Original Research Article

Studies on Linear Body Measurements of Dangi Cattle in their Breeding Tract of Maharashtra

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A B S T R A C T

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In the present investigation the body measurements and body weight of Dangi cattle at more than 36 month of age were studied for different sex (male and female) at different locations in the breeding tract. The idea behind the collection of data in breeding tract of Dangi cattle from the farmers and breeders herd of Dangi rather than on the organized farm to obtain the real picture of the breed in the breeding tract. The body measurements play an important role in judging cattle and often help in predicting probable value of the animals. The chest girth, body length and height are indicative of development of various body cavities, thus giving sufficient idea about development of vital organs. 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 a measure of development of muscles, bones and fat and it has close relationship with the live weight.

Introduction

The livestock sector plays an important role in the socio-economic development of rural households with an integral part of the agriculture. Thus the cattle occupy central position and are basis of the Indian rural livelihood security. The cattle biodiversity in India constitutes 43 well defined breeds of cattle (Anonymous, 2017). The country population of cattle accounts for 17.00 per cent of the total world cattle population. The livestock sector alone contributes nearly 25.6% of value of output at current prices of total value of output in Agriculture, Fishing and Forestry sector. The overall contribution of livestock sector in total GDP is nearly 3.90 per cent at current prices during 2013-14. The

total Bovine population is 299.9 million in 2012 which shows a decline of 1.57% over previous census (Livestock Census, 2012). The Dangi animals are found near the hilly tract where forest is available in the ranges of Sahyadri where it is reared mainly for draught purpose. The Dangi cattle is a hardy and medium-slow draft animal, subsist mostly on grazing alone and they have visible characteristics like distinct white coat colour with red or black spots distributed unevenly over the body with slightly protruding forehead. Horns are short and thick with lateral pointing tips. Dangi Cows are low milk producers with an average lactation milk yield of 175-800 kg. Dangi cattles are extensively used for ploughing, harrowing and other field operations, and also for

carting timber from forest area. Therefore, the present study has been conducted with following objectives:

1. To study body measurements and body weights at different age groups
2. To study the block effect on various characteristics

Materials and Methods

Selection of animals

The data on body measurements of 365 Dangi cattles irrespective of sex was collected by taking actual measurements of each individual in different villages in Akole tehsil of Ahmadnagar district, Igatpuri & Sinner tehsils of Nashik district and Shahapur & Murbad tehsils of Thane district of Maharashtra. From each tehsils Dangi cattles with different age group and sex was chosen randomly for present study. From each tahsil, five villages i.e. total twenty five villages (Table 1) were taken as sample for study.

Tools and Techniques of data collection

The data was collected by measuring different body part in centimetre with a measuring tape and also by the visual examination and interview with the livestock owners with the help of model questionnaire. Arrangement was made to stand the animal on even surface and in normal position at the time of recording body measurement

The collected data of 365 Dangi cattles on body measurements and body weights were subjected to the Least Squares Analysis Technique as outlined by Harvey (1990). The body weights at various age groups in Dangi cattle were estimated by using Aggarwal's modified Shaeffers formula as outlined below.

Live body weight (in Seers) =

$$\frac{\text{Length x Chest Girth}}{Y}$$

Where,

Y= 9.0 if girth is less than 65 inches
Y= 8.5 if girth is between 65-80 inches
Y= 8.0 if girth is more than 80 inches. (1 Seer = 0.93Kg)

Results and Discussions

Body measurements and body weights of Dangi male at more than 36 months of age

Body weight

It is observed from Table 2 that the least squares means of body weight for B_1, B_2, B_3, B_4 and B_5 blocks were 397.56 ± 7.33, 382.21 ± 8.54, 416.72 ± 7.12, 300.97 ± 5.56 and 256.53 ± 9.11 kg, respectively. The highest body weight was observed in B_3 block (416.72 ± 7.12 kg) followed by B_1, B_2, B_4 and B_5 block, respectively. The DMRT has revealed that body weight of Dangi male cattle for B_1 and B_2 differed significantly with B_3, B_4 & B_5 whereas the non-significant difference amongst B_1 and B_2 were observed. The Least Squares Analysis of Variance (Table 3) has revealed that highly significant at ($P<0.01$) effect of block on body weight of Dangi male cattle at more than 36 months of age. The overall LSM for body weight for Dangi male at more than 36 months of age was recorded as 350.80 ± 3.41 kg which is slightly lower than range reported by Jaiswal *et al.,* (1979) as 364.00 to 455.00 kg as well as Nivsarkar *et al.,* (2000) as 363.00 kg, whereas slightly higher than previous findings by Gokhale (2003) as 294.61 ± 4.06 kg and Ahlawat *et al.,* (2014) as 310.00 to 330.00 kg, respectively, in adult Dangi male

