

## RELATIONSHIP OF BODY WEIGHT WITH LINEAR BODY MEASUREMENTS IN ROHILKHAND LOCAL GOATS

Ahmad Fahim\*, B.H.M. Patel, V.V. Rijasnaz

Livestock Production Management,  
Indian Veterinary Research Institute, Izatnagar, Bareilly – 243 122 India

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### ABSTRACT

The present research work was conducted at LPM section, IVRI, Izatnagar to record the morphometric parameters in these local goats and to establish a relationship between live weight and certain body measurements which would help in genetic improvement of this local breed. The mean body weight at birth, 3 months, 9-12 months, 15-18 months and > 18 months were  $2.08 \pm 0.32$ ,  $7.55 \pm 0.46$ ,  $12.08 \pm 0.40$ ,  $17.38 \pm 0.34$  and  $18.35 \pm 0.24$  kg, respectively. The mean chest girth in these age groups were found to be  $29.37 \pm 0.50$ ,  $45.69 \pm 0.71$ ,  $55.29 \pm 0.63$ ,  $61.39 \pm 0.53$  and  $61.04 \pm 0.38$  cm, respectively. The mean body length were found to be  $24.87 \pm 0.44$ ,  $41.19 \pm 0.58$ ,  $47.39 \pm 0.51$ ,  $54.01 \pm 0.43$  and  $54.00 \pm 0.31$  cm, respectively. The mean height at withers in these groups were  $32.13 \pm 0.45$ ,  $46.16 \pm 0.64$ ,  $53.36 \pm 0.56$ ,  $57.38 \pm 0.48$  and  $57.69 \pm 0.34$  cm, respectively. There was positive and significant correlation ( $P < 0.01$ ) at the time of birth between birth weight and chest girth, body length, height at withers and pelvic width which was 0.579, 0.357, 0.682 and 0.361, respectively. Similarly, a positive and significant ( $P < 0.01$ ) correlation was found between mature body weight and chest girth, body length, height at withers, neck length and pelvic width and it was found to be 0.615, 0.319, 0.439, 0.430 and 0.614, respectively.

**Key words:** Chest girth, Goats, Morphometric, Rohilkhand.

### INTRODUCTION

Goat is a multi functional animal and plays a significant role in the economy and nutrition of landless, small and marginal farmers in India. As women and children are closely involved with the rearing of goats, they provide an important means of livelihood. Goats contribute to livestock industry in terms of milk, meat, skin and hair. In spite of their importance, they have received little scientific attention.

Therefore, the present research study was designed to observe body weight measurement relationship in Rohilkhand local goats at LPM section, Indian Veterinary research Institute, Izatnagar, Bareilly. This small sized black coloured goat is available in the Rohilkhand region and mainly used for meat purpose. The Rohilkhand goats have some resemblance with Salem Black/ Black Bengal with few exceptions. To increase meat yield from this breed, require genetic improvement of its

live weight. Proper measurement of this trait, which is often hard in villages due to lack of weighing scale, is requisite for achieving this goal. The need for estimation of the trait from simple and more easily measurable variable such as linear body measurements therefore arises. Studies regarding the linear body measurements of goat have been carried out in other region of the world and their possible use for estimating the animals live weights (Islam *et al.* 1991, Singh and Mishra 2004, Slippers *et al.* 2004 )

### MATERIALS AND METHODS

All the morphometric traits were recorded from 180 goats of different age groups. The animals were divided in eleven age groups. These groups consisted of female animals that were maintained at the sheep and goat farm, IVRI. The animals under study were categorized based on their date of birth and recording was done over a period of 11 months (June to April), so that same animal may be also

\*Corresponding author's e-mail: ahmadfahim300@gmail.com

repeated in subsequent category as the age advanced during the course of study. Goats were maintained under stall-fed condition and housed in separate sheds, each attached with open paddock, which allowed the animals to loiter freely. Throughout the study period, the housing for all the animals were kept identical as much as possible in the given farm condition. Cultivated green fodders (maize/berseem/oat) and water was always available to the experimental animals in sufficient quantity during the course of study. Animals received routine inspection and dipping, drenching and vaccination were done for herd health maintenance.

