Original Research

Non-Genetic Factors Affecting Morphometric Traits in Marwari Goats under Field Conditions

Hemlata Chouhan*, Gyanchand Gahlot, Vijay Kumar Agrawal, Manoj Kumar and Govind Singh Dhakad

College of Veterinary and Animal Sciences, Bikaner, Rajasthan, INDIA

***Corresponding author:** dr.hemlatachouhan@gmail.com

Rec. Date:	Jun 25, 2017 03:31
Accept Date:	Nov 18, 2017 17:13
Published Online:	February 05, 2018
DOI	10.5455/ijlr.20170625033145

Abstract

The aim was to estimate non-genetic factors affecting morphometric traits of Marwari goats under field condition. The morphological information pertaining to Marwari goats (n=36,566) during different stages of life, viz., birth, 3 months, 6 months, 9 months, 12 months, 18 months, 24 months and adult (>2 years) was collected from farmer's flock maintained under AICRP-Goat Project under field condition and born during 1990 to 2015. The effect of different non-genetic factors, viz. year of birth, season, sex and cluster on the different body measurement were estimated through least square analysis method of general linear model. The effect of cluster and year of birth was found to be highly significant (P≤ 0.01) on all the morphometric traits for all age groups. Influence of season of birth was highly significant (P≤ 0.01) on body height at all age group. The effect of season of birth was observed as highly significant (P≤ 0.01) on length and heart girth at all stages except birth. The sex of kid significantly (P≤ 0.01) affected the height at birth, 3, 6, 9, 18, 24, on length at birth, 3, 6, 9, 24 and adult ages, on heart girth at 3, 6, 9, 12 months. The different non-genetic factors significantly affected the morphometric features in Marwari goats.

Key words: Morphometric Traits, Marwari Goat, Non-Genetic Factor

How to cite: Chouhan, H., Gahlot, G., Agrawal, V., Kumar, M., & Dhakad, G. (2018). Non-Genetic Factors Affecting Morphometric Traits in Marwari Goats under Field Conditions. International Journal of Livestock Research, 8(3), 96-105. http://dx.doi.org/10.5455/ijlr.20170625033145

Introduction

India ranks second in world in terms of goat population which is around 135.17 million in the form of rich repository of 26 well defined breeds (Anonymous, 2016). A major chunk (21.66 million) of this goat population is distributed in the state of Rajasthan. The state ranks first in goat population (16.03%) with having major goat breed such Marwari, Sirohi, Jhakrana and Barbari (NBAGR, 2016). The state has also

witnessed an increase of 0.76% in goat population despite a downward trend (3.82 %) in national goat population (Anonymous, 2012).

The Marwari goat breed of Rajasthan is a dual purpose animal that is known for its faster growth, efficient breeding, high salt tolerance and requires less water than any other species of the region **(**Shankarnarayan *et al*., 1985; Rohilla and Patel, 2005). The Marwari goat is the second most populous goat breed in India and accounts for 5.31% (7.18 million) of the total goat population of India with 5.34 million number of pure bred animal (Anonymous, 2012). The breeding tract of Marwari goat extends from the region of Jaisalmer, Barmer, Jalore, Pali, Jodhpur, Nagaur to Bikaner district. The pure bred individuals of Marwari goat are characterized by the presence of predominantly black color with small head and thin tail. The udder is fairly well developed with small and round teat placed laterally. The male bears thick beard. The ears are small and flat. Both sexes have short pointed horns, directed upward and backward (NBAGR, 2016). Growth traits are considered as an important indicator of adaptability of the species in relation to its environmental conditions and play a key role in economics of goat rearing. Therefore, keeping in view, the critical role of Marwari goat in the state animal husbandry practices, the present study was undertaken in Marwari goat to investigate the effects of different non-genetic factors affecting the body measurements.

Materials and Methods

Collection of Morphological Information

The data for the present investigation was collected from farmers flock's of Marwari goat maintained under ICAR sponsored "All India Co-ordinated Research Project (AICRP) on goat improvement," Bikaner, Rajasthan. The information on different morphological measurements of Marwari goat were collected for the period from 1990 to 2015 from the different cluster villages, Deshnoke, Udairamsar, Kalyansar, Nokha, Raiser, Diaya and Moondsar cluster of Bikaner district. The Bikaner district is located in geographical grid position of $27^{o}11'$- $29^{o}3'$ N latitude and $71^{o}54'$-$74^{o}12'$ E longitude with height of 238 meters above sea level. The region is characterized by extreme temperatures as high as 49^{o}C during summer to as low as 0^{o}C during winters. The region receives an annual precipitation of around 260 mm which is also erratic in nature. The information pertaining for various morphological traits were recorded regularly by the technical staff of the project. Animals under the project in cluster villages were reared under semi-intensive manner. During the present study, the different non-genetic factors that were considered for analysis of data are categorized as follows-

Effect of Cluster

The cluster information was classified into seven groups, *viz.*, i_1- i_7.

