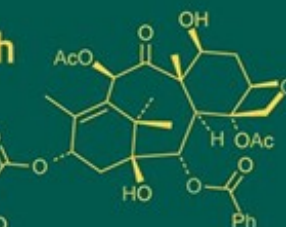


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Body weight and linear body measurements of local (Dharuri) sheep at different stages of growth under field conditions in Beed district of Maharashtra

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ABSTRACT

Body weight and linear body measurements of local (Dharuri) sheep were recorded under field conditions to characterise their growth. Data on 1,487 sheep (484 males, 1,003 females) from four blocks of Beed district, Maharashtra (Adas, Wadhwani, Dharur and Neknoor) were grouped into five age classes (0–3, 4–6, 7–12, 13–36 and above 36 months). Body weight, height at withers, chest girth, body length, ear length and horn length were analysed within each age class by least-squares analysis with block and sex as fixed effects. Overall least-squares mean body weight increased from 8.75 ± 0.19 kg at 0–3 months to 21.22 ± 0.26 , 29.77 ± 0.22 , 40.51 ± 0.37 and 52.98 ± 0.35 kg in the successive age classes. Height at withers, chest girth and body length increased from 41.90 ± 0.34 , 45.15 ± 0.38 and 40.30 ± 0.34 cm at 0–3 months to 81.13 ± 0.25 , 98.59 ± 0.37 and 90.73 ± 0.46 cm above 36 months, respectively. Ear length reached near-mature size (18.37 ± 0.11 cm) by 7–12 months. Block had a significant ($P < 0.05$ or $P < 0.01$) effect on body weight at all ages and on most linear measurements, although its magnitude varied with age. Sex had a highly significant effect on horn length at all ages, whereas its effect on body weight was non-significant throughout. By 7–12 months, animals had attained about 85% of mature height but only 56% of mature body weight, indicating early skeletal development followed by prolonged tissue deposition. The results provide baseline phenotypic information for the characterisation and improvement of the local sheep of Beed district.

Keywords: Body measurements, Body weight, Dharuri sheep, Growth, Least-squares analysis, Sexual dimorphism

Introduction

Sheep rearing is an important component of livestock-based rural livelihoods in the semi-arid regions of Maharashtra. Local sheep populations are maintained under extensive and migratory systems and are adapted to the climatic and management conditions of their home tracts. The Deccani sheep, the principal indigenous breed of the Deccan plateau, is reared mainly for meat and comprises several regional ecotypes that differ in body size and conformation (Nimbkar *et al.*, 2002; Yadav *et al.*, 2017) [1, 2]. Deccani-type non-descript local sheep population of Beed district, locally known as Dharuri. The local sheep population of Beed district, commonly referred to by farmers as Dharuri, has not been systematically characterized and may be described as a Deccani-type non-descript local sheep population. It is important to distinguish this population from officially registered breeds, as Dharuri is not presently listed as a separate registered sheep breed by ICAR–NBAGR.

Recording of body weight and linear body measurements is the first step in the phenotypic characterisation of a population. Height at withers, chest girth and body length indicate skeletal development and body size, while ear and horn dimensions contribute to breed description (Sahana *et al.*, 2004; Raja *et al.*, 2012; Jain *et al.*, 2021) [4, 5, 3]. These measurements are also useful for estimating body weight where weighing balances are unavailable (Ravimurugan *et al.*, 2013; Kumar *et al.*, 2021; Firdaus *et al.*, 2025) [7, 8, 6].

Growth is not uniform throughout life. Linear dimensions increase rapidly in early life and approach mature size at different rates, whereas body weight continues to increase after much of the skeleton has developed because of continued muscle and fat deposition (Bangar *et al.*, 2018; Nimase *et al.*, 2017) [9, 10]. Evaluation of body measurements at different ages is therefore needed to understand the growth pattern of local sheep under field conditions. The present study was undertaken to characterise body weight and linear body measurements of local (Dharuri) sheep at different stages of growth and to assess the effects of block and sex on these traits.

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Materials and methods

Study area and animals

The study was conducted during May in four sheep-rearing blocks of Beed district, Maharashtra, namely Adas, Wadhwani, Dharur and Neknoor. A total of 10 villages representing the four blocks were selected based on the presence and availability of local sheep populations. A total of 1,487 local sheep of both sexes were recorded and grouped into five age classes: 0–3, 4–6, 7–12, 13–36 and above 36 months. Age was ascertained from the owners' records and recall and was confirmed by dentition where necessary.

