The Indian Journal of Veterinary Sciences & Biotechnology ***(2017) Volume 12, Issue 4, 78-82***
ISSN (Print) : 2394-0247 : ISSN (Print and online) : 2395-1176, abbreviated as IJVSBT
http://dx.doi.org/10.21887/ijvsbt.v12i4.7686

Submitted : 07-02-2017 ***Accepted : 23-03-2017*** ***Published : 05-05-2017***

Survivability in Nilagiri and Nilagiri Synthetic Sheep: Genetic and Non-Genetic Effects

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Abstract

Data on 9333 records of Sheep Breeding Research Station, Sandynallah, The Nilagiris (Tamil Nadu) available for 25 years (1989 to 2015) were analyzed for pre- and post-weaning survivability (0-3 months, 3-6 months, 6-9 months and 9-12 months of age). The effect of various genetic and non-genetic factors, viz., breed, contemporary group of birth, birth type, inbreeding, sex and birth weight on survivability were analyzed. The least squares means for survivability during 0-3, 3-6, 6-9 and 9-12 months were 92.8 ± 0.8, 95.3 ± 0.8, 98.6 ± 0.6 and 98.2 ± 0.7 % for Nilagiri sheep and 89.9 ± 1.0, 92.9 ± 1.0, 96.9 ± 0.7 and 97.0 ± 0.8 % for Nilagiri synthetic sheep, respectively. Breed and contemporary group of birth had significant (P<0.01) effects on pre-weaning survivability. Post-weaning survivability was significantly different in the two genetic groups. Contemporary groups and sex of lamb had a significant effect on all the survivability traits, except that for the period from 9-12 months. Birth weight of lambs had a significant influence on early survivability traits of pre-weaning and 3-6 months group.

Key Words: Nilagiri, Nilagiri Synthetic, Sheep, Lamb survivability.

Introduction

The Nilagiri sheep, native to the Nilgiri hills of Tamil Nadu, is adapted over centuries to the unique conditions of climate and topography prevailing in the hilly region. The Nilagiri Synthetic sheep was evolved at the Sheep Breeding Research Station, Sandynallah, The Nilagiris, by crossing Nilagiri with Merino and Rambouillet sheep in the year 1986 (Iyue, 1993). Both Nilagiri and Nilagiri Synthetic sheep are maintained for mutton and fine wool production. However, as the demand for wool in the state is less and selling price of wool does not even match the cost of shearing, the focus has changed to mutton production alone. The main source of income is through sale of male lambs. Survivability is one of the important fitness trait, improvement in which can improve economic returns to the farmer. The heritability for survivability is low and thus the trait is sensitive to various environmental deviations. The present study was undertaken to estimate the mean pre-and post-weaning survivability and to analyze the effect of various genetic and non-genetic factors on pre- and post-weaning survivability of Nilagiri and Nilagiri Synthetic sheep.

Materials and Methods

Data on 9333 (0-3 months), 6245 (3-6 months), 5174 (6-9 months) and 4676 (9-12 months) Nilagiri and Nilagiri Synthetic lambs born from 1989 to 2015 at the Sheep Breeding Research Station,

Sandynallah, The Nilagiris, Tamil Nadu were used for the study. This research station is situated at 11° 25' latitude N and 76° 46' longitude E and altitude ranging from 2090 to 2235 m above mean sea level. The average maximum and minimum temperatures are 19.9° and 9.6°C, respectively with an average annual rainfall of 1272.43 mm. Permanent sheep houses are available for housing the sheep. Rams and ewes are housed separately. New born lambs are housed with their mothers up to 30 days after lambing and thereafter housed separately in lamb pens. Suckling is allowed twice a day until weaning, which is done at three months of age. Concentrate mixture was given at the rate of 50 to 150 g/head/day based on their ages from 15 days to weaning. All the sheep are grazed during the day (6-7 hours).