DOI 10.5455/ijlr.20170625033145

i) Deshnoke
ii) Udairamsar
iii) Kalyansar
iv) Nokha
v) Raiser
vi) Diaya
vii) Moondsar

Effect of Year of Birth

The information on year of birth was grouped into five classes, *viz.*, j_1-j_5.

i) 1990-1995
ii) 1996-2000
iii) 2001-2005
iv) 2006-2010
v) 2011-2015

Effect of Season of Birth

The information on season of birth was grouped into three groups, *viz.*, k_1 - k_3.

i) Summer: March to June
ii) Monsoon: July to October
iii) Winter: November to February

Effect of Sex

On the basis of sex of animal, information was grouped into two groups, *viz.*, l_1-l_2.

i) Male (ii) Female

Statistical Analysis

The effect of different non-genetic factors, *viz.*, cluster, year of birth, season and sex on the different body measurement was estimated through least square analysis method general linear model through SPSS (*ver. 20.0*) software. The following general linear model was adopted to estimate the effect of different non-genetic factors on the growth performance-

$$Y_{ijklm} = \mu + A_i + B_j + C_k + D_l + e_{ijklm}$$

Where

Y_{ijklm} = body measurement of m^{th} kid of l^{th} sex born in k^{th} season of j^{th} year in i^{th} cluster
μ = overall population mean, A_i = effect of i^{th} cluster, B_j = effect of j^{th} year
C_k = effect of k^{th} season, D_l = effect of l^{th} sex, e_{ijklm} = residual error, NID $(0,\sigma^2)$

The pair wise comparison of least square mean was carried out through modified Duncan's multiple range tests of Kramer (1957) to make all possible pair wise comparison of the least square means.

 DOI 10.5455/ijlr.20170625033145

Results and Discussion

The estimates of least-squares means for body height (BH), body length (BL) and body girth (BG) at birth, 3, 6, 9, 12, 18, 24-months of age and adult age are represented in Table 1 to 3, respectively.

Table 1: Effect of nongenetic factors on body height (cm) in Marwari goat at different ages