cattle. In other indigenous breeds the higher body weight was reported than the present findings has been reported by Das (2016) as 375.27 ± 5.29 kg in Red Kandhari cattle and Jagdale (2018) as 378.40 ± 4.60 kg in Khillar cattle, whereas lower by Bainwad (2017) as 302.92 ± 1.73 kg in Red Kandhari cattle and Wagh (2018) as 252.76 ± 1.83 kg in Gaolao cattle, respectively. The overall picture of body weight and body measurements of Dangi male cattle at more than 36 months of age may be attributed to the fact that these cattle are reared in field condition in the breeding tract with different geo-ecological situations of surveyed area and management practices followed there plays an important role on physical measurements parameters of Dangi cattle.

Chest girth

It is observed from Table 2 that the least squares means of chest girth for B_1, B_2, B_3, B_4 and B_5 blocks were 173.91± 1.75, 174.48±2.05, 178.28±1.70, 154.17±1.33 and 150.18±2.18 cm, respectively. The highest chest girth was observed in B_3 district (178.28 ± 1.70cm) followed by B_2, B_1, B_4 and B_5 block, respectively. The DMRT has revealed that chest girth of Dangi male for B_1, B_2 and B_3 differed significantly with B_4 and B_5 whereas, the non- significant difference amongst B_1, B_2 & B_3 were observed. The Least Squares Analysis of Variance (Table 3) has revealed highly significant ($P<0.05$) effect of blocks on chest girth of Dangi male at more than 36 months of age. The overall LSM for chest girth of Dangi male at more than 36 months of age was recorded in the presented study as 166.20± 0.82 cm which is slightly higher than early reported by Hewlett (1912) as 147.32-157.48 cm with an average of 152.4 cm, Gokhale (2003) as 153.81± 0.90 cm, Jagtap *et al.,* (2009) as 133.37 ± 1.49 cm, Maske and Phule (2012) as 150.00 cm and Khadse *et al.,* (2012) as 153.81± 0.90 cm,

whereas slightly lower than previously reported by Jaiswal *et al.,* (1979) as 173.00 cm, Nivsarkar *et al.,* (2000) as 180.00 cm in adult Dangi cattle. The higher chest girth than the present findings has been reported in other indigenous cattle breeds by Magar (2013) as 174.82 ± 0.67 cm and Das (2016) as 171.73 ± 0.77cm in Red Kandhari cattle, respectively. The lower chest girth than the present findings has been reported by Yadav (2008) as 163.22 ± 0.99 cm in Deoni cattle and Wagh (2018) as 156.63 ± 0.48 cm in Gaolao male cattle, respectively.

Body length

It is observed from Table 2 that the overall least squares mean for body length of Dangi male at more than 36 months of age group was 126.04 ± 0.69 cm. The least squares means of body length for B_1, B_2, B_3, B_4 and B_5 blocks were 135.23± 1.48, 129.56± 1.73, 137.80±1.44, 120.93± 1.13 and 106.68±1.84 cm, respectively. The highest body length was observed in B_3 block (137.80 ± 1.44 cm) followed by B_1, B_2, B_4 and B_5, respectively. The Least Squares Analysis of Variance (Table 3) has revealed highly significant effect of block on body length of Dangi male at more than 36 months of age.

The LSM for body length of Dangi male at more than 36 months of age recorded as 126.04 ± 0.69 cm in the present study which is in accordance with previous findings by Gokhale (2003) as 129.06 ± 0.64 cm and Khadse *et al.,* (2012) as 129.06± 0.64 cm in Dangi male cattle. The higher body length as compared to the present study observation has been reported by Hewlett (1912) as 139.70 cm, Jaiswal *et al.,* (1979) as147.00 cm, Nivsarkar *et al.,* (2000) as 143.00 cm, Jagtap *et al.,* (2009) as 142.49 ± 1.45 cm, Maske and Phule (2012) as 140.00 cm in adult Dangi cattle.

