Original Research

Morphometric Characterization of Different Strains of Osmanabadi Goat at 0-3 & 4-6 Months of Age

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Abstract

India possess 135.1 million goats which comes to about 14.66 percent of world population. The body measurements indicate the skeletal growth of the animals. The present study was undertaken on Osmanabadi goat in the breeding tract i.e. Nanded, Latur, Osmanabad, Beed and Parbhani districts of Marathwada region in Maharashtra state. The present work were carried out on the body weight and measurements of 124 Osmanabadi goats at 0-3 and 217 Osmanabadi goats at 4-6 months of age for different sex (male and female), type of birth (single, twin, triplet or quadriplet), breed strains (Entire black & horned, Entire black & polled, Entire black, horned & spotted ear, Entire black, polled & spotted ear and Tan coloured), at different locations in the breeding tract and horned/ polled condition. The overall least square means of body weight, body length, chest girth, paunch girth, height at wither for the Osmanabadi kids at 0 to 3 months of age were recorded as 3.75 ± 0.11 kg, 27.42 ± 0.29 cm, 30.69±0.41, 34.27 ± 0.47 cm, 36.45 ± 0.39 cm and 4 to 6 months 9.29 ± 0.16 kg, 41.60 ± 0.30 cm, 41.60 ± 0.30 cm, 47.62 ± 0.38 cm, 50.60 ± 0.34 cm. The non-significant effect of different sources on the body weight and significant to highly significant effect of sex and districts on the different body measurements may lead to the concrete conclusion that these factors play a major role in exhibiting the specific body measurements.

Key words: Body Measurements, Body Weight, Body Length, Chest Girth, Height at Wither, Height at Pin Bone, Morphometric Characterization, Osmanabadi Goat, Paunch Girth

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Introduction

India possess 135.1 million goats which comes to about 14.66 percent of world population and the country ranks second after China in goat population (FAOSTAT, 2012). The body measurements indicate the skeletal growth of the animals. Body length and height at withers are the measures of bone growth while chest girth is measure of development of muscles, bones and fat and it has close relationship with the live

weight (Pomeroy, 1955). According to FAO (2008), phenotypic characterization of AnGR is the process of identifying distinct breed population and describing their external and production characteristics in a given environment and under given management, taking into account the social and economic factors that affect them.

This study was planned in the breeding tract to determine the physical characters of different strains of Osmanabadi such as body measurements, body weight, body confirmation and coat colour.

Material and Methods

The present study was undertaken on Osmanabadi goat in the breeding tract i.e. Nanded, Latur, Osmanabad, Beed and Parbhani districts of Marathwada region in Maharashtra state. The present work were carried out on the body weight and measurements of 124 Osmanabadi goats at 0-3 and 217 Osmanabadi goats at 4-6 months of age for different sex (male and female), type of birth (single, twin, triplet or quadriplet), breed strains (entire black & horned, entire black & polled, entire black, horned & spotted ear, entire black, polled & spotted ear and tan coloured), at different locations in the breeding tract and horned/ polled condition. The study on phenotypic correlations between body weight and body measurements at 0-3 and 4-6 months of age was also carried out as per Pearsons correlation coefficient (Snedecor & Cochran, 1989).

The data on body weights and measurements were subjected to the Mixed Model Least Squares Analysis Technique as outlined by (Harvey, 1976) of variance using following mathematical model.

$$Y_{ijkl} = \mu + T_i + S_j + V_k + D_l + H_m + e_{ijkl}$$

Where,

Y_{ijkl} = Indicate the observation on i^{th} type of birth of individual of j^{th} sex, k^{th} breed strain and l^{th} district of study.

μ = Population mean.

T_i = Effect of i^{th} type of birth (B_1, B_2, ----- B_4); (B_1 = single born, B_2 = twin born, B_3 = triplet born; B_4 quadriplet born).

S_j = Effect of j^{th} sex (Male S_1 and Female S_2).