Body measurements

Body weight (kg), height at withers, chest girth, body length, ear length and horn length (cm) were recorded following standard procedures. Physical measurements were recorded using appropriate measuring instruments. The following body measurements were recorded on each animal:

- Body weight (kg), recorded using a portable weighing balance, to the nearest 100 g.
- Body length (cm), the distance from the point of the shoulder to the pin bone.
- Height at withers (cm), the perpendicular distance from the ground to the highest point of the withers.
- Chest girth (cm), the circumference of the chest measured immediately behind the forelegs.
- Ear length (cm), the length of the ear measured along the ventral surface from the base to the tip.
- Horn length (cm), the distance from the base to the tip of the horn, measured along the outer curvature.

Linear measurements were taken with a flexible measuring tape to the nearest 0.1 cm, with the animal standing squarely on level ground, generally in the morning before the flock left for grazing. All measurements were taken by the same person to avoid between-observer variation.

Body weight was recorded with a 100 kg spring balance wherever the owner permitted weighing. Where direct weighing was not possible, body weight was estimated from age-specific regression equations based on body measurements.

Statistical analysis

Data were analysed separately within each age class, because the objective was to describe development at each stage of growth. Owing to unequal subclass numbers, the least-squares procedure of Harvey (1960) [11] was used with the following model:

$$Y_{ijk} = \mu + B_i + S_j + e_{ijk}$$

where Y_{ijk} is the observation on the k th animal of the j th sex in the i th block; μ is the overall mean; B_i is the fixed effect of the i th block ($i = 1$ to 4: Adas, Wadhwani, Dharur and Neknoor); S_j is the fixed effect of the j th sex ($j = 1$, male; 2, female); and e_{ijk} is the random error, assumed NID ($0, \sigma^2_e$).

The significance of block and sex effects was tested by the F -test. Differences among least-squares means were tested by Duncan's multiple range test as modified by Kramer (1957) [12]. Approximate average daily gain between successive age classes was calculated as the difference between the class means divided by the interval (days) between class mid-points (1.5, 5, 9.5, 24.5 and 48 months). Allometric coefficients of each linear measurement relative to body weight were obtained as the slope b of the regression $\ln Y = \ln a + b \ln BW$.

Results and discussion

Population structure

The age- and sex-wise structure of the sampled population is presented in Table 1. The population comprised 484 males (32.5%) and 1,003 females (67.5%). The 13–36 month class was the largest (421 animals; 28.3%), followed by 0–3 months (409; 27.5%), above 36 months (250; 16.8%), 4–6 months (213; 14.3%) and 7–12 months (194; 13.0%). Dharur contributed the most animals (428), followed by Wadhwani (392), Adas (348) and Neknoor (319). The sex ratio was nearly balanced up to 12 months of age, but females made up 91% of animals aged 13–36 months and 81% of those above 36 months. This reflects the common practice of selling male lambs as they reach marketable weight while retaining females for breeding, and the large proportion of young stock indicates regular replacement within the flocks.

Table 1. Age- and sex-wise distribution of local (Dharuri) sheep across the four blocks

Age group (months)	Sex	Adas	Wadhwani	Dharur	Neknoor	Total
0–3	Male	52	58	66	40	216
	Female	48	61	58	26	193
	Total	100	119	124	66	409
4–6	Male	23	21	27	24	95
	Female	31	29	34	24	118
	Total	54	50	61	48	213
7–12	Male	18	20	24	25	87
	Female	22	23	30	32	107
	Total	40	43	54	57	194
13–36	Male	12	13	11	3	39
	Female	69	93	113	107	382
	Total	81	106	124	110	421
Above 36	Male	8	16	16	7	47
	Female	65	58	49	31	203
	Total	73	74	65	38	250
Overall	Male	113	128	144	99	484
	Female	235	264	284	220	1,003
	Total	348	392	428	319	1,487

(continued on next page)

