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Analysis of the Interrelationships between Various Body Dimensions in Young Lambs

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Abstract

The aim of the current study was to examine the relationship between various body measurements of native sheep in the Southern Punjab area of Pakistan. Data (n = 97) on several linear body measurements, along with the animals' identities, were recorded for this purpose. Lambs aged 1 to 6 months were included in the study. Two flocks of animals were involved, and both male and female participants were considered. The body measurements used in this study included: body length, ear length, ear width, head width, withers height, head length, heart girth, neck width, neck length, rump width, rump length, and tail length. The data were collected, updated, and checked for normal distribution. Pearson's correlation coefficient was used to assess the relationships between the measurements. This study provides valuable insights into the associations between different body measurements of native sheep.

Keyword: Body measurements, Pearson correlation, Sheep, Linear measurements
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Introduction

Sheep (*Ovis aries*) are an important breed of livestock that provide mutton, wool, and other byproducts. In meat animals, size and shape are important characteristics. Animals are often evaluated visually, which is a specific method of assessment (Yakubu, 2003; Abanikannda et al., 2002). Accurate measurements of body shape and size can improve growth selection by enabling breeders to distinguish between animals that mature slowly and those that mature rapidly, even when they have different proportions.

The relationship between morphological characteristics and body weight in South African native sheep was studied using standard statistical techniques, such as path analysis. This study aimed to develop a functional model for estimating body weight based on various body measurements and to identify both direct and indirect causal relationships between the body weight of Indigenous sheep and their linear body measurements (Tyasi et al., 2015). The current research focuses on identifying correlations between linear body measurements and this will serve as a guide in the respective field for further investigations.

Materials and Methods

The purpose of this study was to examine the sheep flocks that can be located in and around Multan. The identities of sheep with the date of birth, lambing dates, types of births, and other relevant information have been recorded with the data on their various body measurements. Body measurements recorded were as follows: Body length, Ear length, Ear width, Head width, Withers height, Head length, Heart girth, Neck width, Neck length, Rump width, Rump length, and Tail length.

A vernier caliper set in centimeters and tailor tape were used to measure linear body measurements. The data was edited, and then Pearson's correlation coefficient was used to evaluate it.

$$rxy = \sum (X - X)\,(Y - \bar{Y}) / \sqrt{(\sum (X - X)2)\,(\sum (Y - Y)2}$$

The statistical package for the social sciences (SPSS) was used throughout the whole analysis.

Results and Discussions

In the current study, a significant correlation was found between withers height (WH) and body length (BL), with a range of 0.86–0.92 cm. This correlation is higher than the findings of previous studies by Mule et al. (2014), Dekhili and Aggoun (2014), Yakubu (2012), Ravimurugan et al. (2013), Afolayan et al. (2006), Tadesse et al. (2012), Tariq et al. (2012) and Yunusa et al. (2013). However, it is lower than the correlations reported by Fajemilehin and Salako (2008), Khan et al. (2006), and Yakubu (2010).

The average correlation between WH and head length (HL) in our study ranged from 0.41 to 0.84 cm, which aligns with the results of Yunusa et al. (2013). The correlation between head width and withers height ranged from 0.29 to 0.60 cm, similar to findings by Yunusa et al. (2013), Yakubu (2010), and Yakubu (2012). The relationship between WH and ear length (EL) in the present study (0.53–0.83 cm) was also comparable to the results of Yunusa et al. (2013) and Yakubu and Muhammad (2012).

Our study found higher correlations between WH and heart girth (HG), with values ranging from 0.84 to 0.93 cm. These results are consistent with those of Afolayan et al. (2006), Yakubu (2010), Yunusa et al. (2013), and Yakubu and Muhammad (2012).

However, some studies, including those by Fajemilehin and Salako (2008) and Kamarudin et al. (2011), reported wider ranges for these values.

Withers height and rump length (RL) showed correlations between 0.67 and 0.90 cm, which were higher than those found by Yakubu (2012) but comparable to the studies of Yunusa et al. (2013) and Yakubu (2010). The correlation between WH and rump width (RW) ranged from 0.46 to 0.90 cm, which was higher than the values reported by Yunusa et al. (2013), but similar to those found by Yakubu (2010) and Yakubu (2012). The correlation between WH and tail length (TL) ranged from 0.03 to 0.84 cm, consistent with the results of Yunusa et al. (2013) and Tariq et al. (2012).