Factors	At birth	3 month	6 month	9 month	12 month	18 month	24 Month	Adult
Overall mean (μ)	36.85 ± 0.32	44.10± 0.58	55.44± 0.31	59.76± 0.39	60.72 ± 0.24	61.96±0.29	62.57± 0.23	64.50 ± 0.71
	-1829	-4295	-10763	-5470	-5124	-2769	-2755	-3561
Cluster								
Deshnoke	36.47^{d}± 0.40	45.76^{f}±0.71	56.76^{e}±0.46	59.50^{e}±0.62	60.21^{c}±0.43	61.99^{bc}±0.43	62.08^{b}± 0.35	63.24^{b}± 0.80
	-105	-884	-4430	-2509	-1692	-1007	-806	-1090
Diaya	35.03^{c}± 0.37	39.27^{a}±0.85	48.02^{a}±1.02	50.24^{a}±1.30	59.01^{bc}± 0.62	61.66^{bc}±0.81	62.18^{b}±0.51	65.71^{d}±1.21
	-201	-311	-120	-59	-89	-75	-169	-68
Kalyansar	34.76^{bc}± 0.34	40.12^{c}±0.66	50.83^{bc} ±0.44	54.85^{c}±0.61	61.45^{d}± 0.53	64.30^{e}±0.55	65.20^{d}±0.44	67.48^{e}±0.84
	-487	-1316	-2819	-1518	-632	-194	-159	-556
Moondsar	33.54^{a}±0.36	44.38^{e}± 0.81	52.31^{c}± 0.57	59.27^{e}±0.88	61.24^{de}±0.44	62.52^{c}±0.44	63.67^{c}± 0.36	67.74^{ef}±0.81
	-198	-403	-621	-272	-1607	-834	-1003	-1123
Nokha	35.07^{cd}± 0.34	41.24^{d}± 0.92	54.16^{d}± 1.15	61.53^{f}±1.32	62.26^{e}±0.60	63.04^{d}±0.62	63.61^{c}±0.50	64.53^{c}±0.89
	-266	-180	-78	-53	-273	-140	-119	-241
Raiser	34.20^{b}±0.35	39.49^{b}± 0.72	49.26^{b}±0.79	52.73^{b}± 0.91	58.71^{b}±0.54	61.02^{b}±0.53	63.66^{c}±0.44	68.95^{f}± 0.82
	-572	-750	-264	-164	-317	-284	-242	-191
Udairamsar	-	50.44^{g}± 0.76	55.74^{de}± 0.48	56.20^{d}±0.66	57.81^{a}±0.53	59.23^{a}±0.54	59.60^{a}±0.44	60.83^{a} ±0.88
		-451	-2431	-895	-514	-235	-257	-292
Year of Birth								
1990-1995	37.42^{c}± 0.24	43.49^{c}± 0.73	54.50^{b}± 0.58	55.30^{a}± 0.95	62.84^{c}±0.35	61.65^{bc} ±0.39	62.10^{b} ±0.29	62.29^{b} ±0.37
	-104	-292	-481	-260	-1620	-932	-1285	-1735
1996-2000	33.63^{a}± 1.51	40.77^{b}± 0.90	57.19^{d}±0.68	58.34^{bc}±0.66	61.56^{bc}±0.36	62.89^{c}±0.36	64.13^{c}± 0.29	68.22^{c}± 0.37
	-2	-124	-220	-234	-1149	-760	-502	-1362
2001-2005	37.10^{b}± 0.49	39.00^{a}± 0.37	55.69^{c}± 0.37	57.63^{b}±0.56	59.16^{a}±0.37	60.44^{a}±0.39	61.37^{a}± 0.30	62.01^{a}±0.45
	-23	-2246	-9540	-4694	-1855	-726	-567	-301
2006-2010	38.02^{d}± 0.19	48.52^{d}± 2.72	50.52^{a}±1.21	59.65^{c}± 1.36	61.01^{b}±0.58	61.83^{b}±0.58	62.63^{bc}±0.48	63.39^{bc}± 0.85
	-249	-12	-117	-70	-317	-289	-366	-159
2011-2015	38.08^{d} ±0 .07	51.71^{e}± 0.34	59.29^{e}±0.64	60.87^{d}± 0.86	61.49^{bc}± 1.08	63.02^{d} ±0.93	64.62^{d} ±0.89	69.58^{d} ±3.34
	-1451	-1621	-405	-212	-183	-62	-35	-4
Season of Birth								
Monsoon	36.90^{b}± 0.33	44.13^{b}± 0.66	55.63^{b}±0.34	61.68^{b}± 0.41	61.93^{b}± 0.31	62.07^{c}±0.33	62.09^{a}±0.26	63.78^{a}± 0.71
	-641	-795	-5748	-4991	-1926	-1227	-1161	-1576
Summer	37.18^{C}± 0.34	44.52^{b}±0.65	53.01^{a}± 0.48	58.69^{a}± 0.70	59.34^{a}± 0.39	60.78^{a}± 0.36	63.11^{c}±0.25	64.23^{b}± 0.73
	-515	-665	-486	-219	-1740	-712	-881	-1001
Winter	36.47^{a}± 0.33	43.65^{a}± 0.64	57.68^{c}±0.33	58.91^{a}±0.60	59.60^{a}±0.34	61.04^{b}±0.33	62.51^{b}±0.28	65.48^{c}±0.74
	-673	-2835	-4529	-260	-1458	-830	-713	-984
Sex of Kid								
Female	36.56± 0.33	43.23±0.59	51.54±0.31	56.73±0.38	61.64± 0.22	61.88±0.21	62.29 ±0.18	63.98 ±0.69
	-907	-2504	-8185	-4877	-4213	-2612	-2597	-3331
Male	37.14± 0.33	44.96±0.60	59.34±0.34	60.99±0.47	61.99± 0.44	62.03± 0.49	62.85±0.36	65.02±0.80
	-922	-1791	-2578	-593	-911	-157	-158	-230

*No. of observations are given in parentheses. Estimates with different superscripts differ significantly. ** = highly significant (P≤0.01), * = significant (P≤0.05), NS = non-significant (P≥0.05).*

DOI 10.5455/ijlr.20170625033145

The overall least-squares means for body measurements ranged from 36.85± 0.32 to 64.50 ± 0.71 cm for height, 30.19 ± 0.34 to 60.74± 0.67 cm for length and 36.59 ± 0.30 to 72.32 ± 0.77 cm for heart girth for all age groups.

