



## Short Communication

# Potential Contribution of Multi Vertebrae Variation to the Carcass Weight of Balochi and Harnai Sheep Breeds

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**Abstract** | The aim of our study was to observe the vertebrae variation and its relation with carcass weight and quantity of Balochi and Harnai sheep breeds of Baluchistan. For this purpose, we have observed Thoracic T and lumber L vertebrae variation by removing carcass from 3 randomly selected male animals of each breed. We have observed seven vertebrae variation in both sheep breeds from T-12 to T-14, L-5 to L-7 and T-11 to T-12, L-4 to L-6 in Balochi and Harnai breed, respectively. The thoracic and lumber vertebrae which possess more number in Balochi sheep as compared with Harnai breed has produced more amount of carcass about 1.56 to 2.01 kg, respectively. It is concluded that due to presence of more number of thoracic and lumber vertebrae number in Balochi breed produced more meat as compared with Harnai breed.

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## 1. Introduction

Vertebrae column or spinal column is main part of animal body which provide shape, structure and protection the vertebrate animals. The vertebrae column is made up of a series of segment. Each species possess unique and different number of

various vertebrae segments. The spinal column of vertebrae has been divided into various parts such as cervical, thoracic, lumber sacral and caudal (Zhang *et al.*, 2017). It is has been reported that mammals have mainly fixed segment of vertebrae number in most of the species, whereas a small amount of variation has been observed in segments of vertebrae in post

cervical regions such as thoracic, and lumber parts of few species (Li et al., 2017). Variation in thoraco vertebrae number region has been reported for commercial choice in mammalian breeding. Similarly, it is reported that the screening of sheep vertebrae variation may cause increase in potential meat production (Yang et al., 2009). To identify the number of vertebrae variation may improve the quality and production of meat. It is therefore identification of vertebrae variation in small ruminant sheep and goat will increase the importance of small ruminant meat industry Kaleri et al. (2022); Mikwa et al. (2011). Li et al. (2017), suggested that about 30 to 40 percent of vertebrae variation in 4 different breeds of sheep were found including Poll Dorsetcross Mule, Texel cross Mule and Texl Scottish Balck face. Such type of results depicted by Zhang et al. (2017); Kaleri et al. (2018) and Mikwa et al. (2011), that carcass weight, length, thickness and height of carcass are mainly influenced by thoracic and lumber vertebrae number in large and small ruminant carcass. Small ruminants are major source of food and income (milk, meat, wool and leather) for both large and small scale farmers of Pakistan. Balochi and Harnai are both fat tailed and medium size sheep breeds commonly raised for mutton and wool purpose. Both breeds commonly found in different areas of Baluchistan province including Dera Murad, Quetta, Loralai and Sibbi (Kaleri et al., 2018, 2022). The purpose of this study was to evaluate the extent of variation in thoraco lumber vertebrae area of Balochi, Harnai sheep and its correlation with carcass weight and height.

## 2. Materials and Methods

### 2.1 Management

Present study conducted to assess the number of vertebrae variation and its influence on the carcass weight of Balochi and Harnai sheep breeds kept under intensive management system with inbreeding method was applied. Animals were selected on the bases of age and health status age formula given by (Vatta et al., 2006) from four different private sheep farms with their respective areas. In this study all the procedures were performed according to the protocol of Pakistan Animal Slaughter Procedure at Organic meat company, Karachi. We have observed the vertebrae column and carcass weight thoracic vertebrae length and lumber vertebrae length and lumber vertebrae of 3 randomly selected animals from each breed.

### 2.2 Data record

Total 60 animals with 30 animal male from each breed having 8 month age of were slaughtered. First we measured the carcass weight of both breeds after that carcass was divided into two parts in order to exposure of vertebrae column of slaughtered animals and number of thoracic and lumber vertebrae number were recorded. In this study we also observed the carcass weight of thoracic and lumber vertebrae to total length of vertebrae of both breeds.

### 2.3 Statistical analysis

The analysis of results was perfumed by using the (ANOVA method in SPSS version 19.0). In order to observe the carcass traits, effect of age and effect of sex the statistical model suggested by (Li et al., 2017) was applied.