V_k = Effect of k^{th} breed strain; (V_1, V_2 ------- V_5); (V_1= entire black & horned, V_2= entire black & polled, V_3= entire black, horned & spotted ear, V_4= entire black, polled & spotted ear and V_5= tan coloured).

D_l = Effect l^{th} district of study; (D_1, D_2, ------D_5); (D_1= Nanded, D_2= Latur, D3= Osmanabad, D4= Beed, D_5= Parbhani).

H_m = Effect of m^{th} horned or polled condition; (H=horned and P=polled)

e_{ijkl} = The random error associated with Y_{ijkl} body weight and body measurement characters and assumed to be independently and normally distributed about a mean zero and with variance $\delta^2 e$.

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Result and Discussions

The overall Least Square Means of body weight (Table 1) for the Osmanabadi kids at 0 to 3 months of age were recorded as 3.75 ± 0.11 kg in agreement with Pattanaik and Mishra (1985) as 4.80 ± 0.09 kg in Black Bengal goat (Shinde, 2000), 5.72 ±0.46 and 4.93 ±0.16 kg for male and female and Nikam *et al.* (2012)5.62 ± 0.08 kg in Osmanabadi goat.

Table 1: Least Squares Means and Standard Errors for different measurements of Osmanabadi Goat at 0-3 months of age

Sources	Code	N	Body weight	Body length	Chest girth	Paunch girth	Height at Wither	Height at Pin Bone
Population Mean	**μ**	**124**	**3.75± 0.11**	**27.42±0.29**	**30.69±0.41**	**34.27±0.47**	**36.27±0.39**	**34.34±0.50**
Sex								
Male	S1	87	4.07^{a} ±0.12	28.27^{a}±0.30	31.39^{a}±0.43	35.24^{a}±0.49	37.24^{a} ±0.41	34.99^{a}±0.52
Female	S2	37	3.43^{b}±0.16	26.57^{b}±0.40	30.00^{b}±0.56	33.29^{b}±0.64	35.67^{b}±0.53	33.69^{a}±0.68
Type of Birth								
Single born	B1	22	3.88^{a}±0.19	27.48^{a}±0.49	31.15^{a}±0.69	34.54^{a}±0.79	36.39^{a}±0.65	34.03^{a}±0.84
Twin born	B2	61	3.87^{ab}±0.12	27.86^{ab}±0.32	31.06^{ab}±0.45	34.81^{ab}±0.52	37.14^{ab}±0.43	35.04^{a}±0.55
Triplet born	B3	41	3.51^{a}±0.16	26.92^{a}±0.40	29.87^{a}±0.57	33.45^{a}±0.65	35.82^{a}±0.54	33.94^{a}±0.69
Strain								
EBH	V1	15	4.13^{a}±0.23	28.53^{a}±0.60	31.75^{a}±0.84	35.91^{a}±0.96	37.60^{a}±0.80	35.50^{a}±1.02
EBP	V2	75	3.59^{a}±0.25	27.13^{a}±0.63	30.68^{a}±0.89	33.82^{a}±1.01	36.53^{a}±0.85	33.82^{a}±1.08
EBH & Spotted Ear	V3	8	3.66^{a}±0.37	27.13^{a}±0.94	29.91^{a}±1.32	33.63^{a}±1.51	35.56^{a}±1.26	33.95^{a}±1.61
EBP & Spotted Ear	V4	26	3.62^{a}±0.28	26.89^{a}±0.71	30.44^{a}±1.01	33.70^{a}±1.15	36.12^{a}±0.96	34.07^{a}±1.22
District								
Nanded	D1	17	3.82^{a}±0.22	27.57^{a}±0.56	30.62^{a}±0.78	33.99^{a}±0.90	36.23^{a}±0.75	32.87^{b}±0.95
Latur	D2	25	3.83^{a}±0.18	27.84^{a}±0.46	31.42^{a}±0.65	34.98^{a}±0.74	37.25^{a}±0.62	35.10^{ab}±0.79
Osmanabad	D3	25	3.67^{a}±0.17	27.27^{a}±0.43	30.96^{a}±0.61	34.36^{a}±0.70	35.95^{a}±0.58	34.63^{b}±0.74
Beed	D4	30	3.81^{a}±0.18	27.22^{a}±0.45	30.16^{a}±0.64	33.80^{a}±0.73	36.18^{a}±0.61	33.72^{b}±0.77
Parbhani	D5	27	3.61^{a}±0.18	27.21^{a}±0.46	30.31^{a}±0.65	34.20^{a}±0.75	36.65^{a}±0.62	35.37^{ab}±0.79
Horn/Polled Condition								
Polled	P	105	3.76^{a}±0.23	27.45^{a}±0.58	30.39^{a}±0.81	34.15^{a}±0.93	36.05^{a}±0.77	34.55^{a}±0.99
Horned	H	19	3.74^{a}±0.28	27.39^{a}±0.72	34.38^{a}±1.01	34.38^{a} ±1.16	36.85^{a}±0.97	34.12^{a}±1.23

