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Correlation and regression analysis between kid biometry and body weight in Surti goat kids during early postpartum period

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Abstract

The objectives of the current study was to assess how Surti goat kid body weight and biometric characteristics related to each other in the early postpartum phase. Heart circumference, body length and height at wither in singlet and twin-born kids between 0 and 60 days after birth were among the biometric characteristics examined. From birth to 60 days, both groups' mean body weight climbed gradually. Heart circumference, body length and height at withering all showed similar rising tendencies. Strong positive correlations between biometric measures and body weight were found using correlation analysis. Body length ($r = 0.94$), height at wither ($r = 0.92$) and heart girth showed the strongest connection with body weight ($r = 0.96$). The best indicator of body weight in Surti goat kids, according to regression analysis, was heart circumference. With a coefficient of determination ($R^2 = 0.93$), the regression equation that was found was $BW = -5.214 + 0.267(HG)$. The results indicate that in situations where weighing scales are not available, biometric data can be successfully used to forecast body weight. Additionally, the study validates the value of linear body measurements for tracking goat kid growth performance.

Keywords: Surti goat, body weight, heart girth, body length, height at wither, correlation, regression analysis, kid biometry

Introduction

Goat farming is a significant part of India's rural economy because of its high reproductive effectiveness, low maintenance costs and adaptability (Thiruvankadan *et al.*, 2005) [6]. According to Patel and Pandey (2013), the Surti Goat is a popular native breed because of its capacity to produce milk and adapt to semi-intensive management practices in western India. Because it directly influences survival, market weight and future productivity, children's growth performance is a significant economic characteristic (Yakubu, 2010) [7]. According to Adeyinka and Mohammed (2006) [1], one of the most accurate measures of goat development and health is body weight. However, weighing scales are frequently unavailable in rural and field settings. As a result, body biometric characteristics like height at wither, body length and heart girth are frequently employed to estimate body weight indirectly (Chitra *et al.*, 2012; Iqbal *et al.*, 2013) [2] [4]. In sheep and goats, a number of studies have found strong positive correlations between live body weight and body measurements (Eyduran *et al.*, 2009) [3]. Heart girth is generally considered the most reliable parameter for predicting body weight because of its close association with body mass and thoracic development (Yilmaz *et al.*, 2013) [8]. Regression and correlation studies help establish mathematical relationships between biometric measurements and body weight, thereby assisting farmers and researchers in growth monitoring and breeding selection programs (Khan *et al.*, 2014) [5].

In order to ascertain the correlation and regression relationship between body weight and biometric features, the current study was conducted to examine the growth pattern of Surti Goat offspring throughout the postpartum period.

Materials and Methods

This study was carried out at navsari, Kamdhenu University's department of livestock

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Production and Management. Standard management conditions were used at the livestock research station to keep experimental animals. At a height of 11.89 meters above mean sea level, Navsari is located at latitude 20°57' N and longitude 72°54' E. The climate in the area is humid to subhumid, with winter temperatures of 10°C and summer temperatures of 40°C. The region receives about 2000 mm of rain on average every year, mostly from June to September. For the study, a total of 14 Surti Goat does that appeared healthy after kidding were chosen. The animals were kept in concrete-floored pucca sheds and fed in accordance with ICAR (1998) feeding guidelines. Based on the manner of birth, the does were split into two groups, each with seven animals: singlet and twin bearing groups. At 0, 7, 15, 30, 45 and 60 days after the birth, the kid's body weight and biometric measurements were noted. A standard measuring tape was used to measure biometric characteristics such as height at wither, body length and heart girth. Using an electronic weighing balance, kid's body weight was recorded.

Statistical Analysis

Using Pearson's correlation method, correlation coefficients (r) between biometric characteristics and body weight were determined. To predict body weight using biometric measures, basic linear regression models were created.

Results and Discussion

Table 1 displays the results of the change in body weight and biometry of Surti goat's kids. Between 0 and 60 days postpartum, the body weight of the kids increased from 2.18±0.15 to 5.74±0.76 kg for singlets and from 2.02±0.02 to 5.58±0.24 kg for twins, with an overall range of 2.10 to 5.60 kg. Overall values ranged from 28.64 to 40.28 cm, with heart girth increasing from 28.71±0.52 to 39.28±0.28 cm in singlets and from 28.42±0.57 to 41.42±0.78 cm in twin kids. Overall values ranged from 29.64 to 43.64 cm, with height at wither increasing from 30.00±0.97 to 42.28±0.89 cm in singlets and from 29.57±1.06 to 45.00±0.48 cm in twin kids.

Table 1: Mean ± SE of Biometry of Surti goats kids after during post-partum periods