Body weight was taken during early morning in empty stomach animals using weighbridge at monthly intervals and the following linear body measurements were made using the tailor's tape measure as previously used for linear body measurements in Sahel goats (Mohammed and Amin 1997).

Measurements were taken when the animal stood comfortably and evenly on his / her feet on hard plain ground. The definition of various body measurements which was studied are as under.

1. Body length (BL): It was measured as oblique distance from the point of shoulder to the tip of the pin bone.
2. Height at wither (HAW): It was recorded from the highest point of withers to the ground level taking care that the surface is smooth and leveled.
3. Chest girth (CG): It was recorded as circumference of chest in the mid-sternum region just behind the point of elbow.
4. Pelvic width (PW): It was recorded as the horizontal distance between anterior superior spines of ilia.
5. Neck length (NL): It was measured as the distance from the middle dip of vertebrae between the shoulder blades to the poll.

Data collected were analyzed using least square means technique (SAS-12). Statistical analysis of body measurement and body weight was carried out by using least square mean model LSM (SAS-12). The relationship of bodyweight and linear body measurements were estimated by Pearson correlation (SPSS-16).

## RESULTS AND DISCUSSION

Table-1 summarizes the average measurements in terms of least square means obtained for the traits under study. The least square means for body weights differed significantly ( $P < 0.01$ ) among all age groups. However there was non-significant difference in body weight between animals of 2 months and 3 months. Body weight was  $2.08 \pm 0.32$ ,  $3.68 \pm 0.32$ ,  $5.11 \pm 0.32$ ,  $7.25 \pm 0.32$ ,  $7.55 \pm 0.46$ ,  $8.75 \pm 0.26$ ,  $10.28 \pm 0.26$ ,  $12.08 \pm 0.40$ ,  $15.01 \pm 0.34$ ,  $17.38 \pm 0.34$  and  $18.35 \pm 0.24$  kg at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and  $> 18$  months, respectively. Results clearly indicate that body weight increases proportionately with the advancement of age. However, body gain was very less between 2 months to 3 months. Further maximum body weight gain was observed between after 9 months due to natural increase in dry matter intake after reaching puberty. Female adult weight of these goats ( $> 18$  months) was at par with Salem Black reported by Thiruvankadan and Karunanithi (2006). Earlier studies on Rohilkhand goats showed that at 3 months, body weight was  $5.70 \pm 0.34$  kg (Madhuri 2008). The values reported in other breeds / strains for 3 month body weight ranged from 4.01 kg in Black Bengal and its crosses to 12.28 kg in Jhakrana goats (Rai and Singh 1995). Madhuri (2008) reported that at 4 months, body weight in these local goats was  $6.18 \pm 0.32$  kg and at 6 months, their body weight was  $7.03 \pm 0.31$  kg and their average figure was slightly lower than the values obtained in present study. The values reported by other breeds / strains of goats for 6 month body weight ranged from 9.79 kg in Zalawadi goats to 17.04 kg in Kutchi goats (Singh *et al.* 2007 and Kumar *et al.* 2007). The mature body weight reported in other breeds / strains ranged from 10.80 kg in local goats of Sumatra to 35 kg in Saanen (Sitepu 1985 and Chawla *et al.* 1984). Rohilkhand goats mature body weight falls between large and dwarf category breeds and thus can be classified under medium sized goats.

The body measurements in different age groups have been presented in Table 1. The CG was  $29.37 \pm 0.50$ ,  $36.52 \pm 0.50$ ,  $39.83 \pm 0.50$ ,  $44.85 \pm 0.50$ ,  $45.69 \pm 0.71$ ,  $46.99 \pm 0.41$ ,  $50.14 \pm 0.41$ ,  $55.29 \pm 0.63$ ,  $57.69 \pm 0.53$ ,  $61.39 \pm 0.53$

TABLE 1 : Least squares' means of body weight (BW), chest girth (CG), body length (BL), height at withers (HAW), ear length (EL), neck length (NL) and pelvic width (PW) for local goats in different age groups