Body length (BL) and head width (HW) had correlations ranging from 0.42 to 0.58 cm, which were greater than those reported by Tyasi et al. (2015) but lower than those observed by Yunusa et al. (2013), Yakubu (2010), Petrovic et al. (2012), and Yakubu (2012). Our study also showed body length and ear length (EL) correlations ranging from 0.50 to 0.71 cm, higher than those of Yunusa et al. (2013) but lower than the results of Yakubu and Muhammad (2012).

The body length and heart girth (HG) correlations ranged from 0.82 to 0.90 cm, supporting findings from Afolayan et al. (2006), Tariq et al. (2012), Yakubu and Muhammad (2012). However, these values were lower than those reported by Fajemilehin and Salako (2008), Kamarudin et al. (2011). Our findings for BL and rump length (RL) ranged from 0.65 to 0.83 cm, which were lower than those reported by Yakubu (2010) but higher than those of Yunusa et al. (2013).

Finally, correlations between rump width (RW) and body length (BL) ranged from 0.44 to 0.87 cm. These values were lower than those reported by Petrovic et al. (2012) but consistent with the findings of Yakubu (2010), Yakubu (2012), and Yunusa et al. (2013).

Table 1. Correlation coefficient among the various body measurements of flock 1's female sheep, aged 1-6 months

Traits	WH	BL	HL	HW	EL	EW	NL	NW	HG	RL	RW
BL	0.92**	1									
HL	0.84**	0.753**	1								
HW	0.56**	0.580**	0.600**	1							
EL	0.833**	0.712**	0.798**	0.514*	1						
EW	0.812**	0.699**	0.670**	0.544*	0.802**	1					
NL	0.815**	0.833**	0.782**	0.567**	0.792**	0.629**	1				
NW	0.919**	0.931**	0.811**	0.672**	0.721**	0.806**	0.787**	1			
HG	0.930**	0.884**	0.914**	0.668**	0.769**	0.713**	0.774**	0.920**	1		
RL	0.802**	0.732**	0.833**	0.457*	0.663**	0.672**	0.636**	0.770**	0.788**	1	
RW	0.896**	0.782**	0.920**	0.517*	0.813**	0.754**	0.748**	0.821**	0.905**	0.906**	1
TL	0.841*	0.727*	0.868*	0.658*	0.748*	0.698*	0.676*	0.753*	0.841*	0.853*	0.891**

WH: Withers Height; BL: Body Length; HW: Head width; NL: Neck Length; EL: Ear Length; HL: Head Length; NW: Neck Width; RW: Rump Width; EW: Ear Width; RL: Rump length; HG: Heart Girth; TL: Tail Length.

Table 2. The correlation coefficient among the various body measurements of flock 1's male sheep aged 1-6 months

Trait	WH	BL	HL	HW	EL	EW	NL	NW	HG	RL	RW
BL	0.861**										
HL	0.787**	0.790**									
HW	0.588**	0.521*	0.502*								
EL	0.662**	0.606**	0.702**	0.252^{NS}							

EW	0.645**	0.582*	0.446^{NS}	0.196^{NS}	0.646**						
NL	0.859**	0.772**	0.712**	0.552*	0.529*	0.709**					
NW	0.926**	0.830**	0.845**	0.559*	0.644**	0.587*	0.809**				
HG	0.927**	0.896**	0.832**	0.572*	0.619**	0.662**	0.816**	0.906**			
RL	0.904**	0.833**	0.775**	0.631**	0.518*	0.545*	0.810**	0.931**	0.919**		
RW	0.851**	0.868**	0.690**	0.598*	0.426^{NS}	0.492*	0.795**	0.872**	0.894**	0.950**	
TL	0.571*	0.587*	0.379^{NS}	0.225^{NS}	0.381^{NS}	0.395^{NS}	0.555*	0.473^{NS}	0.549*	0.405^{NS}	0.467^{NS}

WH: Withers Height; BL: Body Length; HW: Head width; NL: Neck Length; EL: Ear Length; HL: Head Length; NW: Neck Width; RW: Rump Width; EW: Ear Width; RL: Rump length; HG: Heart Girth; TL: Tail Length.

