

A STUDY ON THE EFFECT OF NON-GENETIC FACTORS INFLUENCING BODY WEIGHT IN MECHERI SHEEP

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ABSTRACT

Data on 3649 Mecheri sheep, maintained at Mecheri Sheep Research Station, Pottaneri, Salem, India and recorded between 1979 and 2012, were analysed to study the effect of non-genetic factors affecting the body weight and average daily gain from birth to twelve months of age. The least squares means for birth weight, 3, 6, 9 and 12 months body weight were 2.31 ± 0.009 , 8.71 ± 0.049 , 12.27 ± 0.075 , 14.80 ± 0.100 and 18.31 ± 0.155 kg respectively. The pre and post-weaning average daily gains were 70.86 ± 0.509 and 32.92 ± 0.494 g and the associated growth efficiencies were 3.80 ± 0.019 and 1.44 ± 0.006 , respectively. Males were significantly heavier and had a higher weight gain than females during all stages of growth and their differences tended to increase with age. Highly significant differences ($p \leq 0.01$) associated with the year of lambing were observed in body weight and weight gain at different stages of growth. The weight of lambs born during season 2 (November - February) was significantly higher than those born in season 1 (March-October) from birth to nine months of age. A significant difference ($p \leq 0.05$) was seen at 12th month body weight of lambs born during season 2. These variations can be correlated with the seasonal changes and fodder availability. Hence, it is necessary to plan the lambing season rationally by controlling the oestrus and mating time.

Keywords: Breed, genetics, growth trait, sheep

INTRODUCTION

Sheep plays a major source of income for the rural people of Tamil Nadu. Mecheri sheep are one among the eight recognised breeds of Tamil Nadu, India and distributed in Salem, Erode, Namakkal, Karur and parts of Dharmapuri districts. They are mainly reared for their unique qualities like higher dressing percentage and better skin quality (Acharya, 1982; Karunanithi *et al.*, 2005). The body weight of the lambs play a major role in selection programmes for breeding pertaining

to meat animals. The real genetic potential of the animals are masked by the effect of various non-genetic factors that affect the growth traits. Some of the definable non-genetic factors that affect the growth traits are climate and seasonal differences, year of birth and sex of the lambs. Hence, the corrected performance records of an animal for classifiable non-genetic sources of variation, are essential for obtaining precise estimates of genetic parameters and breeding values so that breeding animals with the potential genetic merit can be identified and selected for further genetic

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improvement. Hence, the present study was carried out to study various non-genetic factors influencing the body weight of Mecheri sheep. The information thus collected will be useful to identify the most important environmental factors influencing the genetic potential of the animals, which in turn will be useful for formulating a suitable breeding programme.

MATERIAL AND METHODS

Data on the growth of 3649 Mecheri sheep (1847 males and 1802 females), maintained at Mecheri Sheep Research Station, Pottaneri, Tamil Nadu, India were collected over a period of 34 years (1979 - 2012). The growth traits analysed were weight at birth, 3, 6, 9 and 12 months. The average daily gains in live weights from birth until weaning and from weaning until the age of 12 months were estimated. The efficiency of growth was assessed as the gain in body weight per kg of initial weight (Mandal *et al.*, 2003). The data were classified according to period, season and sex. The year of lambing were divided into seven periods (1979-83, 1984-88, 1989-93, 1994-98, 1999-03, 2004-08 and 2009-12) and the season of birth was classified as season 1 (November-February) and season 2 (March-October). The data were analysed using a mixed-model least-squares analysis of fitting constants (Harvey, 1990).

RESULTS AND DISCUSSION

The least-squares means (\pm SE) for body weight at different ages are presented in Table 1. The overall least-squares means for birth, weaning, six, nine and 12 months body weights were 2.31 ± 0.009 , 8.71 ± 0.049 , 12.27 ± 0.075 , 14.80 ± 0.100 and 18.31 ± 0.155 kg respectively. In contrast to the present study, Thiruvankadan *et al.* (2011) observed lower least-squares means for body weights at different ages for the same breed. The sex of the lamb had a highly significant ($p < 0.01$) effect on body weight at all stages of growth. Comparison of the least-squares means for lamb weights at different age showed that the difference between