Means connected by same superscripts do not differ significantly

The overall least squares mean for body length of Osmanabadi goat at 0-3 months of age group was 27.42 ± 0.29 cm. The LSM for body length of the Osmanabadi kids at 0-3 months of age recorded as 27.42± 0.29 cm in the present study which is agreement with Shinde (2000) as 33.93 ± 0.87 and 33.52 ± 0.31 cm for male and female Osmanabadi (Raskar *et al*., 2008) 32.08 ± 0.55 cm., Mule *et al.* (2011) 32.33 ± 0.18 cm and Nikam *et al*. (2012) 34.67 ± 0.29 cm in Osmanabadi goat, respectively. The overall Least Squares mean for chest girth of Osmanabadi goat at 0-3 months of age group was 30.69 ± 0.41cm. The overall Least Squares mean for paunch girth of Osmanabadi goat at 0-3 months of age group was 34.27 ± 0.47 cm. The overall Least Squares mean for height at wither of Osmanabadi goat at 0-3 months of age group was 36.45

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± 0.39 cm. The overall LSM for height at wither of Osmanabadi goats at 0-3 months of age was 36.45 ± 0.39 cm. The similar findings for height at wither in Osmanabadi goat were reported by Shinde (2000) as 37.21 ±0.92 and 36.88 ±0.33 for the male and female and Nikam *et al*. (2012) 38.76 ± 0.24 cm, respectively. The overall Least Squares mean for height at pin bone of Osmanabadi goat at 0-3 months of age group was 34.34 ± 0.50 cm. The sex showed highly significant (P<0.01) effect (Table 3) on most of the traits whereas rest of the factors showed non-significant effect on these traits for Osmanabadi goat at 0-3 months of age. The overall least squares mean (Table 2) for body weight of Osmanabadi goat at 4-6 months of age group was 9.29 ± 0.16 kg which is in agreement with Shinde (2000) 11.62 ±1.25 and 11.40 ±0.38 kg for male and female in Osmanabdi goat.

Table 2: Least Squares Means and Standard Errors for different measurements of Osmanabadi goat at 4-6 months of age