		BW(kg)	CG(cm)	BL(cm)	HAW(cm)	EL(cm)	NL(cm)	PW(cm)
Overall		10.16±0.09 (662)	48.53±0.02 (662)	42.06±0.01 (662)	47.58±0.13 (662)	13.75±0.07 (662)	20.28±0.05 (662)	8.56±0.03 (662)
Age Group								
1	Birth	2.08±0.32 (57)	29.37±0.50 (57)	24.87±0.44 (57)	32.13±0.45 (57)	9.95±0.25 (57)	9.03±0.18 (57)	5.10±0.11 (57)
2	15day	3.68±0.32 (57)	36.52±0.50 (57)	31.11±0.44 (57)	36.96±0.45 (57)	10.91±0.25 (57)	12.14±0.18 (57)	6.25±0.11 (57)
3	1 month	5.11±0.32 (57)	39.83±0.50 (57)	33.99±0.44 (57)	40.25±0.45 (57)	12.11±0.25 (57)	16.99±0.18 (57)	7.29±0.11 (57)
4	2 months	7.25±0.32 <sup>a</sup> (57)	44.85±0.50 <sup>a</sup> (57)	39.07±0.44 (57)	44.35±0.45 (57)	12.97±0.25 (57)	19.03±0.18 (57)	7.77±0.11 <sup>a</sup> (57)
5	3 months	7.55±0.46 <sup>a</sup> (28)	45.69±0.71 <sup>ab</sup> (28)	41.19±0.58 <sup>a</sup> (28)	46.16±0.64 <sup>a</sup> (28)	13.79±0.32 <sup>a</sup> (28)	20.11±0.26 (28)	7.50±0.16 <sup>a</sup> (28)
6	> 3-6 months	8.75±0.26 (87)	46.99±0.41 <sup>b</sup> (87)	42.21±0.33 <sup>a</sup> (87)	47.07±0.36 <sup>a</sup> (87)	14.11±0.18 <sup>a</sup> (87)	21.01±0.15 (87)	7.80±0.09 <sup>a</sup> (28)
7	> 6-9 months	10.28±0.26 (86)	50.14±0.41 (86)	44.12±0.33 (86)	48.87±0.36 (86)	14.90±0.18 (86)	23.02±0.15 (86)	8.48±0.09 (86)
8	> 9-12 months	12.08±0.40 (36)	55.29±0.63 (36)	47.39±0.51 (36)	53.36±0.56 (36)	16.58±0.29 <sup>b</sup> (36)	24.39±0.23 (36)	9.46±0.14 (36)
9	> 12-15 months	15.01±0.34 (50)	57.69±0.53 (50)	51.70±0.43 (50)	55.15±0.48 (50)	15.29±0.24 <sup>b</sup> (50)	25.40±0.19 <sup>a</sup> (50)	10.35±0.12 (50)
10	> 15-18 months	17.38±0.34 (50)	61.39±0.53 <sup>c</sup> (50)	54.01±0.43 <sup>b</sup> (50)	57.38±0.48 <sup>b</sup> (50)	14.67±0.24 (50)	25.00±0.19 <sup>a</sup> (50)	11.13±0.12 (50)
11	> 18months	18.35±0.24 (97)	61.04±0.38 <sup>c</sup> (97)	54.00±0.31 <sup>b</sup> (97)	57.69±0.34 <sup>b</sup> (97)	15.40±0.17 <sup>b</sup> (97)	24.65±0.14 (97)	11.64±0.09 (97)

LSM showing same superscripts in lower case letters in a column do not differ significantly ( $P > 0.05$ );

Figures in parentheses are the numbers of animals

and 61.04± 0.38 cm at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months, respectively. These values differed significantly at different age groups except between the age of 2 months and 3 months. Earlier studies (Madhuri 2008) on these local goats suggest that chest girth at 2 months was 40.44± 0.78 cm, 3 months was 42.15± 0.70 cm. Chest girth ranged from 30.00 cm in Assam local goats to 45.96 cm in Kutchi goats (Bhadula 1979 and Kumar *et al.* 2007). At 6 months heart girth ranged from 45.2 cm in Assam local goats to 53.36 cm in Chegu pashmina goats (Das *et al.* 1993 and Karna 1997).