Body weight and body measurements at different ages

Least-squares means of body weight and body measurements at each age are presented in Tables 2 to 6, and the analyses of variance in Table 7. Body weight and all principal linear measurements increased steadily with age. Body weight increased from 8.75 ± 0.19 kg at 0–3 months to 21.22 ± 0.26 , 29.77 ± 0.22 , 40.51 ± 0.37 and 52.98 ± 0.35 kg at 4–6, 7–12, 13–36 and above 36 months, respectively. Over the same period, height at withers increased from 41.90 ± 0.34

to 81.13 ± 0.25 cm, chest girth from 45.15 ± 0.38 to 98.59 ± 0.37 cm and body length from 40.30 ± 0.34 to 90.73 ± 0.46 cm. A progressive increase in body weight and body dimensions with age has also been reported in Deccani sheep (Mane *et al.*, 2014; Adangale *et al.*, 2017; Nimase *et al.*, 2017; Bangar *et al.*, 2018) [14, 13, 10, 9] and in other Indian breeds (Ravimurugan *et al.*, 2010; Yadav *et al.*, 2011) [15, 16]. The body weight and body dimensions of adult animals in the present study are higher than those generally reported for Deccani sheep (Yadav *et al.*, 2017) [2] and other Deccan plateau breeds.

Table 2. Least-squares means ($\pm$ SE) of body measurements and body weight of local (Dharuri) sheep at 0–3 months of age

Effect	n	Height at withers (cm)	Chest girth (cm)	Body length (cm)	Ear length (cm)	Horn length (cm)	Body weight (kg)
Overall mean	409	41.90 ± 0.34	45.15 ± 0.38	40.30 ± 0.34	8.96 ± 0.07	0.17 ± 0.02	8.75 ± 0.19
Block							
Adas	100	42.58 ± 0.67	43.90 ± 0.75	40.14 ± 0.66	8.04 ± 0.14	0.10 ± 0.04	8.34 ± 0.36
Wadhwani	119	40.61 ± 0.61	42.48 ± 0.69	38.62 ± 0.60	8.51 ± 0.13	0.05 ± 0.03	7.61 ± 0.33
Dharur	124	40.97 ± 0.60	45.79 ± 0.67	40.00 ± 0.59	9.48 ± 0.13	0.18 ± 0.03	8.99 ± 0.33
Neknoor	66	43.43 ± 0.82	48.44 ± 0.93	42.45 ± 0.81	9.79 ± 0.18	0.36 ± 0.05	10.04 ± 0.45
Sex							
Male	216	42.09 ± 0.46	45.50 ± 0.51	40.55 ± 0.45	9.02 ± 0.10	0.32 ± 0.03	8.96 ± 0.25
Female	193	41.71 ± 0.49	44.80 ± 0.55	40.06 ± 0.49	8.89 ± 0.11	0.03 ± 0.03	8.53 ± 0.27

Values are least-squares means $\pm$ SE. The overall mean for horn length is the unweighted average of the male and female estimates.

Table 3. Least-squares means ($\pm$ SE) of body measurements and body weight of local (Dharuri) sheep at 4–6 months of age

Effect	n	Height at withers (cm)	Chest girth (cm)	Body length (cm)	Ear length (cm)	Horn length (cm)	Body weight (kg)
Overall mean	213	59.71 ± 0.36	65.53 ± 0.40	58.13 ± 0.37	13.99 ± 0.11	1.99 ± 0.10	21.22 ± 0.26
Block							
Adas	54	55.14 ± 0.70	60.06 ± 0.79	53.02 ± 0.72	12.39 ± 0.21	1.83 ± 0.19	18.62 ± 0.51
Wadhwani	50	62.39 ± 0.73	67.92 ± 0.82	60.40 ± 0.75	14.71 ± 0.22	2.38 ± 0.20	23.65 ± 0.53
Dharur	61	60.40 ± 0.66	65.94 ± 0.74	58.41 ± 0.68	14.10 ± 0.20	2.07 ± 0.18	21.86 ± 0.48
Neknoor	48	60.90 ± 0.74	68.19 ± 0.84	60.69 ± 0.76	14.77 ± 0.23	1.69 ± 0.20	20.74 ± 0.54
Sex							
Male	95	59.89 ± 0.53	65.68 ± 0.60	58.26 ± 0.54	14.04 ± 0.16	4.00 ± 0.14	21.18 ± 0.38
Female	118	59.52 ± 0.48	65.38 ± 0.54	58.00 ± 0.49	13.95 ± 0.15	0.00 ^a	21.26 ± 0.34

Values are least-squares means $\pm$ SE. ^aFemales were predominantly polled; the additive block + sex model gave near-zero or slightly negative estimates (-0.06 to 0.00), which are shown as 0.00 .