Sources	Code	N	Body weight	Body length	Chest girth	Paunch girth	Height at Wither	Height at Pin Bone
Population mean	**μ**	**217**	**9.29±0.16**	**41.60±0.30**	**47.62±0.38**	**50.60±0.34**	**49.94±0.28**	**42.13±0.18**
Sex								
Male	S1	138	9.58^{a}±0.19	42.07^{a}±0.37	48.51^{a}±0.47	51.69^{a}±0.41	50.58^{a}±0.34	42.74^{a}±0.21
Female	S2	79	9.00^{a}±0.25	41.14^{a}±0.48	46.73^{b}±0.60	49.50^{b}±0.53	49.30^{b}±0.43	41.52^{b}±0.28
Type of Birth								
Single born	B1	59	9.34^{a}±0.29	41.01^{a}±0.56	47.09^{a}±0.71	50.08^{a}±0.63	49.78^{a}±0.51	41.99^{a}±0.33
Twin born	B2	92	9.28^{a}±0.24	41.38^{a}±0.46	47.49^{a}±0.58	50.43^{a}±0.51	49.64^{a}±0.42	41.88^{a}±0.27
Triplet born	B3	66	9.25^{a}±0.27	42.42^{a}±0.53	48.27^{a}±0.67	51.28^{a}±0.59	50.41^{a}±0.48	42.53^{a}±0.31
Strain								
EBH	V1	46	9.99^{a}±0.46	41.26^{a}±0.89	47.38^{a}±1.13	50.87^{a}±0.99	50.40^{a}±0.82	42.83^{a}±0.52
EBP	V2	44	9.38^{ab}±0.49	41.77^{a}±0.94	46.86^{a}±1.19	50.54^{a}±1.05	50.03^{a}±0.86	41.92^{a}±0.55
EBH & Spotted Ear	V3	69	8.95^{b}±0.45	41.13^{a}±0.87	48.10^{a}±1.09	50.22^{a}±0.97	49.89^{a}±0.79	42.27^{a}±0.50
EBP & Spotted Ear	V4	58	8.84^{ab}±0.44	41.66^{a}±0.85	48.14^{a}±1.07	50.76^{a}±0.95	49.45^{a}±0.78	41.52^{a}±0.50
District								
Nanded	D1	43	9.32^{a}±0.35	42.26^{a}±0.67	48.42^{a}±0.85	51.46^{a}±0.75	49.60^{b}±0.61	42.13^{a}±0.39
Latur	D2	42	9.25^{a}±0.34	42.55^{a}±0.66	48.83^{a}±0.84	52.84^{a}±0.74	51.83^{ac}±0.61	43.13^{ab}±0.39
Osmanabad	D3	43	9.83^{a}±0.34	41.35^{ab}±0.66	46.65^{ab}±0.83	48.87^{b}±0.73	49.24^{b}±0.60	41.62^{a}±0.38
Beed	D4	43	9.03^{a}±0.34	41.92^{a}±0.67	49.03^{ac}±0.84	51.34^{a}±0.74	50.24^{ab}±0.61	41.90^{a}±0.39
Parbhani	D5	46	9.02^{a}±0.33	39.95^{b}±0.63	45.17^{b}±0.80	48.47^{b}±0.71	48.79^{b}±0.58	41.88^{a}±0.37
Horn/Polled condition								
Polled	P	103	9.28^{a}±0.40	41.62^{a}±0.78	47.98^{a}±0.98	50.81^{a}±0.87	49.97^{a}±0.71	42.46^{a}±0.45
Horned	H	114	9.31^{a}±0.41	41.59^{a}±0.78	47.26^{a}±0.99	50.38^{a}±0.87	49.91^{a}±0.72	41.80^{a}±0.46

Means connected by same superscripts do not differ significantly.

The overall least squares mean for body length of Osmanabadi goat at 4-6 months of age group was 41.60 ± 0.30 cm. This finding is in agreement with report of Shinde (2000) as 42.20 ± 1.98 and 42.10 ± 0.61 cm for male and female Osmanabadi and higher values were reported by Mandakmale (2002) as 54.23 ± 0.31 cm; Raskar *et al*. (2008) 46.36 ± 0.15 cm; Chaudhari *et al.* (2010) 53.60 ± 0.69; Mule *et al.* (2011) 45.75 ±

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0.27 cm and Nikam *et al*. (2012) 48.70 ± 0.34 cm in Osmanabadi respectively. The overall Least Squares mean for chest girth of Osmanabadi goat at 4-6 months of age group was 47.62 ± 0.38 cm which is in agreement with Shinde (2000) as 48.02 ± 1.79 cm in Osmanabadi goat.