Height at wither

It is observed from Table 2 that the least squares means of height at wither for B_1, B_2, B_3, B_4 and B_5 blocks were 131.32 ± 1.15, 132.28 ± 1.34, 133.08 ± 1.12, 124.81 ± 0.87 and 124.95 ± 1.43 cm, respectively. The hig hest height at wither was observed in B_3 block (133.08 ± 1.12cm) followed by B_2, B_1, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 3) has revealed that highly significant effect of blocks on height at wither of Dangi male at more than 36 months of age. The overall LSM for height at wither of Dangi male at more than 36 months of age was 125.29 ± 0.53 cm in the present study which is in accordance with previously reported by Jaiswal *et al.,* (1979) as 127.00 cm and slightly higher than Hewlett (1912) as 114.30-127.00 cm with an average of 120.5 cm, Nivsarkar *et al.,* (2000) as 118.00 cm and Gokhale (2003) as 117.45 ± 0.43 cm, Jagtap *et al.,* (2009) as 100.74 ± 0.75 cm and Khadse *et al.,* (2012) as 117.45 ± 0.43 cm, respectively, in adult Dangi male cattle. The higher height at wither as compared to the present study observations has been reported by Maske and Phule (2012) as 130.00 cm in Dangi male cattle, Bainwad (2017) as 141.24 ± 0.39 cm in Red Kandhari male cattle and Jagdale (2018) as 141.78 ± 0.59 cm in Khillar male cattle, respectively.

Belly girth

It is observed from Table 2 that the least squares means of belly girth for B_1, B_2, B_3, B_4 and B_5 blocks were 203.59 ± 2.68, 206.04 ± 3.12, 211.25 ± 2.60, 192.69 ± 2.03 and 170.86 ± 3.33 cm, respectively. The highest belly girth was observed in B_3 district (211.25 ± 2.60 cm) followed by B_2, B_1, B_3 and B_5 block, respectively. The DMRT has revealed that belly girth of Dangi cattle for B_1, B_2 and B_3 differed highly significant with B_4 and B_5 whereas, the non-significant difference amongst B_1, B_2 and B_3 were observed. The Least Squares Analysis of Variance (Table 3) has revealed that highly significant ($P<0.01$) effect of block on the belly girth of Dangi male at more than 36 months of age. The overall Least Squares mean for belly girth of Dangi male at more than 36 months of age group was 196.89 ± 1.25 cm which is in accordance with Bainwad (2017) as 194.07 ± 0.54 cm in Red Kandhari male cattle. The lower belly girth than the present study have been reported by Das (2016) as 182.11 ± 0.83 cm in Red Kandhari cattle, Jagdale (2018) as 189.59 ± 0.82 cm in Khillar male cattle, Wagh (2018) as 174.69 ± 0.55 cm in Gaolao male cattle, respectively. The lower belly girth reported by various authors in indigenous cattle breeds might be due to differences in their genetic makeup coupled with differences in their management and environment to which they are exposed.

Height at hip bone

It is observed from Table 2 that the least squares means of height at hip bone for B_1, B_2, B_3, B_4 and B_5 blocks were 133.91 ± 1.18, 134.84 ± 1.37, 136.14 ± 1.14, 127.29 ± 0.89 and 107.36 ± 1.46cm, respectively. The highest height at hip bone was observed in B_3 block (136.14 ± 1.14cm) followed by B_2, B_1, B_4 and B_5 block, respectively.

The Least Squares Analysis of Variance (Table 3) has revealed that highly significant effect of blocks on height at hip bone of Dangi male at more than 36 months of age. The overall LSM for height at hip bone of Dangi male at more than 36 months of age was recorded in the present study as 127.91 ± 0.55 cm in the present study which is lower than earlier findings by Jaiswal *et al.,* (1979) as 132.00 cm, whereas higher than Jagtap *et al.,* (2009) as 108.77 ± 0.74 cm, respectively, in Dangi cattle.