Table 4. Least-squares means ($\pm$ SE) of body measurements and body weight of local (Dharuri) sheep at 7–12 months of age

Effect	n	Height at withers (cm)	Chest girth (cm)	Body length (cm)	Ear length (cm)	Horn length (cm)	Body weight (kg)
Overall mean	194	69.20 ± 0.28	79.01 ± 0.33	69.75 ± 0.31	18.37 ± 0.11	3.16 ± 0.15	29.77 ± 0.22
Block							
Adas	40	70.02 ± 0.61	80.14 ± 0.71	70.78 ± 0.68	18.46 ± 0.24	2.92 ± 0.31	30.79 ± 0.47
Wadhwani	43	68.23 ± 0.58	77.82 ± 0.68	68.63 ± 0.66	18.08 ± 0.23	2.96 ± 0.30	28.95 ± 0.46
Dharur	54	68.64 ± 0.52	78.40 ± 0.61	69.05 ± 0.59	18.24 ± 0.21	3.13 ± 0.27	29.25 ± 0.41
Neknoor	57	68.93 ± 0.51	79.67 ± 0.59	70.53 ± 0.57	18.71 ± 0.20	3.62 ± 0.26	30.09 ± 0.40
Sex							
Male	87	68.45 ± 0.41	78.45 ± 0.48	69.07 ± 0.46	18.18 ± 0.16	6.35 ± 0.21	29.50 ± 0.32
Female	107	69.96 ± 0.37	79.57 ± 0.43	70.43 ± 0.42	18.56 ± 0.15	0.00 ^a	30.04 ± 0.29

Values are least-squares means $\pm$ SE. ^aFemales were predominantly polled; the additive block + sex model gave near-zero or slightly negative estimates (-0.06 to 0.00), which are shown as 0.00 .

Table 5. Least-squares means ($\pm$ SE) of body measurements and body weight of local (Dharuri) sheep at 13–36 months of age

Effect	n	Height at withers (cm)	Chest girth (cm)	Body length (cm)	Ear length (cm)	Horn length (cm)	Body weight (kg)
Overall mean	421	75.71 $\pm$ 0.33	90.60 $\pm$ 0.39	78.70 $\pm$ 0.35	18.57 $\pm$ 0.10	4.81 $\pm$ 0.15	40.51 $\pm$ 0.37
Block							
Adas	81	73.70 $\pm$ 0.50	88.26 $\pm$ 0.59	76.54 $\pm$ 0.53	18.30 $\pm$ 0.14	4.27 $\pm$ 0.22	37.79 $\pm$ 0.56
Wadhwani	106	74.83 $\pm$ 0.46	89.79 $\pm$ 0.54	77.71 $\pm$ 0.48	18.64 $\pm$ 0.13	4.89 $\pm$ 0.20	39.45 $\pm$ 0.51
Dharur	124	76.27 $\pm$ 0.45	91.32 $\pm$ 0.53	79.20 $\pm$ 0.47	18.61 $\pm$ 0.13	5.12 $\pm$ 0.20	41.08 $\pm$ 0.50
Neknoor	110	78.05 $\pm$ 0.49	93.04 $\pm$ 0.58	81.35 $\pm$ 0.52	18.73 $\pm$ 0.14	4.98 $\pm$ 0.22	43.70 $\pm$ 0.55
Sex							
Male	39	75.14 $\pm$ 0.64	90.09 $\pm$ 0.75	78.14 $\pm$ 0.67	18.24 $\pm$ 0.18	9.68 $\pm$ 0.28	40.18 $\pm$ 0.71
Female	382	76.28 $\pm$ 0.20	91.12 $\pm$ 0.24	79.27 $\pm$ 0.22	18.90 $\pm$ 0.06	0.00 ^a	40.83 $\pm$ 0.23

Values are least-squares means $\pm$ SE. ^aFemales were predominantly polled; the additive block + sex model gave near-zero or slightly negative estimates (–0.06 to 0.00), which are shown as 0.00.

Values are least-squares means $\pm$ SE.

Effect of block

The analysis of variance (Table 7) showed that the effect of block varied with age and trait. At 0–3 months, block had a significant effect on height at withers ($P < 0.05$) and a highly significant effect ($P < 0.01$) on all other traits. At 4–6 months, block significantly affected all traits except horn length. At 7–12 months, block effects were significant only for body length and body weight ($P < 0.05$). At 13–36 months, block had highly significant effects on all traits except ear length, and above 36 months block significantly affected all traits except horn length.

