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INBREEDING EFFECTS ON POST-WEANING GROWTH TRAITS OF THALLI SHEEP IN PAKISTAN

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Data on 9080 records of Thalli sheep maintained at Livestock Experiment Station, Rakh Ghulaman Distt. Bhakkar during the period of 1975-2004 were utilized in the present study. Average values for 180, 270 days, yearling and post-weaning average daily gain were 22.37±4.21, 25.96±4.90, 28.93±5.20 and 0.028±0.02 kg, respectively. Effect of inbreeding on post weaning growth traits was studied by analysis of variance technique and by regression method. Level of inbreeding ranged from 10.15 to 37.50 percent with the mean value of 1.70 percent of population. Inbreeding significantly ($P<0.05$) affected weight at 270 days of age, yearling weight and post-weaning average daily gain. Weight at 270 days of age, yearling weight and post-weaning average daily gain decreased 0.013, 0.019 and 0.098 kg as 1 percent increase in the level of inbreeding. Inbreeding had non-significant effect on weight at 180 days of age. Regression value for trait was 0.093. The net effect of inbreeding in a selection programme will depend on the magnitude of the selection response relative to the depression due to the accumulated inbreeding. Depending on whether genetic gain and inbreeding depression compensate for each other or the level of inbreeding of the animals, may need to be accounted for in the selection process.
Key words: Sheep, Inbreeding, post-weaning, growth.

INTRODUCTION

Small Ruminants contribute to a greater extent to the economy of small farmers. Sheep form an effective complementary component of a livestock farming system. In spite of their importance to Pakistan's economy, sheep and goats have received little attention and poor support. Thalli is a famous breed of Thall area of the Punjab out of 28 different breeds of sheep found in Pakistan. The traits of economic importance in sheep include birth weight, weaning weight, yearling weight and greasy fleece weight. These traits are influenced by several genetic and environmental factors viz: sex of lamb, type of birth, climate and seasonal variation during different years. Flock's productivity is related directly to the average production of each ewe in the flock, which can be determined by its component traits: fertility (ewes lambing per ewe exposed), prolificacy (lambs born per ewe lambing), lamb survival (lambs surviving to weaning per lamb born) and lamb weaning weight (weight at 120 d) as reported by Long and Thomas, 1989. Accuracy of identifying genetically superior animals is the basic requirement for genetic improvement through selection. Inbreeding is a system of mating of closely related individuals. Inbreeding is known to affect metric traits. Reduction of additive genetic variance, as well as phenotypic values are its most significant deleterious effects. Yet the emergence of disorders due to recessive gene action constitutes another important aspect. Despite the fact that some effect of inbreeding can be positively used in selection schemes (Toro, 1993), breeders are aware of the deleterious effects and try to avoid them. This is particularly true when the selection of nucleus and the related population is of small size. The present study has been planned with the objective of evaluating the effect of inbreeding on post-weaning growth traits of Thalli sheep kept at Livestock Experiment Station (LES) Rakh Ghulaman district Bhakkar during the period 1975-2004. The information will be helpful in developing future breeding plans for the genetic improvement of Thalli sheep in the country.

MATERIALS AND METHODS

Source of data

Pedigree and performance records of Thalli sheep maintained at Livestock Experiment Station (LES), Rakh Ghulaman, district Bhakkar during 1975-2004 were utilized for the study. Following data were collected: Individual's identity, type of birth, date of birth, sire, dam, body weights at 180 days and 270 days of age, yearling weight and daily average gain.

The post-weaning performance traits examined in this study included as follows:

i) Weight at 180 days of age (W 180)
ii) Weight at 270 days of age (W 270)
iii) Yearling weight (W 365)
iv) Post-weaning average daily gain

Management and feeding practices

Overall animals were maintained in open enclosures throughout the year. However, roofed shelters were provided to protect these animals from severe weather. All animals were sent out for grazing from 8 am to 5 pm in the summer and spring season but in the winter season with little amendment in the grazing schedule from 9am to 4.30 pm. The feeding of the animals was mainly through grazing of the available seasonal fodder and forages. However, the animals were offered concentrate ration during scarcity period as well as during breeding season for flushing. The young lambs were kept indoors. They were allowed to suckle their dams freely from evening through morning till the ewes were taken out for grazing in the morning. All the lambs were weaned around 120 days and were shifted to separate pens for post-weaning rearing. The animals were vaccinated against Enterotoxaemia, Foot and Mouth disease, Sheep Pox, Pleuro-Pneumonia and Haemorrhagic Septicaemia.