Body measurements and body weights of Dangi female at more than 36 months of age

Body weight

It is observed from Table 4 that the least squares means of body weight for B_1, B_2, B_3, B_4 and B_5 blocks were 345.56 $\pm$4.77, 332.78$\pm$4.81, 325.70$\pm$4.83, 281.12$\pm$ 4.94 and 260.17$\pm$5.15 kg, respectively. The highest body weight was observed in B_1 block (345.56 $\pm$ 4.77 kg) followed by B_2, B_3, B_4 and B_5 block, respectively. The DMRT has revealed that body weight of Dangi female for B_1 and B_2 differed highly significant with B_3, B_4 and B_5, whereas the non-significant difference amongst B_1 and B_2 were observed. The Least Squares Analysis of Variance (Table 5) has revealed that highly significant at (P<0.01) effect of blocks on body weight of Dangi female at more than 36 months of age. The overall LSM for body weight for Dangi female at more than 36 months of age were recorded as 309.06 $\pm$ 2.19 kg which is within the range as earlier findings by Jaiswal *et al.,* (1979) as 270.00 to 365.00 kg, whereas lower body weight than present findings has been reported by Gokhale (2003) as 228.23 $\pm$ 1.92 kg, Ahlawat *et al.,* (2014) as 220.00 to 250.00 kg, respectively, in Dangi female cattle.

Chest girth

It is observed from Table 4 that the least squares means of chest girth for B_1, B_2, B_3, B_4 and B_5 blocks were 158.25$\pm$1.57, 155.97$\pm$1.58, 155.05$\pm$ 1.59, 148.56$\pm$ 1.62 and 144.11 $\pm$ 1.69 cm, respectively. The highest chest girth was observed in B_1block (158.25 $\pm$ 1.57 cm) followed by B_2, B_3, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 5) has revealed highly significant effect of blocks on chest girth of Dangi female at more than 36 of age. The overall LSM for chest girth of Dangi

female at more than 36 months of age were recorded in the presented study as 152.39 $\pm$ 0.72 cm which is slightly lower than previous findings by Jaiswal *et al.,* (1979) as 157.00 cm, whereas slightly higher than Hewlett (1912) as 140-152 cm with an average of 146.00 cm, Gokhale (2003) as 139.29 $\pm$ 0.57 cm, Jagtap *et al.,* (2009) as121.44 $\pm$ 1.38 cm, Khadse *et al.,* (2012) as 139.29$\pm$ 0.57 cm and Sharma and Pundir (2014) as 139.29 cm, respectively, in adult Dangi female cattle. The higher chest girth than the present findings has been reported by as Nivsarkar *et al.,* (2000) as 173.00 cm in Dangi female cattle, respectively.

Body length

It is observed from Table 4 that the least squares means of body length for B_1, B_2, B_3, B_4 and B_5 blocks were 133.33$\pm$2.32, 131.04$\pm$2.34, 130.58$\pm$2.35, 118.15 $\pm$2.40and 112.68$\pm$2.51cm, respectively. The highest body length was observed in B_1 block (133.33 $\pm$ 2.32 cm) followed by B_2, B_3, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 5) has revealed highly significant effect of blocks on body length of Dangi female at more than 36 months of age. The LSM for body length of Dangi female at more than 36 months of age recorded as 125.15 $\pm$ 1.07cm which is in accordance with previous findings by Nivsarkar *et al.,* (2000) as 125.00 cm, Gokhale (2003) as 122.28 $\pm$ 0.39 cm, Khadse *et al.,* (2012) as 122.28$\pm$ 0.39 cm and Sharma and Pundir (2014) as 122.28 cm, whereas slightly lower than Jaiswal *et al.,* (1979) as 134.69 $\pm$ 3.07 cm and Jagtap *et al.,* (2009) as 121.44 $\pm$ 1.38 cm, respectively, in adult Dangi female cattle.

Height at wither

It is observed from Table 4 that the least squares means of height at wither for B_1, B_2, B_3, B_4 and B_5 blocks were 131.63$\pm$0.82,

125.13 $\pm$0.82, 124.51$\pm$0.83, 121.65$\pm$0.84 and 109.33$\pm$0.88 cm, respectively. The highest height at wither was observed in B_1block (131.63 $\pm$ 0.82 cm) followed by B_2, B_3, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 5) has revealed that highly significant effect of blocks on height at wither of Dangi female at more than 36 months of age. The overall LSM for height at wither of Dangi female at more than 36 months of age was 122.45 $\pm$ 0.37 cm which is as per the similar findings with Jaiswal *et al.,* (1979) as 119.00 cm, whereas slightly higher than previous finding by Nivsarkar *et al.,* (2000) as 108.00 cm, Gokhale (2003) as 113.29 $\pm$ 0.39 cm, Jagtap *et al.,* (2009) as 105.26 $\pm$ 0.91 cm, Khadse *et al.,* (2012) as 113.00$\pm$0.29 cm and Sharma and Pundir (2014) as 113.00 cm, respectively, in adult Dangi female cattle. The lower height at wither reported than present findings has been reported by Hewlett (1912) as 101.60-114.30 cm in adult Dangi female cattle.

