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Effect of Non-Genetic Factors on Growth Performance of Farm Bred Nellore Jodipi Sheep

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ABSTRACT

Recorded data on body weight (i.e. at birth, 3, 6, 9 and 12 month) of 5044 Nellore Jodipi sheep over a period of twenty three years (i.e., 1993-94 to 2015-16) were collected from the ICAR, Sheep Breeding Station, located in Palamaner, Chittoor district of Andhra Pradesh under Network Project on Sheep Improvement (NWPSI) were used to study the effect of non-genetic factors on growth traits. The average weights at birth, 3, 6, 9 and 12 months of age were 3.03 ± 0.01, 13.29 ± 0.07, 17.86 ± 0.10, 21.34 ± 0.12, 24.96 ± 0.15kg, respectively. Significant effects associated with the period of birth, parity of dam, season of birth and sex of lambs were observed on body weight at different stages of growth. An increasing trend in body weights was observed with increase in parity upto fifth parity and there after it decreased. The off season lambs achieved higher body weight for birth, 3^{rd,} and 12th month of age than main season lambs, where as body weights of 6th and 9th months lambs were higher in main season than the corresponding off season. Males were heavier than females at all stages of growth and the sex differences tended to increase with age.The significant effect of non-genetic effects on growth warrants inclusion of these factors in mixed models used for genetic evaluation and estimation of breeding values, failing which can lead to erroneous breeding values. The results of this study will be useful in suggesting suitable management plans like duration of mating, determination of marketing age etc.

Key words: Non-genetic factors, Growth traits, Genetic evaluation, Management plans, Sheep

INTRODUCTION

Sheep rearing is an important source of income generation in the livelihood of small and marginal farmers in India. Nellore breed is the tallest sheep breed in India and have three strains namely Jodipi, Palla, and Brown which are widely distributed in Andhra Pradesh.

It is a popular mutton breed in southern region of country. Selection objectives such as growth are influenced by non-genetic factors such as year, season, parity and sex etc. and ignoring these can lead to bias in selection. Moreover knowledge on the effect of non-genetic factors will help in suggesting suitable managemental interventions.

Birth weight, 3-month weight (weaning weight), 6-month weight and 12-month weight have direct effect on the productivity and health status of sheep, which inturn determines the income from rearing of sheep. The animals weighing heavier at birth and weaning have a better survivability and may grow faster and likely to increase the overall productivity. The present study was undertaken to evaluate the growth performance of Nellore Jodipi sheep and study non-genetic factors influencing them.

MATERIAL AND METHODS

The flocks were maintained under semi-intensive management system. Animals are housed based on sex and age groups and they were provided with 200 – 250 grams of concentrate feed daily. Heat detection of ewes was done with teaser ram in the morning and evening during the breeding season. The ewes in heat were mated in the morning with selected sires. Natural breeding and Artificial Insemination both are followed as breeding methods in the farm. Male to female ratio for breeding is around 1:20. The dam parity at each year was studied and the dams were maintained up to maximum of six lambings. Lambing in the flock was seasonal mainly observed in two seasons i.e., main season (Nov-Mar) and off season (Jun-Oct). At birth, each lamb was weighed and identified by metal ear tag. Lambs were allowed to suckle up to three months. Weaning of lambs was generally done at 90 days. Animals were vaccinated against PPR, enterotoxaemia, FMD etc.

Data

Recorded data on body weight (i.e. at birth, 3, 6, 9 and 12 month) of 5044 Nellore Jodipi

sheep over a period of Twenty three years (i.e., 1993-94 to 2015-16) were collected from the ICAR, Sheep Breeding Station, located in Palamaner, Chittoor district of Andhra Pradesh under Network Project on Sheep Improvement (NWPSI) . Data was classified for each trait according to period of birth, season of birth, parity of dam and sex of the lamb. The period of birth from 1993 to 2016 was divided into 6 periods, each comprising 4 years. Each year of lambing was also divided into 2 seasons, i.e. main season (Nov-Mar) and off season (Jun-Oct). Parity into six classes and sex into two (Male and Female).

Statistical analyses

The data classified, as said above, was analyzed to study the effect of period, season, sex and parity on the birth, 3rd , 6th, 9th and 12th month body weights of the animals by using general linear model (SPSS ver 25). The following fixed effects model was used for analysis.

$$Y_{ijklm} = \mu + P_i + S_j + X_k + T_l + e_{ijklm}$$
Where,

Y_{ijklm} = m^{th} record of the individual lambed in i^{th} period, j^{th} season, of kth sex and l^{th} parity.