The body length was found to be 24.87± 0.44, 31.11± 0.44, 33.99± 0.44, 39.07± 0.44, 41.19± 0.58, 42.21± 0.33, 44.12± 0.33, 47.39± 0.51, 51.70± 0.43, 54.01± 0.43 and 54.00± 0.31 cm at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months, respectively. The values differed significantly

in different age groups except between the animals of 3 months and animals more than 3 months up to 6 months. There is possibility of weaning stress practiced at the age of 3 months in farm. Body length at 3 months averaged 28.00 cm in Assam local goats to 53.85 cm in Borneo white goats (Bhadula 1979 and Mohammad *et al.* 2006). The results this study agreed with the parameters of medium sized category goats. At the age of 6 months, body length range from 42.01 cm in Korean native goats to 55.48 cm in Chegu pashmina goats (Kim *et al.* 2002 and Karna 1997).

The height at withers at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months were 32.13± 0.45, 36.96± 0.45, 40.25± 0.45, 44.35± 0.45, 46.16± 0.64, 47.07± 0.36, 48.87± 0.36, 53.36± 0.56, 55.15± 0.48, 57.38± 0.48 and 57.69± 0.34 cm, respectively. Similarly there was significant difference in the values of HAW except between the animals of 3 months and animals more than 3 months up to 6

months. Height at withers at 3 months ranged from 28.66 cm in Assam local goats to 48.78 cm in Kutchi goats (Bhadula 1979 and Kumar *et al.*, 2007). At 6 months, height at withers ranged from 40.27 cm in Korean native goats to 56.84 cm in Kutchi goats (Kim *et al.* 2002 and Kumar *et al.* 2007).

Devendra and Burns (1983) reported that on the basis of height at withers, adult goats can be classified as large (> 65 cm), small to medium (51-65 cm) and dwarf (< 50 cm) categories. According to the results, Rohilkhand goats can be grouped under small to medium sized breeds having mean adult value of  $57.69 \pm 0.34$  cm.

The pelvic width was found to be  $5.10 \pm 0.11$ ,  $6.25 \pm 0.11$ ,  $7.29 \pm 0.11$ ,  $7.77 \pm 0.11$ ,  $7.50 \pm 0.16$ ,  $7.80 \pm 0.09$ ,  $8.48 \pm 0.09$ ,  $9.46 \pm 0.14$ ,  $10.35 \pm 0.12$ ,  $11.13 \pm 0.12$  and  $11.64 \pm 0.09$  cm at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months, respectively. The values of pelvic width differed significantly in different age groups.

The ear length was observed to be  $9.95 \pm 0.25$ ,  $10.91 \pm 0.25$ ,  $12.11 \pm 0.25$ ,  $12.97 \pm 0.25$ ,  $13.79 \pm 0.32$ ,  $14.11 \pm 0.18$ ,  $14.90 \pm 0.18$ ,  $16.58 \pm 0.29$ ,  $15.29 \pm 0.24$ ,  $14.67 \pm 0.24$  and  $15.40 \pm 0.17$  cm at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months, respectively. The growth of ears declines after 3 months of age and later there was non-significant difference ( $P > 0.05$ ) was obtained in different groups. It was reported by Thiruvankadan and Karunanithi (2006) that ear length in Salem Black goats is  $16.0 \pm 0.1$  cm which is at par with Rohilkhand goats.

The neck length was found to be  $9.03 \pm 0.18$ ,  $12.14 \pm 0.18$ ,  $16.99 \pm 0.18$ ,  $19.03 \pm 0.18$ ,  $20.11 \pm 0.26$ ,  $21.01 \pm 0.15$ ,  $23.02 \pm 0.15$ ,  $24.39 \pm 0.23$ ,  $25.40 \pm 0.19$ ,  $25.00 \pm 0.19$  and  $24.65 \pm 0.14$  cm at birth, 15 day, 1 month, 2 months, 3 months, 3-6 months, 6-9 months, 9-12 months, 12-15 months, 15-18 months and > 18 months, respectively. The values differed significantly between different age groups and the length almost becomes constant after 12 months of age.

