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Post-weaning growth performance in Deccani Sheep

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Abstract
The effect of certain non-genetic factors on post-weaning growth traits of 301 Deccani lambs maintained at Livestock Research Station, Mahabubnagar, Telangana State was studied from October, 2012 to July, 2015. The least squares mean body weight was15.58 ± 0.15, 19.09 ± 0.14 and 22.95 ± 0.18 kg at 180, 270 and 360 days of age, respectively. Highly significant influence of sex on weight at 180 days ($P \leq 0.01$) and of season on weight at 270 days ($P \leq 0.05$) was observed.Weight of dam and parity had non-significant effect on the body weights studied. Moderate heritability ranging from 0.20 ± 0.06 to 0.30 ± 0.05 was obtained for body weights.

Keywords: body weight, Deccani Sheep, growth, heritability

Introduction
Deccani, an important sheep breed of Deccan plateau is a dual purpose breed mainly reared for mutton production and coarse wool. The breed is predominantly black with white markings in some, is small in size and hardy. The breed has evolved through ages as a result of pure breeding and natural selection. However, in view of the dwindling market for wool, farmers are preferring Nellore sheep, a hairy breed and this has resulted in indiscriminate crossbreeding of Deccani sheep with Nellore. If the present trend continues, one need not wonder even if the breed becomes extinct.
Having evolved as a result of natural selection for quite a long period, Deccani is more suitable to the local harsh agro climatic conditions and poor feed and fodder resources. There is an urgent need to assess the performance of this breed under standard management besides planning for its genetic improvement, to exploit the potential of this well adapted breed of Deccan plateau. Keeping the above scenario in view, the present study is taken up to study the post-weaning performance of Deccani sheep under organized farm conditions, as post-weaning performance forms an important role in the mature weight and meat yield from sheep.

Material and Methods
A total of 301 purebred Deccani lambs born to fourteen sires and 189 dams at Livestock Research Station, Mahabubnagar were utilized for the present study. The experimental animals were housed in asbestos sheet roofed sheds with mud floor. Grazing was allowed for 8 hours besides supplementing with 3 kg green fodder and 300 g concentrate mixture (CP 18%) per animal daily. Body weights were recorded at 180 (BW180), 270 (BW270) and 360 (BW360) days with 50 gm accuracy. The data were subjected to least squares analysis (Harvey, 1966) and the means were compared by Duncan's multiple range test (Kramer,1957) to study the influence of genetic and non-genetic factors such as season of birth, sex of the lamb, ewe weight at lambing and parity of the ewe by using the following statistical model:

$Y_{ijklm} = \mu + P_i + C_j + A_k + S_l + e_{ijklm}$

where,

Y_{ijklm} = is the body weight or body measurement of the m^{th} animal of i^{th} sex born in the j^{th} season belonging to k^{th} weight group of dam at lambing and l^{th} parity of dam at lambing

μ = overall mean

P_i = effect of i^{th} sex of the lamb (male, female)

C_j = effect of j^{th} season of lambing (Season I: Jan.-June; Season II: July-Dec.)

A_k= effect of k^{th} weight group of dam at lambing (<25kg, 25-30kg, >30kg)

S_l = effect of l^{th} parity of dam (1^{st}, 2^{nd}, 3^{rd}, 4^{th} parity)

e_{ijklm} = residual random error, NID (0, $\sigma 2$)

Data were corrected for significant non-genetic effects before it is utilized for estimation of genetic parameters. Heritability was estimated by paternal half-sib correlation method (Becker, 1984). Genetic, phenotypic and environmental correlations between different economic traits were estimated by Minimum Variance Quadratic Unbiased Estimator (MIVQUE).

Results and Discussion

The present investigation revealed a highly significant influence of sex on body weight at 180 days only ($P \leq 0.01$) wherein male lambs had higher body weight than female lambs (Table 1). Similar findings where significant influence of sex on BW180 besides BW270 and BW360 were reported in Deccani breed by Chikurdekar *et al.* (2012) [4] and Mane *et al.* (2014) [22]. Hormonal differences between male and female lambs might be the reason for the sexual dimorphism for body weight.