Table 2: Effect of nongenetic factors on body length (cm) of Marwari goat at different ages

Factors	At birth	3 month	6 month	9 month	12 month	18 month	24month	Adult
Overall mean (μ)	30.19±0.34	39.20 ± 0.50	45.55±0.30	50.16±0.32	52.54±0.20	56.59 ± 0.34	57.96±0.38	60.74 ± 0.67
	-1829	-4295	-10763	-5470	-5124	-2769	-2755	-3561
Cluster								
Deshnoke	30.29^{b}± 0.41	39.58^{e}± 0.61	50.21^{de}±0.45	52.56^{e}±0.52	54.66^{d}±0.37	58.22^{e}± 0.52	58.56^{b}±0.46	58.93^{b}± 0.78
	-105	-884	-4430	-2509	-1692	1007)	-806	-1090
Diaya	31.14^{bc}± 0.39	32.43^{a}± 0.72	38.60^{a}±1.00	48.99^{b}±1.08	52.95^{c}±1.04	57.26^{d}± 0.96	60.76^{de}±0.67	65.97^{d}± 1.18
	-201	-311	-120	-59	-89	-75	-169	-68
Kalyansar	29.48^{ab}±0.35	37.47^{c}± 0.56	44.76^{c}±0.44	49.92^{c}± 0.51	53.94^{d}±0.40	56.47^{c}±0.65	59.64^{c}±0.05	60.76^{bc}±0.82
	-487	-1316	-2819	-1518	-632	-194	-159	-556
Moondsar	31.22^{c}±0.37	38.03^{cd}±0.79	46.97^{d}±0.56	51.74^{d}± 0.73	52.95^{c}±0.34	59.46^{f}±0.52	60.38^{d}±0.48	61.64^{c}± 0.79
	-198	-403	-621	-272	-1606	-834	-1003	-1123
Nokha	29.47^{a}±0.36	38.40^{d}±0.79	45.42^{cd}±1.13	49.42^{c}±1.10	50.61^{b}±0.54	57.91^{b}±0 .74	58.95^{bc}±0.65	60.93^{bc}± 0.87
	-266	-180	-78	-53	-273	-140	-119	-241
Raiser	29.53^{ab}± 0.36	34.10^{b}± 0.61	41.01^{b}±0.78	42.89^{a}± 0.75	50.08^{a}±0.61	50.28^{a}±0.64	57.31^{a}± 0.58	59.70^{a}± 0.79
	-572	-750	-264	-164	-317	-284	-242	-191
Udairamsar	-	39.41^{de}± 0.65	50.95^{e}± 0.47	55.33^{f}±0.55	57.76^{e}± 0.45	62.21^{g}± 0.66	64.01^{e}±0.57	67.84^{e}±0.86
		-451	-2431	-895	-514	-235	-257	-292
Year of Birth								
1990-1995	30.32^{c}± 0.25	40.16^{c}± 0.62	44.39^{b}±0.57	44.91^{a}±0.79	52.30^{bc}±0 .34	55.94^{a}±0.45	60.74^{c}± 0.38	62.74^{c}± 0.36
	-104	-292	-481	-260	-1620	-932	-1285	-735
1996-2000	36.21^{d}±1.57	42.42^{d}± 0.77	46.78^{c}± 0.67	48.51^{b}±0.55	53.74^{d}±0.33	57.79^{c}±0.43	61.14^{c}± 0.38	62.64^{c}± 0.36
	-2	-124	-220	-234	-1149	-760	-502	-1362
2001-2005	27.06^{a}±0.51	37.06^{b}± 0.32	47.52^{d}±0.37	49.63^{c}±0.46	51.87^{a}±0.33	56.46^{ab}± 0.46	58.17^{b} ±0.40	59.17^{b} ± 0.44
	-23	-2246	-9540	-4694	-1854	-726	-567	-301
2006-2010	27.86^{b}±0.20	36.46^{a}± 2.32	39.44^{a}± 1.19	49.56^{cd}± 1.13	52.17^{b}±0.65	56.04^{ab}± 0.68	61.33^{c}± 0.63	62.64^{c}±0.83
	-249	-12	-117	-70	-317	-289	-366	-159
2011-2015	29.48^{bc}± 0.07	43.61^{e}±0.29	49.90^{e}±0.63	50.20^{d}±0.72	52.61^{c}±0.71	56.80^{b}± 1.09	57.34^{a}± 1.17	57.57^{a}± 3.25
	-1451	-1621	-405	-212	-183	-62	-35	-4
Season of Birth								
Monsoon	30.30±0.34	40.14^{b}± 0.57	45.63^{b}± 0.33	51.47^{c} ± 0.34	52.51^{a} ±0.25	56.79^{b}±0.39	59.21^{a}±0.34	59.34^{a}± 0.68
	-641	-795	-5748	-4991	-1926	-1227	-1161	-1576
Summer	30.08±0.35	39.89^{b}± 0.56	43.66^{a}±0.47	49.22^{b}±0.58	53.69^{b}±0.25	54.88^{a}±0.42	60.18^{b}±0.33	61.52^{c}± 0.69
	-515	-665	-486	-219	-1739	-712	-881	-1001
Winter	30.18± 0.34	37.61^{a}±0.56	47.35^{c}± 0.33	48.75^{a}±0.52	52.45^{a}±0.27	57.72^{c}± 0.39	60.54^{b}±0.45	61.37^{b}±0.70
	-673	-2835	-4529	-260	-1458	-830	-713	-984
Sex of Kid								
Female	30.05±0.34	38.84± 0.52	45.13± 0.30	49.18± 0.32	52.28±0.18	55.82± 0.24	59.17± 0.24	59.87± 0.65
	-907	-2504	-8185	-4877	-4213	-2612	-2597	-3331
Male	30.33± 0.34	39.59± 0.53	45.97± 0.33	51.14± 0.39	52.79±0 .30	57.37±0.58	60.71±0.42	61.62±0.76
	-922	-1791	-2578	-593	-910	-157	-158	-230