## 3. Results and Discussion

It has been reported that number of thoracolumbar vertebrae thoracic + lumber mostly remain conserved at 19 in sheep animal, that is considered as ancestral limited form, which contain 13 number of thoracic and T13 and 6 number of lumber vertebrae L6. However, we have recorded seven type of vertebrae formation in Balochi and 4 type of vertebrae in Harnai sheep as described in Tables 1 and 2. It has been written in various books that most of the sheep possess vertebrae 13 thoracic and 6 lumber, whereas in some cases it was recorded multi vertebrae traits as described in Tables 1 and 2. The change in the number of vertebrae were had more than one or two rudimentary ribs on vertebrae. Whereas the variation in the lumber vertebrae was observe at the end segment of lumber vertebrae that was transvers process on both side of 6 lumber vertebrae. It has been observed that remaining variants, the number of thoracic lumber vertebrae were remain same or decreased during comparison with previous information of their ancestral thoracic lumber vertebrae T13 and L6 as presented in Tables 1 and 2. Wong et al. (2015), suggested that the total number of vertebrae column of sheep remain same although after observing of the variation in thoraco lumber vertebrae, that is may be due to homeotic transformation at the development stage of vertebrae. It has been reported that homeotic Transformation is not responsible for variation in the number of vertebrae; just it may change the place and identity from 1<sup>st</sup> thoracic to last segment of lumber vertebrae. In our study we also observed the carcass weight and

length of thoraco lumber vertebrae of animal showing variation in thoracic lumber vertebrae regions length as details are described in Tables 1 and 2. The average carcass weight in Balochi sheep was observed 11 to 12 kg and average length of thoracic and lumber vertebrae was observed 28 to 30 and 17 to 18 cm, respectively. Similarly, the average carcass weight was observed in Harnai sheep 6 to 7 kg and average length of Thoracic and Lumber vertebrae region was recorded 26 to 27 and 14 to 15 cm, respectively. The variation in vertebrae number of the Balochi sheep as compared with Harnai sheep showed that carcass weight of Balochi sheep was ( $P \leq 0.0001$ ) significantly heavier than the Harnai sheep breed, details are given in Tables 1 and 2.

**Table 1: Vertebrae variation and characteristics in Balochi breed.**

| Type of vertebrae    | Average thoracic vertebrae length (cm) | Average lumber vertebrae length (cm) | Average carcass weight (kg) |
|----------------------|--|--------------------------------------|-----------------------------|
| T-14L-5 <sup>a</sup> | 30.11±64 <sup>a</sup>                  | 17.43±11 <sup>c</sup>                | 12.25±63 <sup>a</sup>       |
| T-14L-6 <sup>a</sup> | 30.79±12 <sup>a</sup>                  | 18.31±71 <sup>b</sup>                | 11.71±11 <sup>b</sup>       |
| T-12L-7 <sup>c</sup> | 29.15±37 <sup>b</sup>                  | 19.67±31 <sup>b</sup>                | 11.25±51 <sup>b</sup>       |
| T-13L-6 <sup>b</sup> | 28.17±67 <sup>c</sup>                  | 18.27±56 <sup>b</sup>                | 12.37±73 <sup>a</sup>       |
| T-13L-7 <sup>b</sup> | 29-37±54 <sup>b</sup>                  | 20.37±19 <sup>a</sup>                | 10.19±43 <sup>c</sup>       |
| T-12L-7 <sup>c</sup> | 28.62±32 <sup>c</sup>                  | 18.15±21 <sup>b</sup>                | 10.57±91 <sup>c</sup>       |
| T-13L-6 <sup>b</sup> | 26.32±19 <sup>d</sup>                  | 16.56±37 <sup>d</sup>                | 9.21±13 <sup>d</sup>        |