#### **Relationship between different physical traits:**

There was positive and significant correlation

( $P < 0.01$ ) at the time of birth between birth weight and chest girth, body length, height at withers and pelvic width which was 0.579, 0.357, 0.682 and 0.361, respectively. The correlation between birth weight and neck length was found to be non-significant and it was 0.010 respectively. The correlation between chest girth and other parameters vary positively and significantly ( $P < 0.01$ ) except neck length which had negative correlation (-0.051). The correlation between body length and neck length, pelvic width was non-significant and it was 0.225, 0.123, respectively. Height at withers had non-significant correlation with neck length which was 0.011. Pelvic width and neck length had negative correlation between them which was -0.121 (Table 2). Mohammed and Amin (1997) obtained a good correlation ( $r^2 > 0.80$ ) between body weight and chest girth in different categories from birth up to 6 months and it was concluded that body weight of Sahel goats can be estimated in the field using morphometric measurements taken with a tape. At 3 months, chest girth showed a good and significant ( $P < 0.01$ ) correlation with body weight which was 0.850. Similarly body length was also significantly correlated (0.657) at this stage. There was significant correlation ( $P < 0.05$ ) of neck length with body weight, chest girth and body length which was 0.457, 0.417, 0.570, respectively. Between 6-9 months, body weight was significantly correlated ( $P < 0.01$ ) to chest girth, body length and height at withers which was 0.747, 0.803, 0.638, respectively. Similar results were obtained for the correlation among different parameters up to 15 months.

However, a positive and significant ( $P < 0.01$ ) correlation was found between mature body weight and chest girth, body length, height at withers, neck length and pelvic width and it was found to be 0.615, 0.319, 0.439, 0.430 and 0.614 respectively. Correlation between most of the morphometric trait at maturity were positive at significant level ( $P < 0.01$ ). The correlation between neck length and chest girth, height at withers was found to be 0.227, 0.219, respectively which was not significant. However the correlation of neck length and body length was found to be significant at ( $P < 0.05$ ) and it was 0.305 (Table 2). Otoikhian *et al.* (2008) reported the body measurement parameters as a

TABLE 2 : Correlation coefficient among body weight (BWT), chest girth (CG), body length (BL), height at withers (HAW), neck length (NL) and pelvic width (PW) in Rohilkhand goats.

		BWT	CG	BL	HAW	NL	PW
Birth	BWT	1					
	CG	0.579**	1				
	BL	0.357**	0.399**	1			
	HAW	0.682**	0.590**	0.315*	1		
	NL	0.01	-0.051	0.225	0.011	1	
	PW	0.361**	0.348**	0.123	0.299*	-0.121	1
3 month	BWT	1					
	CG	0.850**	1				
	BL	0.657**	0.691**	1			
	HAW	0.301	0.217	0.339	1		
	NL	0.457*	0.417*	0.570**	0.154	1	
	PW	0.541**	0.617**	0.397*	-0.51	0.335	1
6-9 months	BWT	1					
	CG	0.747**	1				
	BL	0.803**	0.567**	1			
	HAW	0.638**	0.535**	0.685**	1		
	NL	-0.039	-0.155	0.026	0.070	1	
	PW	0.293**	0.446**	0.231*	0.215*	-0.162	1
12-15 months	BWT	1					
	CG	0.758**	1				
	BL	0.552**	0.431**	1			
	HAW	0.655**	0.743**	0.561**	1		
	NL	0.137	-0.049	0.215	0.124	1	
	PW	0.430**	0.174	0.242	0.320*	0.405**	1
Maturity	BWT	1					
	CG	0.615**	1				
	BL	0.319*	0.510**	1			
	HAW	0.439**	0.682**	0.690**	1		
	NL	0.430**	0.227	0.305*	0.219	1	
	PW	0.614**	0.596**	0.457**	0.525**	0.034*	1

Correlation is significant ( $P < 0.01$ )

Correlation is significant ( $P < 0.05$ )

function of assessing body weight in goats under on-farm research environment. They reported the effect of age on body measurement parameters of goats. Similarly Singh and Mishra (2004) studied the estimation of body weight using body conformation traits in Barbari goats.

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