At 0–3 months, lambs from Neknoor were the heaviest (10.04 $\pm$ 0.45 kg) and those from Wadhwani the lightest (7.61 $\pm$ 0.33 kg). At 4–6 months, Wadhwani recorded the highest body weight (23.65 $\pm$ 0.53 kg), followed by Dharur, Neknoor and Adas. At 7–12 months, block means were close, ranging from 28.95 $\pm$ 0.46 to 30.79 $\pm$ 0.47 kg. At 13–36 months, animals from Neknoor (43.70 $\pm$ 0.55 kg) and Dharur (41.08 $\pm$ 0.50 kg) were heavier than those from Wadhwani (39.45 $\pm$ 0.51 kg) and Adas (37.79 $\pm$ 0.56 kg), whereas above 36 months block means again converged (51.77 $\pm$ 0.52 to 53.87 $\pm$ 0.71 kg).

The inconsistent ranking of blocks across age classes suggests that the block differences arise mainly from local differences in flock management, grazing resources and feed availability rather than from genetic differentiation among blocks. Significant effects of location or flock on growth traits of Deccani sheep have also been reported (Chikurdekar *et al.*, 2012; Bangar *et al.*, 2017) [18, 17]. Because block and flock were confounded in this field study, part of the block effect may also reflect differences between individual flocks.

Effect of sex

Sex had a highly significant effect ($P < 0.01$) on horn length at every age, but relatively little influence on body weight and the principal body measurements. Sex did not significantly affect body weight at any age. At 7–12 months, sex significantly affected height at withers ($P < 0.01$) and body length ($P < 0.05$), with females having slightly larger values than males, and at 13–36 months sex had a significant effect on ear length ($P < 0.01$).

Male horn length increased from 0.32 $\pm$ 0.03 cm at 0–3 months to 4.00 $\pm$ 0.14, 6.35 $\pm$ 0.21, 9.68 $\pm$ 0.28 and 8.90 $\pm$ 0.58 cm in the successive age classes, whereas females were predominantly polled. Horn length is therefore a strongly sexually dimorphic trait in this population, as in most Indian sheep breeds in which rams are horned and ewes polled (Sahana *et al.*, 2004; Raja *et al.*, 2012) [4, 5].

Table 6. Least-squares means ($\pm$ SE) of body measurements and body weight of local (Dharuri) sheep at above 36 months of age

Effect	n	Height at withers (cm)	Chest girth (cm)	Body length (cm)	Ear length (cm)	Horn length (cm)	Body weight (kg)
Overall mean	250	81.13 $\pm$ 0.25	98.59 $\pm$ 0.37	90.73 $\pm$ 0.46	18.72 $\pm$ 0.09	4.46 $\pm$ 0.33	52.98 $\pm$ 0.35
Block							
Adas	73	81.00 $\pm$ 0.40	98.23 $\pm$ 0.59	89.65 $\pm$ 0.74	18.59 $\pm$ 0.14	4.74 $\pm$ 0.52	52.47 $\pm$ 0.56
Wadhwani	74	79.81 $\pm$ 0.38	97.19 $\pm$ 0.55	88.95 $\pm$ 0.69	18.44 $\pm$ 0.13	4.13 $\pm$ 0.49	51.77 $\pm$ 0.52
Dharur	65	81.85 $\pm$ 0.40	99.47 $\pm$ 0.58	92.13 $\pm$ 0.72	18.97 $\pm$ 0.14	4.19 $\pm$ 0.51	53.82 $\pm$ 0.55
Neknoor	38	81.87 $\pm$ 0.52	99.48 $\pm$ 0.75	92.19 $\pm$ 0.94	18.90 $\pm$ 0.18	4.78 $\pm$ 0.67	53.87 $\pm$ 0.71
Sex							
Male	47	81.27 $\pm$ 0.45	98.77 $\pm$ 0.65	90.86 $\pm$ 0.82	18.69 $\pm$ 0.15	8.90 $\pm$ 0.58	53.15 $\pm$ 0.62
Female	203	81.00 $\pm$ 0.22	98.42 $\pm$ 0.32	90.60 $\pm$ 0.40	18.76 $\pm$ 0.08	0.02 $\pm$ 0.29	52.82 $\pm$ 0.30

The small sex differences in body size contrast with the marked sexual dimorphism usually reported for Deccani sheep; Yadav *et al.* (2017) [2] found males to be 42% heavier than females across five Deccani ecotypes. The discrepancy may be explained partly by the sharp decline in the number of males after 12 months of age (39 males at 13–36 months and 47 above 36 months), which probably reflects selective sale of faster-growing males, and partly by the use of estimated body weights for some animals.