*No. of observations are given in parentheses. Estimates with different superscripts differ significantly. ** = highly significant (P≤0.01), * = significant (P≤0.05), NS = non-significant (P≥0.05).*

DOI 10.5455/ijlr.20170625033145

Similar information was reported by (Dixit *et al*., 2013) for heart girth in Surti goats while lower values of height and length were observed in Surti goat. However, (Verma *et al*., 2015) observed lower value of height and heart girth for Ganjam breed of Odisha while similar body length was reported to that of Marwari goat.

Effect of Cluster

In present study, the significant effect of cluster was observed on body height of animals. The Deshnoke cluster of Marwari goat was observed superior in terms of height at birth, 3, 6 and 9 month of age whereas Nokha cluster reported higher height at 12 month of age. The animals maintained under Kalyansar cluster gained significantly higher height at 18 and 24 of age month of age.

Marwari goat reported highly significant (P≤ 0.01) effect of cluster on length. Deshnoke cluster reported higher value of length at 3, 6 and 18 month of age, while the Udairamsar cluster reported higher value of length at 9, 12 and 24 month of age. The cluster effect was also evident on heart girth in a significant manner (P≤ 0.01) in Marwari goat. Higher heart girth was observed in animals of Deshnoke cluster for 3, 9, 12, 18, 24-month and adult animals. The 6-month cluster effect on heart girth was more significant in Udairamsar cluster area.

The present study is in agreement with similar results reported by Sharma *et al*. (2010) in Sirohi goats who observed highly significant (P≤ 0.01) effect of cluster on height and length at birth and 3 months of age and heart girth at 3 months of age. However, Kharkar *et al*. (2015) observed significant effect (P≤ 0.05) of cluster on body length at birth in Berari goats. Dudhe *et al*. (2015) reported highly significant (P≤ 0.01) effect of cluster at birth, 3, 6, 9 and 12 months of age in Sirohi goat.

Effect of Year

The effect of year of birth in the present study was observed to be highly significant (P≤ 0.01) on body height during all stages of life. The height was observed to be significantly higher in the animals which were born during 2011-2015. The body length was also affected significantly (P≤ 0.01) by the year of birth in Marwari goat. The body length was observed to be higher at birth, 3, 6, 9 and adult age for the kids born during 2011-2015 whereas the kids borne during 1996-2000 reported higher values of boy length at 12 and 18 month of age. Heart girth of Marwari goat was found highly dependent (P≤ 0.01) on year of birth which shows that kids borne during 2011-2015 have higher heart girth than kids borned during any other period. Khan and Sahni (1983) observed similar effect of year of birth on body height and body length at 3 months of age. Kumar *et al*. (1992) observed significant effect year of birth on body length at 3 months, body height at birth, 3 and 6 months of ages, body girth at birth, 3, 6, and 9 months of ages in Jamunapari goat. Dudhe *et al*. (2015) reported highly significant (P≤ 0.01) effect of birth year on

DOI 10.5455/ijlr.20170625033145

all morphometric traits at birth, 3, 6, 9 and 12 months of age in Sirohi goat. The variation in different morphological parameters could be attributed to differences in climate, management and plane of nutrition.