male and female lambs increased from 0.14 kg at birth to 3.42 kg at 12 months of age. These have been attributed to hormonal differences between sexes and their resultant effects on growth (Bell *et al.*, 1970). These sex differences are consistent with results from other investigations (Mandal *et al.*, 2003; Mokhtari *et al.*, 2008; Mohammadi *et al.*, 2010). The period of lambing had highly significant ($p < 0.01$) effect on body weight of the lambs at all developmental stages. The body weight of sheep at different ages was significantly higher in the last period (2009-2012) followed by the preceding period (2004-08). The significant differences in body weight among lambs born in different periods may be attributed to differences in management and environmental conditions such as ambient temperature, humidity, rainfall and availability of good quality feed in sufficient quantity. The lambs born in season 2 had higher body weight than those born in season 1 and there was a highly significant ($p < 0.01$) difference in body weights from birth to nine months of age. The 12-months body weight had a significant effect ($p < 0.05$) due to seasonal changes. However, Thiruvankadan *et al.* (2011) found no significance difference in body weight due to seasonal effect on weaning, sixth and 12th months of age. The higher birth weight of lambs born during season 2 may be due to effect of ambient temperature, since the gestation period of ewes would occur during cooler part of the year. Whereas it was an opposite phenomenon for the lambs born during season 1. The season of birth plays an important role in pre-weaning growth performance indirectly through its influence on the dam's nutrition and hence amount of milk available to the lambs. The quality and quantity of feed given to the lambs after weaning determines the post weaning growth. Most of the environmental factors had highly significant effects on body weights at different ages. These factors were also proven to be important in other studies on various sheep breeds like Muzaffarnagari (Mandal *et al.*, 2003), Ghezel (Baneh *et al.*, 2010), Mengali (Tariq *et al.*, 2011) and Buchi (Aktar *et al.*, 2012).

Table 1 Least-square means (\pm SE) of body weight (kg) of Mecheri sheep at different age groups

Effect	Birth	3 months	6 months	9 months	12 months
Over all	2.31 \pm 0.009 (3649)	8.71 \pm 0.049 (3330)	12.27 \pm 0.075 (2603)	14.80 \pm 0.100 (1916)	18.31 \pm 0.155 (1669)
Sex	**	**	**	**	**
Male	2.38 \pm 0.012 ^b (1847)	9.07 \pm 0.068 ^b (1684)	12.96 \pm 0.111 ^b (1142)	15.55 \pm 0.156 ^b (776)	20.02 \pm 0.284 ^b (566)
Female	2.24 \pm 0.013 ^a (1802)	8.35 \pm 0.070 ^a (1646)	11.57 \pm 0.101 ^a (1461)	14.15 \pm 0.130 ^a (1140)	16.60 \pm 0.125 ^a (1103)
Period	**	**	**	**	**
1979-1983	2.45 \pm 0.022 ^c (400)	9.63 \pm 0.120 ^d (352)	12.64 \pm 0.178 ^d (280)	14.98 \pm 0.221 ^c (229)	17.92 \pm 0.235 ^d (195)
1984-1988	2.10 \pm 0.033 ^a (422)	6.89 \pm 0.187 ^a (363)	11.76 \pm 0.289 ^c (292)	14.02 \pm 0.391 ^b (205)	16.47 \pm 0.406 ^{ab} (186)
1989-1993	2.23 \pm 0.026 ^b (341)	7.71 \pm 0.146 ^b (280)	9.98 \pm 0.209 ^a (233)	12.91 \pm 0.255 ^a (183)	15.53 \pm 0.286 ^a (134)
1994-1998	2.27 \pm 0.025 ^b (444)	7.65 \pm 0.134 ^b (405)	10.60 \pm 0.195 ^b (372)	14.16 \pm 0.235 ^b (302)	17.08 \pm 0.247 ^b (270)
1999-2003	2.28 \pm 0.021 ^b (504)	7.95 \pm 0.111 ^b (462)	12.08 \pm 0.155 ^c (422)	15.14 \pm 0.185 ^c (352)	17.80 \pm 0.214 ^c (279)
2004-2008	2.27 \pm 0.015 ^b (962)	9.19 \pm 0.077 ^c (906)	13.17 \pm 0.117 ^d (714)	16.42 \pm 0.143 ^d (589)	19.85 \pm 0.158 ^e (483)
2009-2012	2.59 \pm 0.019 ^d (576)	11.97 \pm 0.100 ^e (562)	15.66 \pm 0.207 ^e (290)	17.12 \pm 0.441 ^e (56)	23.51 \pm 0.864 ^f (122)
Season	**	**	**	**	*
1	2.25 \pm 0.011 ^a (2165)	8.06 \pm 0.059 ^a (1943)	12.00 \pm 0.090 ^a (1606)	14.54 \pm 0.117 ^a (1193)	18.13 \pm 0.256 ^a (986)
2	2.37 \pm 0.014 ^b (1484)	9.36 \pm 0.078 ^b (1387)	12.53 \pm 0.121 ^b (997)	15.05 \pm 0.163 ^b (723)	18.49 \pm 0.175 ^b (683)

*Significant ($P < 0.05$), ** Highly significant ($P < 0.01$). Means bearing same superscript don't differ significantly ($P > 0.05$). Figures in parentheses are number of observations.

