infancy to puberty. It is advised that more research be done on the relationship between body size features and cannon bone circumference, as well as the genetics underlying this relationship. In order to enhance the spectrum of expression of carcass traits which affect both the number and quality of carcasses in Harnai and other sheep breeds the breeding system based on cannon bone circumference measurement may be created and implemented.

*Funding*

The authors did not receive support from any organization for the submitted work.

*IRB approval*

Not applicable

*Statement of conflict of interest*

The authors have declared no conflict of interest.

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