Table 3: Effect of nongenetic factors on heart girth (cm) of Marwari goat at different ages

Factors	Birth	3 month	6 month	9 month	12 month	18 month	24 month	Adult
Overall mean (μ)	36.59±0.30	45.64±0.54	60.17±0.36	64.13±0.48	66.42±0.21	68.13±0.31	72.02±0.39	72.32±0.77
	-1829	-4295	-10763	-5470	-5124	-2769	-2755	-3561
Cluster								
Deshnoke	36.07^{a}±0.36	55.40^{f}± 0.67	64.64^{g}±0.54	65.04^{e}±0.77	67.03^{e}± 0.34	70.17^{e}±0.46	72.70^{d}±0.60	72.32^{d}±0.87
	-105	-884	-4430	-2509	-1692	-1007	-806	-1090
Diaya	35.93^{a}±0.34	44.49^{c}±0.79	57.38^{c}±1.19	58.59^{b}±1.60	63.61^{b}± 1.07	68.93^{cd}±0.86	77.35^{e}±0.86	78.70^{e}±1.31
	-201	-311	-120	-59	-89	-75	-169	-68
Kalyansar	36.38^{b}± 0.31	41.11^{b}±0.62	54.94^{b}±0.52	55.82^{a}± 0.75	65.50^{d}±0.41	70.00^{d}± 0.58	71.02^{c}± 0.74	72.05^{c}±0.91
	-487	-1316	-2819	-1518	-632	-194	-159	-556
Moondsar	36.95^{c}± 0.33	49.36^{d}± 0.72	59.90^{d}±0.67	60.43^{cd}±1.08	62.82^{a}±0.35	65.78^{a}±0.47	69.82^{a}±0.62	69.92^{a}±0.88
	-198	-403	-621	-272	-1607	-834	-1003	-1123
Nokha	36.62^{bc}± 0.31	40.48^{ab}±0.80	63.90^{e}±1.34	64.15^{d}± 1.62	65.05^{d}± 0.56	68.89^{c}±0.69	70.10^{ab}±0.84	70.96^{b}±0.97
	-266	-180	-78	-53	-273	-140	-119	-241
Raiser	36.57^{bc}±0.32	40.09^{a}± 0.67	54.17^{a}±0.93	55.54^{a}±1.12	62.93^{ab}±0.63	66.63^{b}± 0.56	72.31^{cd}±0.75	72.77^{d}±0.89
	-572	-750	-264	-164	-317	-284	-242	-191
Udairamsar	-	53.75^{e}± 0.71	60.37^{f}± 0.56	61.37^{cd}± 0.81	64.01^{c}±0.46	66.52^{ab}±0.57	70.40^{b}±0.74	70.50^{ab}±0.96
		-451	-2431	-895	-514	-235	-257	-292
Year of Birth								
1990-1995	33.12^{a} ±0.23	43.02^{a} ±0.68	52.89^{a}± 0.68	62.78^{a}±1.17	63.14^{a} ± 0.35	66.31^{a} ±0.41	68.58^{a} ±0.48	69.46^{a} ±0.40
	-104	-292	-481	-260	-1620	-932	-1285	-1735
1996-2000	34.20^{b} ±1.39	44.53^{b} ±0.84	59.52^{b} ± 0.80	63.40^{b} ± 0.81	64.50^{b} ± 0.34	66.28^{a} ±0.39	70.06^{b} ±0.49	69.27^{b} ±0.40
	-2	-124	-220	-234	-1149	-760	-502	-1362
2001-2005	38.08^{cd}±0.45	45.02^{c} ± 0.35	60.94^{c} ±0.44	63.68^{bc}±0.69	64.66^{bc} ± 0.34	68.05^{b} ±0.41	70.17^{b}±0.51	72.28^{c}±0.49
	-23	-2246	-9540	-4694	-1855	-726	-567	-301
2006-2010	38.11^{cd}± 0.17	47.26^{d} ±2.54	62.61^{d} ±1.41	64.31^{bc} ±1.68	65.96^{c} ± 0.67	69.70^{c} ±0.61	75.60^{c} ±0.81	76.24^{d} ±0.93
	-249	-12	-117	-70	-317	-289	-366	-159
2011-2015	39.42^{d} ± 0.07	48.33^{e} ± 0.32	62.89^{d} ± 0.75	64.51^{c}±1.07	67.86^{d} ± 0.73	70.32^{c} ± 0.98	75.67^{c} ±1.50	77.34^{e} ±3.63
	-1451	-1621	-405	-212	-183	-62	-35	-4
Season of Birth								
Monsoon	36.56±0.30	43.51^{a}±0.61	59.77^{b}±0.39	62.45^{b}± 0.51	63.39^{a}±0.26	69.20^{b}±0.37	71.21^{a}±0.44	71.32^{a}±0.78
	-641	-795	-5748	-4991	-1926	-1227	-1161	-1576
Summer	36.69±0.31	44.64^{b}±0.60	58.77^{a}±0.56	60.91^{a}±0.86	64.71^{b}±0.27	68.46^{a}±0.40	71.25^{b}±0.43	72.15^{b}±0.80
	-515	-665	-4991	-219	-1740	-712	-881	-1001
Winter	36.52± 0.30	48.78^{c}±0.60	61.97^{c}± 0.39	65.05^{c}±0.74	65.17^{b}±0.28	69.94^{b}±0.36	71.21^{a}±0.47	73.47^{c}±0.81
	-673	-2835	-4529	-260	-1458	-830	-713	-984
Sex of Kid								
Female	36.52± 0.30	44.82± 0.56	58.00±0.36	61.28±0.47	63.73± 0.19	68.74± 0.22	71.63± 0.31	72.01±0.75
	-907	-2504	-8185	-4877	-4213	-2612	-2597	-3331
Male	36.65± 0.30	46.47± 0.57	62.34±0.40	63.99±0.58	65.11±0.31	69.41± 0.55	72.40± 0.61	72.63±0.87
	-922	-1791	-2578	-593	-911	-157	-158	-230