The factors influencing pre-weaning and post-weaning survivability considered in the study were breed (Nilagiri and Nilagiri Synthetic), contemporary group of birth (53 groups of year and season of birth), inbreeding (0, 0-3.125, 3.126-6.25, 6.26-12.50 and >12.50%), sex, birth type (single and multiple births) and birth-weight (<1.5 kg, 1.5-2.5 kg, 2.5-3.5 kg and >3.5 kg). Survival was studied as a binomial trait with 1 as survived and 0 as died. The general linear model used was

$$Y_{ikmstwn} = \mu + A_i + C_k + F_m + S_s + T_t + W_w + e_{ikmstwn}$$

Where, $Y_{ikmstwn}$ is the survivability of the n^{th} animal of the i^{th} breed, k^{th} contemporary group of birth, m^{th} level of inbreeding, s^{th} sex of lamb, t^{th} birth type and w^{th} birth weight of lamb, μ is the overall mean and $e_{ikmstwn,}$ the corresponding random residual error for each $Y_{ikmstwn.}$ Pair-wise comparison was done using Duncan's Multiple Range Test.

Results and Discussion

The overall least squares means of pre-weaning, 3-6, 6-9, and 9-12 months post- weaning survivability were 92.8 ± 0.8, 95.3 ± 0.8, 98.6 ± 0.6 and 98.2 ± 0.7 % for Nilagiri and 89.9 ± 1.0, 92.9 ± 1.0, 96.9 ± 0.7 and 97.0 ± 0.8 % for Nilagiri Synthetic sheep, respectively (Table 1). The overall pre-weaning and post-weaning survivability was lower than that reported by Rajendran (2005) for Nilagiri and Nilagiri Synthetic sheep and that reported by Mohan *et al*. (1986) for the Nilagiri and Nilagiri x Merino breed. The values fall within the range reported for other breeds in southern parts of India, viz., Nellore and Mandya (Acharya, 1982), Mecheri and Dorset x Nellore x Mecheri sheep (Ulaganathan *et al.,* 1989), Nilagiri and Nilagiri Synthetic (Rajendran, 2005) and Mecheri sheep (Jeichitra, 2013). Lower values than the present findings were also reported among many Indian breeds like Chokla and Nali (Arora *et al.,* 1979), Coimbatore sheep (Misra and Singh, 1979), Nellore (Acharya, 1982) and Muzaffarnagari (Mandal *et al*., 2004), crossbred sheep like Corriedale x Magra (Sharma *et al*., 1991) and ½ Rambouillet x ¾ Australian Merino (Ganai and Pandey, 2000) and exotic breeds like Rambouillet sheep under Indian climatic condition (Ganai and Pandey, 1996) and Karakul sheep (Binabaj *et al*., 2013). Lower values observed in various breeds may be due to differences in breeds, climatic conditions and lamb management. The superior survivability of Nilagiri and Nilagiri Synthetic sheep are indicative of good adaptation of these genetic groups to the region.

The variation in survivability during pre-weaning and post-weaning phases due to the breed and contemporary group of birth was significant. Nilagiri sheep was better in survivability, compared to the Nilagiri Synthetic sheep. Nilagiri breed is indigenous and well adapted to the region, while Nilagiri Synthetic with varying levels of exotic inheritance show slight decrease in survivability. It is the indicator of adaptability of a genetic group under prevailing climatic and management conditions of a particular region (Sharma *et al.,* 2004). The introduction of exotic fine-wool inheritance up to 50% and interbreeding of halfbreds did not result in any decline in survival (Malik *et al.,* 1980). Mishra *et al.* (2006) found survivability of Garole x Malpura halfbreds almost at par with the local Malpura sheep.

Sex effect was significant in pre-weaning and post-weaning survivability up to 9 months of age. Female lambs had slightly higher survivability than male lambs. The difference could mainly be due

Table 1: Least-squares means (± SE) of survivability (%) in Nilagiri and Nilagiri Synthetic sheep