μ = Overall population mean

P_i = Fixed effect of ith period of lambing (P_1 =1993-1996, P_2 =1993-1996, P_3=1993-1996, P_4 =1993-1996, P_5 =1993-1996, P_6 =1993-1996)

S_j = Fixed effect of jth season of lambing (j = main, off)

X_k = Fixed effect of kth sex (k = male, female)

T_l = Fixed effect of lth parity of dam (l = First, second, third, fourth, fifth, sixth)

e_{ijklm} = Error associated with each observation and assumed to be normally and independently distributed with mean zero and variance (0, $\sigma 2e$).

For significant effects, the differences between pairs of levels of effects were tested by Duncan's multiple range tests as modified by Kramer [4].

Table 1: Least-squares means ± standard error of body weight (Kg) of Nellore Jodipi sheep at different stages of growth

Effect	BW		3W		6W		9W		12W	
	n	Mean± S. E	n	Mean± S. E	n	Mean± S. E	n	Mean± S. E	n	Mean± S. E
Overall mean	5008	3.03±0.01	4529	13.29±0.07	4045	17.86 ± 0.10	3073	21.34± 0.12	2332	24.96± 0.15
Period Period		** **		** **		** **		** **		** **
P1 (1993-1996)	551	3.09c ±0.02	528	12.24 e±0.17	445	16.50 e± 0.22	346	19.05 e± 0.27	296	22.88 e± 0.30
P2 (1997-2000)	691	2.94d ±0.02	490	13.22 c±0.16	308	17.66 c± 0.25	214	21.26 c± 0.32	185	24.59 c± 0.34
P3 (2001-2004)	882	2.90e ±0.02	845	14.93 a±0.13	833	18.94 b± 0.16	485	20.94 d± 0.23	286	25.18 c± 0.29
P4 (2005-2008)	879	3.00c±0.02	804	12.52 d±0.13	740	16.91 de± 0.16	427	21.44 c± 0.22	238	24.53 d± 0.31
P5 (2009-2012)	983	3.15a±0.01	920	12.76 cd±0.12	845	17.38 d± 0.15	782	22.10 b± 0.17	765	25.51 b± 0.17
P6 (2013-2016)	1022	3.12b±0.02	942	14.07 b±0.12	874	19.75 a± 0.15	819	23.26 a± 0.17	562	27.05 a± 0.21
Season Season		** **		** **		** **		** **		* *
Main season	3345	2.99 ±0.01	3012	12.99±0.08	2668	18.18±0.11	1997	21.66± 0.13	1601	24.72± 0.15
Off season	1663	3.08 ±0.01	1517	13.59±0.10	1377	17.53± 0.14	1076	21.03± 0.17	731	25.19± 0.20
Sex Sex		** **		** **		** **		** **		** **
Male	2491	3.08 ±0.01	2249	13.71±0.09	1971	18.80±0.12	1257	22.78±0.16	841	27.17±0.20
Female	2517	2.99 ±0.01	2280	12.87±0.09	2074	16.91±0.12	1816	19.90±0.14	1491	22.74±0.15
Parity Parity		** **		** **		** **		* *		** **
First	1888	2.85c ±0.01	1715	12.74 b±0.08	1503	17.30 b±0.12	1090	21.01 d±0.15	809	24.49 d±0.17
Second	1268	3.00b±0.01	1127	13.44 a±0.10	1020	18.26 a±0.14	767	21.57 bc±0.17	580	25.03 bc±0.20
Third	841	3.08a±0.02	768	13.61 a±0.12	686	18.24 a±0.16	530	21.49 bc±0.20	411	25.31 ab±0.23
Fourth	552	3.09a±0.02	495	13.63 a±0.15	447	18.31 a±0.20	359	22.02 a±0.25	280	25.69 a±0.28
Fifth	295	3.10a±0.03	273	13.56 a±0.20	257	17.95 a±0.27	217	21.38 ab±0.31	168	25.18 ab±0.35
Sixth	164	3.07a±0.03	151	12.77 b±0.27	132	17.07 b±0.37	110	20.57 cd±0.43	84	24.04 cd±0.49

Subclass means with different superscript for an effect differed significantly (p < 0.05). BW = Birth weight, 3W = Three months weight, 6W =Six months weight, 12W =Twelve months weight, n = number of observations. ** = significant at p < 0.01, * = significant at p <0.05.