*No. of observations are given in parentheses. Estimates with different superscripts differ significantly. D.F. =degree of freedom, M.S. = Mean squares, ** = highly significant (P≤0.01), *= significant (P≤0.05), NS = non-significant (P≥0.05).*

DOI 10.5455/ijlr.20170625033145

Effect of Season of Birth

Kids born during summer season were observed to have higher body height. The monsoon borne animals reflected higher height at 3, 6, 9 and 18 month of age while summer borne animal reported higher height at 24 month of age. Non-significant effect (P≥ 0.05) of season of birth was observed for length at birth. However, highly significant effect (P≤ 0.01) of season of birth at 3, 6, 18 and 24 month of age was observed on body length for kids borne during winter season. At 9 month of age, higher boy length value was observed animals born during monsoon season and for adult, higher value was observed for kids born in summer season. The effect of season of birth was non significant (P≥ 0.05) on heart girth at birth stage. However, highly significant effect (P≤ 0.01) of season of birth was observed at 3, 6, 9, 12 and adult age, higher value of heart girth and length was observed in winter. At 18 month of age, kids born in monsoon season, obtained higher value of heart length.

Sharma *et al*. (2010) reported significant (P≤ 0.05) effect of season of birth on height and length at birth, highly significant (P≤ 0.01) effect on all three morphometric traits at 3 months of age, Kharkar *et al*. (2015) at 3 months on length, 3 and 12 months body height and at birth and 12 months heart girth on Berari goats. Dudhe *et al*. (2015) reported highly significant (P≤ 0.01) effect of season of birth on body height at 3 and 12 months of ages, significant at birth and 9 months of ages and non-significant at 6 months of age.

Effect of Sex of Kid

Sex of kids had highly significant effect (P≤ 0.01) on body height at birth, 3, 6, 9, 18, 24 months and adult ages, on body length at birth, 3, 6, 9, 24 months and adult ages, on body heart girth at 3, 6, 9, 12 months. It was non- significant on body height at 12, 18 month of age, on body length at 12 month of age, on body heart girth at birth, 18, 24 month and adult age. The male kids were larger to females one with regards to their body length and body girth at all the ages.

The results are in agreement with the findings of Tomar *et al*. (2001), Pathodiya *et al*. (2004) in Sirohi goats, Barhat (2005) in Marwari goats and Hamada *et al*. (2016) in Zaribi goats. Sharma *et al*. (2010) reported highly significant (P≤ 0.01) effect of sex of kid on body length and body girth at birth. 12Kumar *et al*. (1992) in Jamunapari goats reported effect of sex except at 3 months on body length and body height. Birari *et al*. (2012) observed highly significant effect (P≤ 0.01) of sex of kids on all three morphometric traits at birth, 3, 6, 9 and 12 months of ages in Osmanabadi goats. Dudhe *et al*. (2015) observed highly significant effect (P≤ 0.01) of sex of kids on similar morphometric traits at birth, 3, 6, 9 and 12 months of ages. Similarly, Rawat and Singh (2014 observed highly significant effect of sex on all body morphometric measurement at all age groups. However, non-significant effect of sex of kids on

DOI 10.5455/ijlr.20170625033145

body height, body length and body girth on all ages was observed by Rao and Patro (2002) in Ganjam goats and Kharkar *et al*. (2015) in Berari goats.