**Table 2: Vertebrae variation and characteristics in Harnai breed.**

| Type of vertebrae    | Average thoracic vertebrae length (cm) | Average lumber vertebrae length (cm) | Average carcass weight (kg) |
|----------------------|--|--------------------------------------|-----------------------------|
| T-12L-6 <sup>b</sup> | 29.21±43 <sup>a</sup>                  | 16.31±25 <sup>a</sup>                | 7.13±63 <sup>a</sup>        |
| T-11L-4 <sup>c</sup> | 27.29±72 <sup>c</sup>                  | 15.41±51 <sup>b</sup>                | 7.01±67 <sup>a</sup>        |
| T-11L-6 <sup>b</sup> | 26.19±47 <sup>d</sup>                  | 15.87±37 <sup>b</sup>                | 6.21±91 <sup>b</sup>        |
| T-11L-7 <sup>a</sup> | 26.35±22 <sup>d</sup>                  | 14.31±16 <sup>c</sup>                | 6.43±53 <sup>b</sup>        |
| T-12L-5 <sup>c</sup> | 27-31±57 <sup>c</sup>                  | 16.45±93 <sup>a</sup>                | 7.25±87 <sup>a</sup>        |
| T-11L-6 <sup>b</sup> | 28.52±12 <sup>b</sup>                  | 16.53±23 <sup>a</sup>                | 7.17±83 <sup>a</sup>        |
| T-11L-4 <sup>c</sup> | 26.33±51 <sup>d</sup>                  | 15.73±33 <sup>b</sup>                | 6.27±49 <sup>b</sup>        |

The findings of present study showed that there was variation observed in number of vertebrae of Balochi and Harnai sheep. It should be observed at the low level of spontaneous rate of mutation in mammalian vertebrates. It has been reported by Saber (2008); Lori *et al.* (2005) and Donaldson *et al.* (2013) that very few numbers of variations in vertebrae column has been observed in donkey and sheep. However, Donaldson *et al.* (2013), reported that high number

of frequencies 30 to 40 percent of vertebrae character was recorded in four different sheep breeds including Scottish Blackface, Poll Dorset Cross Mule, Texel cross Mule and Texel. With collecting the ideas of various researchers and our study it is common phenomenon of variation among vertebrae column between and within breed of sheep animal. Mikwa *et al.* (2007), supported the findings of our study, who reported that multi vertebrae of Bacon pig has produced after screening of thoracolumbar region variation more meat production. Johnson *et al.* (2005) and Barone *et al.* (2007), depicted that feeding and management system mainly affected the carcass weight, carcass pieces, and carcass characteristics in those animals that have more number of thoracic and lumber vertebrae variation in their vertebrae column. Kaleri *et al.* (2022) and Hopkins *et al.* (2007), revealed that higher carcass weight was recorded in male lamb animal particularly from lower part of neck, shoulder that might be due to long leg and higher fat ratio on body as compared with female animal. Higher meat was produced by male animals as compared with female that might be due to better feeding and management practices with sex influenced particularly more variation due to higher number of thoracic and lumber vertebrae variation in their vertebrae column. In the same way multi vertebrae variation for Balochi breed was observed with significant improved carcass weight by producing more additional meat yield as compared with Harnai breed having less vertebrae variation with small amount meat. Whereas in both breeds increased in the number of thoracic and lumber vertebrae with T14 and L7 or 6 have possess more increased one or two kg of carcass weight as compared with those animals with no variation in thoracic and lumber vertebrae regions. The findings of our study showed that multi-vertebrae Balochi and Harnai sheep is beneficial for carcass weight.

### Conclusions and Recommendations

It is concluded that variation in thoracic and lumber vertebrae of Balochi and Harnai sheep have potential to increased carcass weight, length and quality. It is also concluded that further studies should be carried out for assessment of various carcass traits including (bone proportion, muscles and fat of specially the carcass.

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Present study is the part of PhD thesis submitted by

Mr. Rameez Raja Kaleri submitted to the Department of Animal Breeding and Genetics, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam.

## Novelty Statement

The importance of sheep as meat producing animal increasing worldwide. The increase of thoracic or lumbar number potentially had significant effects on carcass length and weight of sheep. It is therefore highly important to investigate vertebral variation and the association with carcass length and weight in Balochi and Harnai sheep.

## Author's Contribution

Conceived and Designed the Experiment: HA Kaleri, RR Kaleri and GM Solangi. Performed Experiment: RR Kaleri. Collected the Data: MA Memon, DK Bhuptani and AW Solangi. Analyzed the data: AK Kanshi, S Dhari and MA Gopang. Wrote the Paper: RR Kaleri.

## Conflict of interest

The authors have declared no conflict of interest.

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