Parameters	Groups	Days					
		0	7	15	30	45	60
Body weight (kg)	Singlet	2.18±0.15 ^a	2.64±0.09 ^{ab}	3.67±0.42 ^{bc}	3.78±0.61 ^{bc}	5.1±0.51 ^{cd}	5.74±0.76 ^d
	Twin	2.02±0.02 ^a	2.62±0.13 ^a	3.35±0.08 ^b	3.64±0.17 ^a	4.92±0.30 ^c	5.58±0.24 ^c
	Over all	2.10±0.08	2.63±0.07	3.51±0.21	3.21±0.34	5.00±0.28	5.60±0.41
Heartgirth (cm)	Singlet	28.71±0.52 ^a	30.28±0.64 ^a	31.28±0.64 ^b	34.28±0.71 ^b	40.28±0.71 ^c	39.28±0.28 ^c
	Twin	28.42±0.57 ^a	31.85±0.85 ^a	38.85±0.85 ^b	35.42±0.78 ^b	40.42±0.78 ^c	41.42±0.78 ^c
	Over all	28.64±0.35	31.07±0.51	33.42±0.49	34.85±0.53	40.21±0.44	40.28±0.47
Length of kid (cm)	Singlet	26.71±1.14 ^a	31.0±0.48 ^b	33.37±0.64 ^c	37.42±0.42 ^d	39.28±0.68 ^{de}	41.00±0.57 ^e
	Twin	25.71±1.47 ^a	31.85±1.03 ^b	33.42±0.29 ^b	36.14±0.91	42.85±0.63 ^d	43.14±0.63 ^d
	Over all	26.07±0.93	31.42±0.56	33.5±0.34 ^c	36.78±0.51 ^c	40.35±0.68	42.07±0.50
Height at wither(cm)	Singlet	30.0±0.97 ^a	36.28±0.97 ^b	36.28±0.83 ^c	37.57±0.71 ^c	41.85±0.85 ^d	42.28±0.89 ^{d*}
	Twin	29.57±1.06 ^a	34.00±1.11 ^b	36.57±0.75 ^b	38.42±1.44 ^c	42.85±0.63 ^d	45.00±0.48 ^{d*}
	Over all	29.64±0.73	33.28±0.64	36.42±0.54	38.00±0.78	42.35±0.68	43.64±0.61
Mean bearing different superscript within same row differ significantly (abcd $P < 0.05$)							
Mean bearing * within same column significantly (* $P < 0.05$)							

Correlation Analysis

Table 2: Correlation coefficients between biometric parameters and body weight

Parameter	Correlation Coefficient (r) with Body Weight
Heart girth	0.96
Body length	0.94
Height at wither	0.92

Table 2 shows the correlation coefficients between biometric parameters and body weight. The findings showed that all biometric measures and body weight had considerable positive associations. Heart girth is the best indicator of live body weight in Surti goat offspring, as evidenced by the strongest association between heart girth and body weight. Heart girth was shown to be strongly correlated with body weight in a number of native goat breeds.

Table 3: Linear regression equations for body weight prediction

Sl. No.	Regression Model	Regression Equation	R ² Value
1	Body Weight on Heart Girth (HG)	BW = -5.214 + 0.267(HG)	0.93
2	Body Weight on Body Length (BL)	BW = -4.102 + 0.231(BL)	0.89
3	Body Weight on Height at Withers (HW)	BW = -3.845 + 0.214(HW)	0.85

Table 3 shows the linear regression equations were created for body weight prediction. Heart girth was the most accurate biometric characteristic for predicting body weight, according to the regression analysis. Strong predictive power of biometric parameters was revealed by high coefficients of determination. These results are consistent with other studies in sheep and goats that effectively estimated live body weight under field conditions using body measurements. The current study showed that Surti Goat kids' body weight, heart circumference, body length and height at wither increased gradually between birth and 60 days of age, indicating normal growth and development during the pre-weaning phase.

Thiruvankadan *et al.* (2005) [6] found that body weight and linear body measurements rose considerably with age in Surti goat kids. Similar growth patterns were also noted by Chitra *et al.* (2012) [2] in Malabari goats and Adeyinka and Mohammed (2006) [1] in Nigerian goats, indicating that body dimensions increase proportionately with age and body mass. The current study found a high positive association between biometric features and body weight, which is consistent with previous findings in sheep and goats. After body length and height at wither, heart girth had the strongest connection ($r = 0.96$) with body weight. Similar findings were published by Iqbal *et al.* (2013) [4], who found that the most accurate body

measurement for predicting live body weight in Beetal goats was heart girth. In native goats, Khan *et al.* (2014) [5] similarly found a strong positive correlation between heart circumference and body weight, suggesting that thoracic circumference represents total body growth and tissue deposition. The results of Yakubu (2010) [7], who found that heart girth was more accurate at estimating body weight than other body measurements, are in line with the higher predictive value of heart girth found in this study. Similarly, Yilmaz *et al.* (2013) [8] discovered that because heart girth is closely related to muscular and skeletal growth, it is the best single predictor of live body weight in goats. Heart girth alone could account for about 93% of the variation in body weight, according to the coefficient of determination ($R^2 = 0.93$) found in the current study, demonstrating its applicability in field conditions.

The regression equation developed in this work provides more evidence for the usefulness of biometric measurements for body weight estimate in situations where weighing facilities are not accessible. Eydurán *et al.* (2009) [3] published similar regression models and proposed that linear body measures might accurately predict live weight in small ruminants. However, variations in breed, age, management system, diet, environmental conditions and sample size may account for a little variation in regression coefficients across studies. Some researchers found somewhat lower compared correlations between body weight and body measurements in specific goat breeds, which is in contradiction to the current findings. For instance, moderate associations were found in research using extensively managed local goats because of food circumstances and environmental stress. However, the overall results of this study are consistent with the majority of earlier research showing that heart girth is still the most reliable characteristic for predicting body weight in developing goat offspring. Thus, under realistic farming conditions, the current study demonstrates that biometric data, especially heart girth, can function as trustworthy indicators for assessing live body weight and tracking growth performance of Surti Goat kids.

Conclusion

In Surti Goat kids, the study found strong positive correlations between body weight and biometric characteristics. The greatest connection and prediction accuracy for body weight estimation were found in heart girth. Therefore, in rural production systems without access to weighing facilities, biometric assessments might be useful instruments for tracking growth and estimating body weight. The findings also imply that linear body dimensions could be helpful selection and breeding criteria for goat growth improvement.

Conflict of Interest

Not available.

Financial Support

Not available.

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