Conclusion

The effect of cluster and effect of year of birth were found to be highly significant (P≤ 0.01) on all morphometric traits at birth, 3, 6, 9, 12, 18, 24 months and adult ages. Influence of season of birth was highly significant (P≤ 0.01) on body height at all age group.The effect of season of birth was highly significant (P≤ 0.01) on length and heart girth at 3, 6, 9, 12, 18, 24 months and adult ages. The sex of kid had highly significant (P≤ 0.01) effect on height at birth, 3, 6, 9, 18, 24, on length on birth, 3, 6, 9, 24 and adult ages, on heart girth at 3, 6, 9, 12 months.

References

1. Anonymous (2012). 19th Livestock Census. Department of Animal Husbandry, Dairying and Fisheries, Government of India.
2. Anonymous (2016). National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana, India. *www. nbagr.res.in.*
3. Barhat, N.K. (2005). Body weight and measurement in Marwari goats. *Ind. J. Anim. Sci.*, 75(11): 1323-1325.
4. Birari, D.R., Desale, R.J., Deokar, D.K., Deshmukh, A.R. and Mandakmale, S.D. (2012) Growth performance of Osmanabadi goats under field conditions. *Ind. J. Small Rumin.*, 18 (1): 135-137.
5. Dixit, S.P., Aggarwal, R.A.K., Dangi, P.S., Verma, N.K., Vyas, M.K., Rana, J., Sharma, A., Kharadi, V.B., Sabapara, G.P. and Deshpande, S.B. (2013) Phenotypic characteristics, management, performance and genetic variability in *Surti* breed of goat. *Ind. J. Anim. Sci*., 83(4), 423-427.
6. Dudhe, S.D., Yadav, S.B.S., Nagda, R,K,, Pannu, U., Gahlot, G.C. (2015) Genetic and non-genetic factors affecting morphometry of Sirohi goats. *Vet. World.*, *8*(11): 1356-1363.
7. M.S.Hamada, M.S., Elmoghazy, M.M. and Elessawy, D.T. (2016) Assessment of genetic parameters via REML and ML methods for some milk traits in Zzaribi goats. *J. Agric. Res.*, 42(3): 70-80.
8. Khan, B.U. and Sahni, K.L. (1983) Pre-weaning body weights and linear body measurements in *Jamunapari* goats under semi-arid farm conditions. *Ind. J. Anim. Sci.*, 53(8): 835-840.
9. Kharkar, K., Kuralkar, S.V., Kuralkar, P., Bankar, P.S., Chopade M.M. and K.A. Hadole, K.A. (2014) Factors affecting body weight and morphometric characters of *Berari* goats. *Ind. J. Small Rumin..*, 20(1): 12-15.
10. Kramer, C.Y. (1957) Extension of multiple range tests to group correlated means. *Biomet.*, 13:13.
11. Kumar, S., Bhat, P.N., Bhat, P.P and Palia, S.K. (1992) Genetic and non-genetic factors affecting body weights and measurements in *Jamunapari* goats. *Ind. J. Anim. Sci*., 62(9): 894-897.
12. Pathodiya, O.P., Gurjar, M.L., Sharma, M.C. and Khadda, B.S. (2004) Studies on birth weight and morphometry of *Sirohi* kids in farmers field. *Ind. J. Small Rumin.*, 10(1): 74-76.
13. Rao, P.K. and Patro, B.U. (2002) Goat genome in Orissa, Proceeding of seminar on goat genome. *CIRG, Makhdoom*, 105-108.
14. Rawat, S.K. and Singh, S.C. (2014) Characterization of Jamunapari goat in Mahoba district of Bundelkhand region. *Scientific J. Anim. Sci.*, 3 (3):81-86.
15. Rohilla, P.P. and Patel, A.K. (2003) Marwari goat breed of Rajasthan. *Ind. J. Anim. Sci*., 73(6): 705-709.
16. Shankarnarayan, K.A., Bohra, H.C. and P. K. Ghosh (1985) The Goat: An appropriate animal for arid and semi-arid regions. Econo. Politic. Weekly., 20: 1965-1972.
17. Sharma, M.C., Pathodiya, O.P., Tailor, S.P. and Mishra, S. (2010) Pre-weaning growth traits of *Sirohi* kids under farmer's management system. *Ind. J. Small Rumin.*, 16 (1): 243-245.

DOI 10.5455/ijlr.20170625033145

18. Tomar, A.K.S., Kumar, A. Mehta B.S. and Jaishankar J. (2001). Factors affecting early express body traits in Sirohi goats. *Ind. J. Anim.Sci.*, 71(3): 271-273.
19. Verma, N.K., Mishra, P., Aggarwal, R.A.K., Dixit, S.P., Dangi, P.S. and Dash, S.K., (2015) Characterization, performance and genetic diversity among goats of Odisha. *Ind. J. Anim. Sci.*, 85(2): 165–171.

DOI 10.5455/ijlr.20170625033145