Details	Pre-weaning survivability (0 – 3 months)		Post-weaning survivability (3 – 6 months)		(6 – 9 months)		(9 – 12 months)	
	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE	N	Mean ± SE
Overall mean	9333	91.3 ± 0.8	6245	94.1 ± 0.8	5174	97.7 ± 0.6	4676	97.6 ± 0.7
Breed	**		**		**		*	
Nilagiri	4097	92.8 ± 0.8	2814	95.3 ± 0.8	2317	98.6 ± 0.6	2082	98.2 ± 0.7
Nilagiri Synthetic	5236	89.9 ± 1.0	3431	92.9 ± 1.0	2857	96.9 ± 0.7	2594	97.0 ± 0.8
CG of birth	**		*		**		**	
Birth type	NS		NS		NS		NS	
Single	7854	91.1 ± 0.8	5336	94.5 ± 0.9	4457	97.9 ± 0.6	4054	98.0 ± 0.7
Multiple	1479	91.5 ± 1.0	909	93.7 ± 1.0	717	97.6 ± 0.7	622	97.3 ± 0.8
Inbreeding (%)	NS		NS		NS		NS	
0	6335	91.8 ± 0.6	4294	95.7 ± 0.7	3562	98.7 ± 0.5	3247	97.4 ± 0.6
>0 - 3.125	1952	91.9 ± 0.9	1253	95.1 ± 0.9	1028	98.3 ± 0.6	906	97.7 ± 0.7
3.126 - 6.25	671	89.7 ± 1.1	426	94.0 ± 1.2	357	98.3 ± 0.8	320	98.6 ± 0.9
6.26 - 12.5	254	93.3 ± 1.6	184	93.3 ± 1.6	158	98.6 ± 1.1	143	97.9 ± 1.3
>12.5	121	90.0 ± 2.2	88	92.3 ± 2.2	69	94.8 ± 1.5	60	96.6 ± 1.8
Sex	**		**		*		NS	
Male	4636	90.6 ± 0.8	2785	92.7 ± 0.9	2155	97.3 ± 0.6	1838	97.5 ± 0.8
Female	4697	92.0 ± 0.8	3460	95.5 ± 0.9	3019	98.1 ± 0.6	2838	97.8 ± 0.7
Birth weight	**		**		NS		NS	
<1.5 kg	211	80.7^{c} ± 1.8	103	92.6^{c} ± 2.1	74	98.2 ± 1.5	64	95.8 ± 1.8
1.5 – 2.5 kg	2895	90.9^{b} ± 0.8	1696	92.6^{c} ± 0.8	1319	97.4 ± 0.6	1158	97.7 ± 0.7
2.5 – 3.5 kg	5099	95.7^{a} ± 0.8	3558	95.0^{b} ± 0.8	2999	97.5 ± 0.6	2735	98.1 ± 0.6
>3.5 kg	1128	98.1^{a} ± 1.0	888	96.2^{a} ± 1.0	782	97.8 ± 0.7	719	98.9 ± 0.8

** P<0.01; *P<0.05; NS – Non significant; Subclass means with different superscripts are significantly different from each other; CG= Contemporary group; N= Number of observations; SE = Standard error

to higher selection intensity in males and moreover, higher survival rate of the female lambs under uniform managemental conditions indicates that they have comparatively more resistance to diseases and adverse climatological conditions than the male lambs. The lower numbers of males are maintained along with adult rams, while female lambs selected in larger numbers are maintained as uniform groups.

Birth weight of lambs had a significant effect on pre-weaning (0-3 months) and post- weaning survivability (3-6 months). The significant differences in survival rate among different birth weight groups may be due to differences in suckling ability of lambs and survival instinct, being poor in lower birth weight (<1.5 kg) group. Lambs with lower birth weight compensate in terms of survivability at ages after 6 months. Similar observations were reported by Rajendran (2005) in the same genetic groups and Ganai and Pandey (2000) and Binabaj *et al.* (2013) in Rambouillet and Karakul lambs.

Birth type of lambs and inbreeding had a non-significant effect on pre-and post-weaning survivability in Nilagiri and Nilagiri Synthetic breeds of sheep. Normally, it is expected that singleton would have better survival than twins or triplets because of absence of competition for milk and of better care by mothers. But this natural phenomenon was not seen in present study which might be due to better lamb management practices followed at farm. Inbreeding result is in agreement with Mandal *et al*. (2004) in Muzaffarnagari sheep. Survivability of Nilagiri and Nilagiri Synthetic sheep was superior compared to most of the other studies in India.

Among the two genetic groups, Nilagiri showed better survivability. As a fitness trait, survivability was affected by most of the factors included in the study. These factors must be considered while estimation of genetic parameters for survivability in these two populations.

Acknowledgements

The authors are thankful to the Director, Centre for Animal Production Studies, TNUVAS for permission to utilize the data from Sheep Breeding Research Station, Sandynallah for this study. The contributions of the staff of Animal Breeding at the Station in the recording and maintenance of data is acknowledged.

Conflict of Interest: All authors declare no conflict of interest.

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