Table 3: Least Squares Analysis of Variance (ANOVA) for Different Measurements of Osmanabadi goat

Sources	d.f.	Body Weight		Body Length		Chest girth		Paunch Girth		Height at Wither		Height at Pin bone	
		MSS	F value	MSS	F value	MSS	F value	MSS	F value	MSS	F value	MSS	F value
0 - 3 months of age													
Sex	1	9.885	16.53**	71.17	18.18**	47.91	6.16*	93.81	9.22**	60.99	8.67**	41.77	3.64
Type of Birth	2	1.561	2.61	9.55	2.44	17.41	2.24	20.58	2.02	19.67	2.79	16.36	1.42
Strain	3	0.668	1.12	5.89	1.504	6.898	0.89	13.43	1.32	8.78	1.25	7.25	0.63
District	4	0.246	0.41	1.86	0.474	6.292	0.81	4.89	0.48	6.45	0.92	21.31	1.86
H-P	1	0.001	0.002	0.013	0.003	1.052	0.14	0.16	0.0156	1.82	0.26	0.53	0.046
Error	112	0.598		3.92		7.773		10.18		7.038		11.47	
4 - 6 months of age													
Sex	1	16.4	3.48	41.89	2.377	155.1	5.5373*	233.9	10.69**	79.63	5.4280*	73.33	12.29**
Type of Birth	2	0.109	0.023	33.54	1.903	22.21	0.7929	23.92	1.0937	11.94	0.8139	8.438	1.4145
Strain	3	12	2.547	2.13	0.121	17.41	0.6215	4.06	0.1856	5.467	0.3726	6.098	1.0222
District	4	4.694	0.996	45.31	2.571*	116.2	4.1485**	143.5	6.561**	58.29	3.97**	14.18	2.3772
H-P	1	0.009	0.002	0.009	0.00056	4.425	0.1579	1.547	0.707	0.029	0.0019	3.736	0.6263
Error	112	4.712		17.62		28.01		21.87		14.67		5.965	

*** Significant at P<0.01; * Significant at P<0.05*

The overall Least Squares mean for paunch girth of Osmanabadi goat at 4-6 months of age group was 50.60 ± 0.34 cm. while the higher values were reported by Chaudhari *et al.* (2010) as 59.75 ± 0.46 cm and Kharkar *et al.* (2014) as 59.09 ± 0.61 cm for Berari breed, respectively. The overall Least Squares mean for height at wither of Osmanabadi goat at 4-6 months of age group was 49.94 ± 0.28 cm which is in agreement with findings in Osmanabadi goat reported by Shinde (2000) as 48.72 ± 2.07 and 48.50 ±0.64 cm for the male and female, respectively. The overall Least Squares mean for height at pin bone of Osmanabadi goat at 4-6 months of age group was 42.13 ± 0.18 cm which is in agreement with Chaudhari *et al.* (2010) as 46.13 ± 0.58 cm in Osmanabadi goat. The overall Least Squares means for height at hook bone of Osmanabadi goat at 4-6 months of age group was 48.83 ± 0.24 cm.

The phenotypic correlation coefficients observed (Table 4) in the present study of body weight with body length (0.856), chest girth (0.823), paunch girth (0.799), height at wither (0.772), height at pin bone (0.689), height at hook bone (0.774) and width between hook bone (0.616) and amongst the body measurements were positive and highly significantly correlated for Osmanabadi goat at 0-3 months of age. The phenotypic correlation coefficients observed (Table 4) in the present study of body weight with body length (0.246), chest girth (0.237), paunch girth (0.301), height at wither (0.295), height at pin bone (0.211), height at hook

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bone (0.243) and width between hook bone (0.544) were positive and highly significantly correlated and amongst the body measurements were significant to highly significantly correlated for Osmanabadi goat at 4-6 months of age except correlation between height at pin bone with width between hook bone, height at hook bone with width between hook bone were negative non-significant..