Belly girth

It is observed from Table 4 that the least squares means of belly girth for B_1, B_2, B_3, B_4 and B_5 blocks were 203.46$\pm$2.33, 200.06$\pm$2.35, 200.81$\pm$2.36, 186.36$\pm$2.42and 179.36$\pm$2.52 cm, respectively. The highest belly girth was observed in B_1 block (203.46 $\pm$ 2.33 cm) followed by B_3, B_2, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 5) has revealed that highly significant effect of blocks on the belly girth of Dangi female at more than 36 months of age. The overall Least Squares mean for belly girth of Dangi female at more than 36 months of age group was 194.01 $\pm$ 1.07 cm. The lower belly girth than the findings in the present investigation has been reported by Bainwad (2017) as 177.98$\pm$0.39 cm in Red Kandhari female cattle, Jagdale (2018) as 181.95$\pm$ 1.18 cm in Khillar female cattle and Wagh (2018) as 159.10 $\pm$ 0.93 cm in Gaolao female cattle, respectively.

Table.1 List of villages randomly selected for collection of data

Sr.No.	Name of District	Name of Tahsil	Name of the villages
1.	Ahmadnagar	Akole	Khirwire, Rajur, Ekadare, Samsherpur, Mogras
2.	Nashik	Igatpuri	Devle, Ghoti, Dhamani, Igatpuri, Mauli (Khurd)
		Sinner	Duberewadi, Thangaon, Dubere, Belu, Padali
3.	Thane	Shahapur	Katbav, khardi, Khor, Umbarmali, Dondarpada
		Murbad	Bhoirwadi, Moroshi, Bhorande,Diwanpada, Aawlyachiwadi

Table.2 LSM and SE for body measurements (cm) and body weights (kg) of Dangi male at more than 36 months age

Sources	Code	N	LSM $\pm$ SE					
			Body weight (kg)	Chest girth (cm)	Body length (cm)	Height at wither (cm)	Belly girth (cm)	Height at hip bone (cm)
Population mean	μ	176	350.80 $\pm$ 3.41	166.20 $\pm$ 0.82	126.04 $\pm$ 0.69	125.29 $\pm$ 0.53	196.89 $\pm$ 1.25	127.91$\pm$0.55
					Block			
Akole	B$_1$	34	397.56[a]$\pm$ 7.33	173.91[a]$\pm$ 1.75	135.23[a]$\pm$ 1.48	131.32[a]$\pm$ 1.15	203.59[a]$\pm$2.68	133.91[a]$\pm$1.18
Igatpuri	B$_2$	25	382.21[a]$\pm$ 8.54	174.48[a]$\pm$ 2.05	129.56[b]$\pm$ 1.73	132.28[a]$\pm$ 1.34	206.04[a]$\pm$ 3.12	134.84[a]$\pm$1.37
Sinner	B$_3$	36	416.72[ab]$\pm$ 7.12	178.28[a]$\pm$ 1.70	137.80[a]$\pm$ 1.44	133.08[a]$\pm$ 1.12	211.25[a]$\pm$ 2.60	136.14[a]$\pm$1.14
Shahapur	B$_4$	59	300.97[b]$\pm$ 5.56	154.17[b]$\pm$ 1.33	120.93[bc]$\pm$ 1.13	124.81[b]$\pm$ 0.87	192.69[b]$\pm$ 2.03	127.29[b]$\pm$0.89
Murbad	B$_5$	22	256.53[bc]$\pm$ 9.11	150.18[b]$\pm$ 2.18	106.68[bcd]$\pm$1.84	124.95[bc]$\pm$ 1.43	170.86[bc]$\pm$ 3.33	107.36[bc]$\pm$1.46

Note: Means connected by same superscripts do not differ significantly.