The composition of feed varied according to the fodder crops available during the year. Green jowar (*Andropogon sorghum*), maize (*Zea mays*), and guara (*Cyamposis psoraliodes*) were fed during the months of May to Oct. During Nov. to Apr., green berseem, (*Trifolium alexandrium*), oats (*Avena sativa*), and mixture of rape (*Brasica napus*) were mainly given to these animals. Dry straws comprised of guara (*Cyamposis psoraliodes*), gram and wheat (*Triticum species*). The concentrate mixture was composed of crushed oats (*Avena sativa*), wheat bran and oil seed cakes (cotton-seed, rapeseed, etc.). Lumps of common salt (sodium chloride) were also provided in the mangers for free choice licking. Water was provided for 24 hours in the barns. The feeding practices remained uniform throughout the study period except for a few modifications, as and when needed.

Statistical analysis

Data on various performance traits were statistically analyzed to study the effect of inbreeding on these traits. Before data analyses several edits were performed to remove the outliers. In addition to the basic edits of consistency checks for dates and animal identities, records of ewes, which had aborted, missed a period due to sickness or other reasons were eliminated. The records out side three phenotypic standard deviation from the unadjusted means were eliminated. Less than two percent records were eliminated during these edits.

The ranges selected here were similar to those for other local breeds viz. Lohi (Babar, 1994), Hissardale (Akhtar *et al.*, 2001) and Kajli (Qureshi, 1996). Only normal and complete records were considered for analyses. The records from stillbirth or premature were excluded from the study. For data entry MS Excel spreadsheet were used.

Effect of inbreeding on various performance traits

Pedigree records of all animals with records from 1975 through 2004 were used to trace back to the base population. The later consisted of all animals before or at the establishment of the livestock farm. The resulting pedigree data consisted of both male and female sides of pedigree and date of birth of each animal. The birth dates were used to sort data by age, the oldest animal coming first. Animals were then numbered consecutively from 1 to N, unknown parents being identified as zero. The coefficient of inbreeding of each animal was calculated using DFREML set of programmes (Meyer, 1991). Annual trend in inbreeding was estimated by averaging inbreeding coefficient of animals within each year. The effect of inbreeding on various post-weaning growth traits was studied by using a fixed model with inbreeding and other effects viz. year and season of birth as independent variables. The two sets of analyses were carried out, one with ewe classified as inbred (F>0) or non-inbred (F=0), and the other with inbreeding coefficients as a covariate change in performance per unit (%) increase in inbreeding coefficient.

RESULTS AND DISCUSSION

Data on 9080 lambings of Thalli sheep kept at Livestock Experiment Station Rakh Ghulaman, District Bhakkar, spread over a period of 30 years (1975-2004) were used in the present study. Analyses were carried out to study the effect of inbreeding on post-weaning growth traits.

Performance traits

The 180 and 270 days weight weights in this flock averaged 22.37±4.21 and 25.96±4.90 kg, respectively. The average values for yearling weight was 28.93 ± 5.20 kg. The post-weaning average daily gain was 0.028 ± 0.02 kg (Table 1).

Table 1. Mean values for post-weaning growth traits in Thalli sheep

Trait	No. of records	Mean ±SE
180 day weight (kg)	9080	22.37±4.21
270 day weight (Kg)	9080	25.96±4.90
Yearling weight (kg)	7061	28.93±5.20
Post-weaning av. daily gain (kg)	6879	0.028±0.02

Effect of inbreeding on post-weaning growth traits

Analysis of pedigree records of 9080 animals having identification for the extent of inbreeding revealed that 295 (1.70 percent) animals were inbred with the minimum value for inbreeding coefficient as 10.15 percent and the highest level being 37.50 percent. Most frequent value for this category of animals was zero. One of the main reasons for low level of inbreeding in the flock was incompleteness of pedigrees especially for animals born in the earlier years of the period under study.