Table 4: Phenotypic Correlation Coefficients of body weight with body measurements in Osmanabadi goat

Traits	Body weight	Body length	Chest girth	Paunch girth	Height at wither	Height at pin bone	Height at hook bone	Width between hook bone
0-3 months of age								
Body weight	___	0.856**	0.823**	0.799**	0.772**	0.689**	0.774**	0.616**
Body length		___	0.897**	0.913**	0.867**	0.724**	0.755**	0.602**
Chest girth			___	0.933**	0.903**	0.807**	0.887**	0.720**
Paunch girth				___	0.930**	0.809**	0.809**	0.615**
Height at wither					___	0.834**	0.855**	0.660**
Height at pin bone						___	0.858**	0.520**
n= 124								
4-6 months of age								
Body weight	___	0.246**	0.237**	0.301**	0.295**	0.211**	0.243**	0.544**
Body length		___	0.776**	0.610**	0.463**	0.293**	0.352**	0.417**
Chest girth			___	0.825**	0.647**	0.431**	0.552**	0.136^{NS}
Paunch girth				___	0.810**	0.534**	0.678**	0.163*
Height at wither					___	0.501**	0.818**	0.077^{NS}
Height at pin bone						___	0.581**	-0.096^{NS}
N=217								

The lower body weight recorded in the present study may be due to inclusion of birth weight in this age group which might have resulted into the overall lowering of the body weight at 0-3 months of age. Higher paunch girth reported by various authors in indigenous goat breeds might be due to difference in their genetic makeup coupled with differences in their management and environment to which they are exposed. The present data being the field observations of Osmanabadi goat from breeding tract hence the lower paunch girth might have been recorded. The higher ear length than Osmanabadi breed, reported by various authors in Indigenous breed of goats might be due to difference in the breed and the higher values of Osmanabadi goat than the present findings may be attributed to the breed variation. The overall picture of body weight and body measurements of Osmanabadi goat kids at 0-3 months of age has revealed that all

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the LSMs are on lower side as compared to their counter parts of Osmanabadi as reported earlier by different scientists in the same age group. Hence it may be concluded that the overall lower body weight and body measurements observed at 0-3 months of age may be attributed to the fact that these goats are reared in field condition in the breeding tract with almost all unfavorable feeding, housing and management conditions resulting into the comparably lower morphometric performance.

The highly significant to significant effect of sex on almost all body weight and body measurement parameters is indicative of the fact that male surpass in all these traits as compared to female counter parts, however the non-significant effect of genetic factors like type of birth, strain, the strong fact of regional variation resulting in feeding and managemental practices adopted by the Osmanabadi goat keepers. Similarly, it may be the effect of continuous draught or scarcity conditions prevailing in Marathwada region fir last three consecutive years.

The non-significant effect of sex, type of birth, strains, districts and horned/polled condition on the body weight at 4-6 months of age of Osmanabadi goat and significant to highly significant effect of sex and districts on the different body measurements (body length, chest girth, paunch girth, height at wither, height at pin bone and height at hook bone) may lead to the conclusion that these two factors may play a major role in exhibiting the specific body measurements only. The non-significant effect of rest of the factors on other body measurements does not play any role in exhibiting the body weight and measurements.

Conclusion

1. The highly significant to significant effect of sex on almost all body weight and body measurements in Osmanabadi goat at 0-3 months of age may lead to concrete conclusion that the male surpass their female counter parts in all these traits. The non-significant effect of some genetic and non-genetic factors does not play any role in exhibiting / expressing these traits.
2. The non-significant effect of different sources on the body weight and significant to highly significant effect of sex and districts on the different body measurements may lead to the concrete conclusion that these factors play a major role in exhibiting the specific body measurements only in Osmanabadi goat at 4-6 months of age.

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