Table 1: Least-squares mean post-weaning body weights (kg) of Deccani lambs

Effect	BW180			BW270			BW360		
	n	Mean	SE	n	Mean	SE	n	Mean	SE
Overall	286	15.58	0.15	264	19.09	0.14	262	22.95	0.18
Sex of lamb									
Male	140	16.17[a]	0.18	132	19.17	0.17	130	23.02	0.22
Female	146	15.03[b]	0.18	132	19.01	0.18	132	22.88	0.23
Season of birth									
I (Jan-June)	112	15.76	0.20	90	19.32[a]	0.20	90	23.11	0.26
II (Jul-Dec)	174	15.39	0.16	174	18.86[b]	0.15	172	22.78	0.19
Ewe weight									
<25 kg	134	15.81	0.16	121	19.28	0.16	119	23.08	0.20
25 to 30 kg	124	15.52	0.17	116	19.13	0.17	116	23.17	0.21
>30 kg	28	15.39	0.34	27	18.86	0.33	27	22.59	0.41
Parity									
1	88	15.41	0.21	76	18.96	0.22	76	22.90	0.27
2	67	15.58	0.23	62	19.16	0.23	62	22.96	0.28
3	102	15.70	0.19	97	19.07	0.18	95	22.81	0.23
4	29	15.62	0.34	29	19.18	0.32	29	23.13	0.41

Means with similar superscripts in a column within the effect do not differ significantly ($P \geq 0.05$)

Similar significant influence of sex on BW180 besides BW270 and BW360 was reported in different sheep breeds such as Malpura, Marwari, Muzaffarnagari, Magra, Madras Red and Ramnad White breeds by different authors (Gopal, 2006 [12]; Dangi and Poonia 2006 [5]; Nehra and Singh 2006 [23]; Gopal and Prasad Hari 2007 [13]; Gowane and Arora 2010 [10-25]; Ravimurugan *et al.,* 2010 [26]; Balasubramanyam *et al.*, 2012 [2]; Gopal *et al.,* 2012 [15]; Vivekanand *et al.,* 2014 [32]; Gopal and Rout *et al.,* 2014 [14]; Gowane*et al.,* 2015 and Nirban *et al.,* 2015) [24]. However, Balasubramanyam and Kumarasamy (2011) [1] reported significant influence of sex only on BW180 and BW360 in Madras Red sheep.

In the present study, male lambs attained higher body weight than female lambs at all the three stages of post-weaning growth. Similar findings were reported by Gopal (2006) [12], Nehra and Singh (2006) [23], Reddy *et al*. (2009) [27] and Gopal and Rout (2014) [14].

Significant influence of season of birth was observed on BW270 only ($P \leq 0.05$) wherein the season I (Jan to June) born lambs were heavier than those born during season II (July to Dec) (Table 1). Perusal of published literature revealed significant influence of season of birth on BW270 and BW360 in Marwari (Dey and Poonia, 2005 [9] and Nehra and Singh, 2006) [23]; on BW180 in Madras Red (Balasubramanyam *et al.,* 2012) [2], in Deccani (Mane *et al.*, 2014) [22] and on BW360 in Madras Red (Sivakumar *et al.*, 2009) [28] while Balasubramanyam and Kumarasamy (2011) [1] in Madras Red and Chikurdekar*et al.* (2012) [4] in Deccani reported significant effect of season on body weights at all the ages. The variation in the availability of pasture during the seasons could have played a major role in causing the period to period variation in body weights, apart from other environmental and management changes.

Lambs born during season I attained higher body weights when compared to those born during season II at 180, 270 and 360 days of age. Similar trend was reported by Chikurdekar *et al.* (2012) [4] and Mane *et al.* (2014) [22] in Deccani sheep and Nehra and Singh (2006) [23] in Marwari sheep. Season I born lambs are at an advantage in getting adequate nutrition owing to favourable climatic conditions.