Analysis of variance showed that the pre- and post-weaning average daily weight gains were highly significantly affected by period, season and sex. The least-squares means (\pm SE) of average daily weight gain during pre- and post-weaning stages and their corresponding growth efficiencies are presented in Table 2. The overall pre- and post-weaning average daily weight gains in this

study were higher than the estimates reported by Thiruvankadan *et al.* (2011). The highest pre- and post-weaning average daily weight gains were observed in period seven (2009-2012). The high variation in both pre-weaning and post-weaning weights due to year of birth can be explained by variations in amount of annual rainfall that in turn influenced pasture production and availability of

feed. The pre-weaning average daily gain (ADG) was significantly higher ($p < 0.01$) in season 1 whereas the post-weaning ADG was significantly high ($p < 0.05$) at season 2. The overall growth efficiency for pre and post weaning daily gains were 3.80 ± 0.019 and 1.44 ± 0.006 respectively. The effects of year and season significantly affect

the pre-weaning growth efficiency. However, the post weaning growth efficiency is not affected by sex and seasonal variations. A reduction of 2.36 kg (72.75 %) in growth efficiency during post-weaning development as against the pre-weaning stage indicates possible maternal influence.

Table 2

Least-squares means (\pm SE) of average daily weight gain and growth efficiency during pre- and post-weaning stages

Effect	Pre weaning ADG (g/day)	Post weaning ADG (g/day)	Pre-weaning growth efficiency	Post-weaning growth efficiency
Over all	70.86 \pm 0.509 (3330)	32.92 \pm 0.494 (1669)	3.80 \pm 0.019 (3330)	1.44 \pm 0.006 (1669)
Sex	**	**	**	
Male	74.15 \pm 0.705 ^b (1684)	36.89 \pm 0.905 ^b (566)	3.88 \pm 0.028 ^b (1684)	1.49 \pm 0.011 (566)
Female	67.56 \pm 0.733 ^a (1646)	28.95 \pm 0.398 ^a (1103)	3.73 \pm 0.026 ^a (1646)	1.41 \pm 0.007 (1103)
Period	**	**	**	**
1979-1983	79.36 \pm 1.252 ^d (352)	26.86 \pm 0.747 ^a (195)	3.91 \pm 0.058 ^c (352)	1.35 \pm 0.014 ^a (195)
1984-1988	53.04 \pm 1.945 ^a (363)	33.35 \pm 1.292 ^b (186)	3.17 \pm 0.044 ^a (363)	1.42 \pm 0.016 ^b (186)
1989-1993	60.45 \pm 1.524 ^b (280)	26.46 \pm 0.911 ^a (134)	3.38 \pm 0.049 ^b (280)	1.48 \pm 0.019 ^c (134)
1994-1998	59.42 \pm 1.394 ^b (405)	33.02 \pm 0.786 ^b (270)	3.33 \pm 0.043 ^b (405)	1.47 \pm 0.015 ^c (270)
1999-2003	62.75 \pm 1.160 ^b (462)	34.93 \pm 0.681 ^b (279)	3.40 \pm 0.044 ^b (462)	1.46 \pm 0.017 ^b (279)
2004-2008	76.84 \pm 0.797 ^c (906)	37.43 \pm 0.504 ^c (483)	4.00 \pm 0.039 ^d (906)	1.43 \pm 0.010 ^b (483)
2009-2012	104.14 \pm 1.038 ^e (562)	38.38 \pm 2.752 ^b (122)	4.70 \pm 0.040 ^e (562)	1.44 \pm 0.022 ^b (122)
Season	**	*	**	
1	64.19 \pm 0.619 ^a (1943)	33.52 \pm 0.816 (986)	3.50 \pm 0.022 ^a (1943)	1.42 \pm 0.007 (986)
2	77.53 \pm 0.807 ^b (1387)	32.32 \pm 0.557 (683)	4.22 \pm 0.031 ^b (1387)	1.46 \pm 0.010 (683)

*Significant ($P < 0.05$),

** Highly significant

($P < 0.01$). Means bearing same superscript don't differ significantly ($P > 0.05$). Figures in parentheses are number of observations.

CONCLUSIONS

The major non genetic factors affecting growth rate of Mecheri sheep are period, season of birth and sex. The effect of seasonal changes on birth could be minimized and the production efficiency could be improved by planning the lambing season rationally and, controlling the oestrus and mating time. The present results suggest that in order to improve breeding value, selection must be aimed to minimize the definable environmental effect using suitable adjustment factors before going for selection. Indirect maternal effect can be included as a source of variation for estimation of genetic parameters.

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