Table 3. Correlation coefficient among the various body measurements of flock 2's female sheep, aged 1-6 months

Trait	**WH**	**BL**	**HL**	**HW**	**EL**	**EW**	**NL**	**NW**	**HG**	**RL**	**RW**
WH	1										
BL	0.885**	1									
HL	0.749**	0.697**	1								
HW	0.602**	0.493**	0.677**	1							
EL	0.585**	0.501**	0.274^{NS}	0.158^{NS}	1						
EW	0.622**	0.513**	0.557**	0.448**	0.699**	1					
NL	0.705**	0.686**	0.633**	0.533**	0.442**	0.555**	1				
NW	0.730**	0.749**	0.416**	0.463**	0.554**	0.432**	0.670**	1			
HG	0.844**	0.861**	0.660**	0.455**	0.509**	0.583**	0.715**	0.638**	1		
RL	0.742**	0.745**	0.543**	0.568*	0.384*	0.456**	0.554**	0.617**	0.716**	1	**
RW	0.606**	0.622**	0.402*	0.370*	0.396*	0.474**	0.518**	0.629**	0.580**	0.730**	1
TL	0.030^{NS}	0.172^{NS}	0.251^{NS}	0.187^{NS}	0.052^{NS}	-0.085^{NS}	0.199^{NS}	0.038^{NS}	0.028^{NS}	0.116^{NS}	0.021^{NS}

WH: Withers Height; BL: Body Length; HW: Head width; NL: Neck Length; EL: Ear Length; HL: Head Length; NW: Neck Width; RW: Rump Width; EW: Ear Width; RL: Rump length; HG: Heart Girth; TL: Tail Length.

Table 4. Correlation coefficient among the various body measurements of flock 2's male sheep, aged 1-6 months

Traits	**WH**	**BL**	**HL**	**HW**	**EL**	**EW**	**NL**	**NW**	**HG**	**RL**	**RW**
WH	1										
BL	0.864*	1									
HL	0.410*	0.473*	1								
HW	0.288^{NS}	0.424*	0.108^{NS}	1							
EL	0.533**	0.563**	0.174^{NS}	0.163^{NS}	1						
EW	0.336^{NS}	0.435*	0.340^{NS}	0.131^{NS}	0.604**	1					
NL	0.605**	0.552**	0.370^{NS}	0.176^{NS}	0.196^{NS}	0.052^{NS}	1				
NW	0.577**	0.435*	0.104^{NS}	-0.162^{NS}	0.266^{NS}	0.089^{NS}	0.583**	1			
HG	0.866**	0.822**	0.316^{NS}	0.058^{NS}	0.449*	0.241^{NS}	0.585**	0.602**	1		
RL	0.670**	0.647**	0.397^{NS}	0.154^{NS}	0.322^{NS}	0.562**	0.434*	0.256^{NS}	0.615**	1	

RW	0.462*	0.445*	0.079*	0.021^{NS}	0.36 ^{NS}	0.316^{NS}	0.188 ^{NS}	0.351^{NS}	0.480*	0.386 ^{NS}	1
TL	0.217 ^{NS}	0.178^{NS}	0.108^{NS}	0.093^{NS}	0.027^{NS}	0.114^{NS}	- 0.062^{NS}	0.051^{NS}	0.154^{NS}	- 0.007^{NS}	0.198^{NS}

WH: Withers Height; BL: Body Length; HW: Head width; NL: Neck Length; EL: Ear Length; HL: Head Length; NW: Neck Width; RW: Rump Width; EW: Ear Width; RL: Rump length; HG: Heart Girth; TL: Tail Length.

Table 5. Mean values of each trait (1-6 months lambs)

Flock	WH	BL	HL	HW	EL	EW	NL	NW	HG	RL	RW	TL
G1	57.96	55.33	18.25	9.84	25.34	11.68	22.42	14.09	60.87	10.63	10.17	9.70
G2	65.55	63.80	22.61	10.65	27.08	12.06	25.46	16.13	69.55	13.06	12.62	10.31
G3	52.72	50.61	19.04	6.88	23.45	10.03	19.56	12.36	54.10	10.33	16.40	10.06
G4	52.99	50.21	19.61	7.08	24.50	10.10	19.06	12.85	54.59	10.38	16.95	10.05

G1= flock 1 female; G2=Flock 1 male; G3=Flock 2 female; G4=Flock 2 male; WH: Withers Height; BL: Body Length; HW: Head width; NL: Neck Length; EL: Ear Length; HL: Head Length; NW: Neck Width; RW: Rump Width; EW: Ear Width; RL: Rump length; HG: Heart Girth; TL: Tail Length.

Conclusion

The results revealed a wide range of strong and significant correlations, suggesting that if a few body measurements are known, the remaining measurements can be accurately predicted. Additionally, innovative models, as well as different animal types and age groups, can be utilized to assess the body measurements of young animals. However, to reach more definitive conclusions, further research is needed to obtain more accurate data on the body dimensions of smaller animals, such as sheep and goats.

Competing of Interest

The authors declare that the research was carried out without any commercial or financial relationships that could be construed as a potential conflict of interest.

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