Effect of inbreeding on post-weaning traits was studied by analysis of variance technique and by regression method. The inbreeding coefficient independent variable while growth traits were the dependent variables. The pedigree analysis revealed that inbreeding has a significant effect (Table 2 & 3) on type of birth, weight at 270, yearling weight and post-weaning average daily gain ($P<0.05$). Weight at 270 days of age, yearling weight and post-weaning average daily gain decreased 0.013, 0.019 and 0.098 kg due to 1 percent increase in inbreeding (Table 4). Inbreeding has overall detrimental effect on 270 days weight, yearling weight and post-weaning average daily gain. Inbreeding had a non-significant effect on 180 days weight. The regression value for the said trait was 0.093.

The finding of the Vanli *et al.*, (1985) and Wyk *et al.*, (1993) are in line with the present study. Vanli *et al.*, (1985) analyzed data on a flock of Australian Merino lambs at Trangie Research Station in Australia by means of least-squares analysis of variance. Inbreeding of the lamb significantly affected average daily gain and 38 percent of the variation in average daily gain was due to the factors studied. Wyk *et al.*, (1993) analyzed 9551 pedigree records, collected during 1941-90 to study the inbreeding in the Elsenburg Dormer sheep stud and reported that the regressions of inbreeding of lamb on average daily gain was –0.0009 ($P<0.01$).

Mirza *et al.*, (1999) reported that the average yearling weight was 32.92±5.71 kg. The regression of yearling weight on inbreeding was 0.039±0.093 kg. The results indicated that for each percentage increase in inbreeding there was an increase of 0.039 kg in yearling weight, but this effect was not significant in Lohi sheep.

On contrary Akhtar *et al.*, (2000) reported that weights at 180, 270, and 365 days increased with increase in level of inbreeding but statistically this increase was non significant. For the post-weaning growth rates, decreased with increase in level of inbreeding but again decrease did not reach a significant level of 5 % in Hissardale sheep.

Table 2. Effect of inbreeding on type of birth, 180 and 270 days sweight

		Type of birth			180 days weight			270 days weight		
Source of variation	**df**	**MS**	**F**	**Prob.**	**MS**	**F**	**Prob.**	**MS**	**F**	**Prob.**
Inbreeding	1	1.00	6.34	0.01	2.38	0.12	0.72	115.44	4.63	0.03
Error	5027	0.15	-	-	19.06	-	-	24.89	-	-
Total	5029	-	-	-	-	-	-	-	-	-

Table 3. Effect of inbreeding on yearling weight and post-weaning av. daily gain

		Yearling weight			Post-weaning av. daily gain		
Source of variation	**df**	**MS**	**F**	**Prob.**	**MS**	**F**	**Prob.**
Inbreeding	1	130.32	4.51	0.03	0.001	4.24	0.03
Error	5027	28.88	-	-	0.0002	-	-
Total	5029	-	-	-	-	-	-

Negussie *et al.*, (2002) reported that a unit change in inbreeding percentage resulted in an insignificant reduction of 31 g in six-month weight in tropical fat-tailed Horro sheep. The difference in the present study and with the other study might be due to the level of inbreeding. It has been concluded that the application of sophisticated methods of selection, particularly BLUP-based techniques (Henderson, 1973) is to be reconsidered in the light of inbreeding effects. Comparisons of selection methods should, therefore, account for inbreeding depression (Toro and Perez-Enciso, 1990; Quinton *et al.*, 1992). Nevertheless the net effect of inbreeding in a selection programme will depend on the magnitude of the selection response relative to the depression due to the accumulated inbreeding. Depending on whether genetic gain and inbreeding depression compensate for each other, the level of inbreeding of the animals may need to be

accounted for in the selection process (Keller *et al.*, 1989; Klieve *et al.*, 1994; Brisbane and Gibson, 1995). On the other hand, the response to inbreeding is not the same for all animals. There is an important range of variation for the estimates of inbreeding depression reported in the literature (Lamberson and Thomas, 1984). Differences in such a response with respect to identifiable sources of variation should be examined.

Table 4. Effect of inbreeding on post-weaning growth traits

Trait	Inbreeding Effect β*
180 day weight (kg)	0.093
270 day weight (Kg)	-0.013
Yearling weight (kg)	-0.019
Post-weaning average daily gain (kg)	-0.098

*Change in the trait due to 1 percent change in Inbreeding

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