Growth pattern and differential development of traits

The rate of gain was highest early in life and declined with age. Approximate average daily gain fell from about 117 g/day between the 0–3 and 4–6 month classes to about 63 g/day between 4–6 and 7–12 months, 24 g/day between 7–12 and 13–36 months and 18 g/day thereafter. This decelerating pattern is typical of sheep growth curves and agrees with the non-linear growth described for Deccani sheep (Bangar *et al.*, 2018; Nimase *et al.*, 2017) [9, 10]. Because the study was cross-sectional, these values are comparisons between age classes rather than gains measured on the same animals.

Traits also differed in the proportion of adult size reached at a given age. By 7–12 months, animals had attained about 85.3% of adult height at withers, 80.1% of adult chest girth and 76.9% of adult body length, but only 56.2% of adult body weight. Ear length increased from 8.96 ± 0.07 cm at 0–3 months to 18.37 ± 0.11 cm at 7–12 months and changed little thereafter (18.72 ± 0.09 cm above 36 months), showing that it reached mature size earlier than the other dimensions. Thus the skeletal frame developed relatively early, while body mass continued to increase over a longer period.

The allometric coefficients relative to body weight were 0.367 for height at withers, 0.409 for ear length, 0.434 for chest girth and 0.451 for body length. Among the principal skeletal measurements, height had the lowest coefficient and body length the highest, indicating that height approached mature size earlier while body length continued to increase for longer. The ratio of body length to height at withers increased from 0.96 at 0–3 months to 1.01 at 7–12 months and 1.12

above 36 months, and the ratio of chest girth to height from 1.08 to 1.22, indicating that the body became progressively longer and deeper relative to height with advancing age.

Conclusion

Body weight and linear body measurements of local (Dharuri) sheep of Beed district increased steadily with age, from 8.75 kg at 0–3 months to 52.98 kg above 36 months. Growth was rapid early in life and slowed progressively; height at withers and ear length approached adult size earlier than body length and body weight. Block effects on body weight and the principal body measurements were significant at most ages but inconsistent in direction, pointing to differences in management and feed resources. Horn length was the only trait showing strong and consistent sexual dimorphism. These results provide baseline information for the characterisation, conservation and improvement of the local sheep of Beed district.

Table 7. Analysis of variance (mean squares) for body measurements and body weight of local (Dharuri) sheep at different ages

Age (months)	Source	df	Height at withers	Chest girth	Body length	Ear length	Horn length	Body weight
0–3	Block	3	160.00*	569.20**	207.20**	61.81**	1.54**	92.03**
	Sex	1	14.63 ^{NS}	49.44 ^{NS}	24.48 ^{NS}	1.70 ^{NS}	8.48**	18.26 ^{NS}
	Error	404	44.34	56.08	43.36	2.03	0.14	13.28
4–6	Block	3	527.60**	749.10**	661.00**	64.76**	4.56 ^{NS}	232.30**
	Sex	1	7.03 ^{NS}	4.83 ^{NS}	3.68 ^{NS}	0.46 ^{NS}	843.60**	0.41 ^{NS}
	Error	208	26.52	33.63	28.03	2.48	1.89	13.91
7–12	Block	3	38.30 ^{NS}	52.30 ^{NS}	52.56*	3.84 ^{NS}	5.34 ^{NS}	30.06*
	Sex	1	108.50**	59.32 ^{NS}	88.76*	6.80 ^{NS}	1961.00**	13.66 ^{NS}
	Error	189	14.70	19.92	18.47	2.32	3.95	8.92
13–36	Block	3	339.20**	397.20**	413.60**	3.01 ^{NS}	12.50**	606.50**
	Sex	1	44.77 ^{NS}	36.51 ^{NS}	44.24 ^{NS}	14.88**	3280.00**	14.84 ^{NS}
	Error	416	15.49	21.49	17.30	1.28	3.05	19.55
Above 36	Block	3	60.60**	76.12**	169.60**	4.00*	7.24 ^{NS}	65.74*
	Sex	1	2.74 ^{NS}	4.51 ^{NS}	2.59 ^{NS}	0.17 ^{NS}	2949.00**	4.04 ^{NS}
	Error	245	9.23	19.40	30.48	1.09	15.47	17.46

** $P < 0.01$; * $P < 0.05$; NS, non-significant.

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Data availability

The data supporting the findings of this study are available from the corresponding author on reasonable request.

Ethical statement

The study involved only non-invasive recording of body measurements on farmers' sheep, with the owners' consent. No experimental treatment was imposed on the animals.

Conflict of interest

The authors declare that they have no conflict of interest.

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