Table.3 Least squares analysis of variance (ANOVA) for body measurements (cm) and body weights of Dangi male for more than 36 months age

i	ANOVA for body weight			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	149300	81.763**
	Error	171	1826	
ii	ANOVA for chest girth			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	5757	54.986**
	Error	171	104.7	
iii	ANOVA for body length			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	4475	59.730**
	Error	171	74.92	
iv	ANOVA for height at wither			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	3391	75.624**
	Error	171	44.84	
v	ANOVA for belly girth			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	6712	27.486**
	Error	171	244.2	
vi	ANOVA for height at hip bone			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	3495	74.030**
	Error	171	47.21	

** Significant at $P < 0.01$

Table.4 LSM and SE for body measurements (cm) and body weights (kg) of Dangi female at more than 36 months age

Sources	Code	N	LSM $\pm$ SE					
			Body weight (kg)	Chest girth (cm)	Body length (cm)	Height at wither (cm)	Belly girth (cm)	Height at hip bone (cm)
Population mean	μ	189	309.06 $\pm$ 2.19	152.39 $\pm$ 0.72	125.15 $\pm$ 1.07	122.45 $\pm$ 0.37	194.01 $\pm$ 1.07	124.87 $\pm$ 0.65
Block								
Akole	B$_1$	40	345.56^a $\pm$4.77	158.25^a $\pm$1.57	133.33^a $\pm$2.32	131.63^a $\pm$ 0.82	203.46^a $\pm$2.33	134.05^a $\pm$1.42
Igatpuri	B$_2$	39	332.78^a $\pm$4.81	155.97^a $\pm$1.58	131.04^a $\pm$2.34	125.13^b $\pm$ 0.82	200.06^a $\pm$2.35	127.55^b $\pm$1.43
Sinner	B$_3$	39	325.70^{ab} $\pm$4.83	155.05^a $\pm$1.59	130.58^a $\pm$2.35	124.51^b $\pm$ 0.83	200.81^a $\pm$2.36	127.36^b $\pm$1.44
Shahapur	B$_4$	37	281.12^b $\pm$4.94	148.56^b $\pm$1.62	118.15^b $\pm$2.40	121.65^{bc} $\pm$0.84	186.36^b $\pm$2.42	123.79^b $\pm$1.47
Murbad	B$_5$	34	260.17^{bc} $\pm$5.15	144.11^b $\pm$1.69	112.68^b $\pm$2.51	109.33^{bcd} $\pm$0.88	179.36^{bc} $\pm$2.52	111.63^{bc} $\pm$1.53

Note: Means connected by same superscripts do not differ significantly.

Table.5 Least squares analysis of variance (ANOVA) for body measurements (cm) and body weights of Dangi female for more than 36 months age

i	ANOVA for body weight			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	49200	54.413**
	Error	184	904.2	
ii	ANOVA for chest girth			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	1260	12.912**
	Error	184	97.58	
iii	ANOVA for body length			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	3085	14.409**
	Error	184	214.1	
iv	ANOVA for height at wither			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	2425	91.578**
	Error	184	26.48	
v	ANOVA for belly girth			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	4087	18.886**
	Error	184	216.4	
vi	ANOVA for height at hip bone			
	Sources of variation	**d.f.**	**M.S.S.**	**F-value**
	Block	4	2477	30.858**
	Error	184	80.27	

** Significant at $P < 0.01$

Height at hip bone

It is observed from Table 4 that the least squares means of height at hip bone for B_1, B_2, B_3, B_4 and B_5 blocks were 134.05 ± 1.42, 127.55 ± 1.43, 127.36 ± 1.44, 123.79 ± 1.47 and 111.63 ± 1.53 cm, respectively. The highest height at hip bone was observed in B_1 block (134.05 ± 1.42 cm) followed by B_2, B_3, B_4 and B_5 block, respectively. The Least Squares Analysis of Variance (Table 5) has revealed that highly significant effect of blocks on height at hip bone of Dangi female at more than 36 months of age. The overall LSM for height at hip bone of Dangi female at more than 36 months of age was recorded in the present study as 124.87 ± 0.65 cm which is in accordance with earlier Scientist by Jaiswal *et al.,* (1979) as 122.00 cm and higher than Jagtap *et al.,* (2009) as 101.60 ± 1.06 cm, respectively, in adult Dangi female cattle.

In conclusion, the effect of block was found highly significant on body weight in all Dangi cattle age group in both sex. The effect of block was found significant to highly significant on chest girth, body length and belly girth in > 36 month male and female group of animals. Hence it is

concluded that geo-ecological situations of surveyed area and management practices followed there plays an important role on physical measurements parameters of Dangi cattle.

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