RESULTS AND DISCUSSION

The results for effect of non-genetic factors on growth were presented in Table1. Period, season, sex and parity had significant influence on all the growth traits studied. The least squares means for birth, 3rd, 6th, 9th, and 12th month body weights , were 3.03 ± 0.01, 13.29 ± 0.07, 17.86 ± 0.10, 21.34 ± 0.12, 24.96 ± 0.15 kg, respectively.The mean performance of Nellore Jodipi sheep observed in this study were in close agreement with that reported by Reddy et al.[9], for the same breed.

Effect of Period

The body weight traits did not show any trend with period of birth, but was highly significant (P<0.01) at all developmental stages in this study. The present findings corroborated with the results of Sivakumar et al.[10], in Madras Red ; Reddy et al.[9], in Nellore and Thiruvenkadan et al.[11], in Mecheri sheep, who also obtained the significant effect of period/year of birth on body weights . The body weight differences among lambs born in different periods in our study may be attributed to differences in management, selection of rams and environmental conditions etc.

Effect of Sex

Sex of the lambs had significant influence on body weights at all ages studied. The mean

body weights for males is significantly higher (P<0.01) than the corresponding values for females in all age groups and the sexual dimorphism widened with age. The least squares means of birth, 3rd, 6th, 9th, 12th month body weights were 3.08 ± 0.01, 13.71 ± 0.09, 18.80 ± 0.12, 22.78 ± 0.16 and 27.17 ± 0.20, kg respectively in males and 2.99 ± 0.01, 12.87 ± 0.09, 16.91 ± 0.12, 19.90 ± 0.14, and 22.74 ± 0.15, kg in females, respectively. Due to the anabolic effect of harmones, males have shown better performance than females[3]. In relation to endocrinal system, estrogen hormone has a limited effect on the growth of long bones in females. That could be one of the reason in which females have smaller body and lighter weight against males[8]. Apart from this, another factor attributed is that, since, more intense selection is practised in males for breeding than in females, this may led to widening of difference among them as age advances. These findings are in concurrence with the results of Reddy *et al.*[9], and Ekambaram *et al.*[1], in the same Nellore breed.

Effect of Season of Birth

The body weights showed significant difference (P<0.01) between the seasons. The least square means for off season (Jun-Oct) at birth, 3rd, and 12th months were significantly higher than the corresponding main season (Nov-Mar) values. The least square means of body weights of off season for birth, 3rd, and 12th months were 3.08 ± 0.01, 13.59 ± 0.10, and 25.19 ± 0.20, kg and in main season 2.99 ± 0.01, 12.99 ± 0.08 and 24.72 ± 0.15, kg respectively. The off season lambs achieved higher weight due to better fodder availability during the season as monsoon rains make the pasture lush. The least square means of body weights at 6th and 9th months lambs in off season were 17.53 ± 0.14 and 21.03 ± 0.17 and in main season, 18.18 ± 0.11 and 21.66 ± 0.13 Kg respectively. The least square means for 6th and 9th months lambs are higher in main season than the corresponding off season. This may be because the main season lambs reach the age of 6 to 9 months in rainy season during which time the growth is conducive. The significant effect of season of birth on body weights was also reported in different breeds of sheep[5,6,2]. These findings are similar to the findings of Ganesan *et al.*[2], in Madras Red sheep.

Effect of Parity

The parity of dam contributed significantly (P<0.01 to P<0.05) for all growth traits of lamb.An increasing trend in body weights was observed with increase in parity upto fifth parity and there after it decreased and this may be due to the fact that as the age of the dam increases, uterine space and other factors necessary for lamb growth improves and after fifth parity ewes tend to loose their teeth and old age causes poor nutrition to lambs in utero and suckling as well.

The low birth weight of lambs in younger ewes may be due to the existence of relative competition between the still growing ewes and the developing foetus for nutrients/food[6,11].

Similarly, Mandal *et al.*[7], in Muzaffarnagari, Kushwaha *et al.*[6], in Chokla, Thiruvenkadan *et al.*[11], in Mechari have found significant effect of parity of dam on different body weights of lamb.

CONCLUSION

The significant effect of non-genetic effects on growth warrants inclusion of these factors in mixed models used for genetic evaluation and estimation of breeding values, failing which can lead to erroneous breeding values. The results of this study will be useful in suggesting suitable management plans like duration of mating, determination of marketing age etc.

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