Weight of ewe had a non-significant influence on post-weaning body weight. Any influence of dam on the weight of lamb seen during early days generally wanes off by weaning time. However, Dangi and Poonia (2006) [5], Nehra and Singh (2006) [23] and Nirban *et al.* (2015) [24] and Vivekanand *et al.* (2014) [32] found significant influence of dam's weight at lambing on BW180, BW270 and BW360 in some Indian breeds.

The effect of parity of ewe was also non-significant on post-weaning body weights. This non-significant effect might be due to waning of maternal effects and absence of physical influence of dam during post-weaning stage. Vivekanand *et al.* (2014) [32] and Nirban *et al.* (2015) [24] also found non-significant effect of parity on BW180, BW270 and BW360 in Magra and Marwari sheep, respectively.

The overall least-squares mean body weights recorded were 15.58 ± 0.15, 19.09 ± 0.14 and 22.95 ± 0.18 kg at 180, 270 and 360 days, respectively (Table 1). Body weight recorded in the present study was within the range for BW180 but lesser for BW270 and BW360 when compared to the reports on Deccani sheep by ICAR Annual Report, Rahuri (2009-10, 2010-11), Chikurdekar *et al.* (2012) [4] and Mane *et al.* (2014) [22] who reported a range of 13.86 to 22.04, 21.17 to 23.06 and 23.94 to 24.27 kg for BW180, BW270 and BW360, respectively.

Published literature on other breeds revealed a range of 14.00 to 21.00, 17.80 to 25.24 and 19.88 to 28.00 kg for body weights at 180, 270 and 360 days (Nehra and Singh 2006,

Kumar *et al.*, 2008, Sivakumar *et al.*, 2009, Karunanithi *et al.*, 2011, Balasubramanyam and Kumarasamy, 2011, Balasubramanyam *et al.*, 2012, Devendran *et al.*, 2014 and Nirban *et al.*, 2015) [23, 20, 28, 18, 1, 8, 26, 2, 24].

Table 2: Estimates of heritability (on diagonal), and genetic (above diagonal) and phenotypic correlations (below diagonal) of the post-weaning body weights among the Deccani sheep

	BW180	BW270	BW360
BW180	0.20±0.06	0.41±0.04	0.81±0.10
BW270	0.83±0.04	0.28±0.03	0.82±0.02
BW360	0.42±0.05	0.82±0.02	0.30±0.05

In the present study, heritability estimates of body weights during post-weaning periods were moderate and ranged from 0.20 ± 0.06 to 0.30 ± 0.05 (Table 2). The heritability estimate obtained for yearling weight at 360 days is the highest (0.30) which indicates that possibly, the additive genes for growth were better expressed or the environmental variance is progressively reduced at later ages. For post-weaning body weights, moderate heritabilities ranging from 0.08 to 0.33 were reported in the literature (Kushwaha *et al.*, 2009; Gowane and Arora 2010 [10-25]; Prince *et al.*, 2010; Devendran *et al.*, 2010; Ved Prakash *et al.*, 2012; Devendran *et al.*, 2014; Jeichitra *et al.*, 2015 and Venkataramanan *et al*., 2015) [21, 10-25, 25, 26, 29, 8, 17, 30] in Chokla, Malpura, Avikalin, Madras Red, Mecheri, Nilagiri and Sandyno sheep. Estimates of moderate heritabilities for post-weaning body weights obtained by paternal half-sib method indicated the possibility of improvement by selection. Heritability estimates for 6, 9 and yearling weights seem to be a good criterion for selection because they were substantial.

The genetic and the phenotypic correlations among body weights recorded in the present study were mostly positive. The genetic correlations ranged from 0.41 to 0.82 while phenotypic correlations ranged from 0.42 to 0.82. The positive and moderate to high genetic correlations among most of the body weight traits indicated the possibility of correlated response. The genetic and phenotypic correlations for post-weaning body weights ranged from 0.23 to 0.99 and from 0.19 to 0.99 in Madras Red, Nilagiri and Sandyno sheep, as per the published literature (Balasubramanyam *et al.*, 2012 and Venkataramanan *et al*., 2015, 2016) [2, 30-31].

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