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EFFECT OF INBREEDING ON PRE-WEANING GROWTH TRAITS IN THALLI SHEEP

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ABSTRACT

Pedigree records of 17250 Thalli sheep with 17030 lambings maintained at the Livestock Experiment Station, Rakh Ghulaman, Distt. Bhakkar, Pakistan during the period from 1975 to 2004 were utilized in the present study. Average values for birth weight, weights at 60 and 90 days of age, weaning weight and pre-weaning average daily gain were 4.11 ± 0.82, 11.58 ± 3.57, 14.92 ± 4.56, 18.95 ± 4.56 and 0.12 ± 0.04 kg, respectively. Coefficients of inbreeding ranged from 10.15 to 37.50 percent for 295 animals, being 1.70 percent of the flock. Inbreeding significantly ($P<0.01$) affected birth and 60 days weight. Birth weight and 60 days weight decreased by 0.051 and 0.048 kg for each 1 percent increase in the level of inbreeding. However, inbreeding had non significant effect on weight at 90 days of age, weaning weight and pre-weaning average daily gain. The regression values for these traits were 0.010, 0.083 and 0.105, respectively. It was concluded that inbreeding showed deleterious effects only in early stages of life but as the lambs grew older the effect of inbreeding on pre-weaning traits diminished.

Key words: Thalli sheep, inbreeding, birth weight, growth traits.

INTRODUCTION

There are about 28 different breeds of sheep found in Pakistan. Among these, Thalli is a famous breed of Thall area of the Punjab. 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 non genetic factors viz: sex of lamb, type of birth, climate and seasonal variation during different years. Among these factors, seasonal and climatic variations from year to year affect the production of the whole flock, whereas sex, type of birth and age affect the performance of an individual. It is, therefore, imperative to estimate the extent of all such factors so that the genetic variation among animals can be used to design breeding plans for further improvement.

According to Long and Thomas (1989), productivity of flock 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 days of age). Accuracy of identifying genetically superior animals is the basic requirement for genetic improvement through selection but assessment of the true breeding value of an animal is not possible. Instead, estimated breeding values (EBVs) are calculated which are estimates of the true breeding value of an animal.

Inbreeding is a system of mating of closely related individuals. This system is known to affect metric traits. Reduction of additive genetic variance, as well as phenotypic values is its most significant deleterious effect. Moreover, 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. The present study was planned with the objective of evaluating the effect of inbreeding on pre-weaning growth traits of Thalli sheep kept at Livestock Experiment Station Rakh Ghulaman (LES) district Bhakkar, Pakistan during the period 1975 to 2004. The information so generated would be helpful in developing future breeding plans for the genetic improvement of Thalli sheep in the country.

MATERIALS AND METHODS

Source of data

Pedigree records of 17250 Thalli sheep with 17030 lambings maintained at the Livestock Experiment Station (LES), Rakh Ghulaman, district Bhakkar, Pakistan over a period of 30 years from 1975 to 2004 was utilized for the study. The data on individual's identity, sire, dam, body weights at birth, 60 and 90 days of age and weaning (120 days) were recorded. From this data birth weight, weight at 60 days of age, weight at 90 days of age, weaning weight and pre-weaning average daily gain were computed.

Mangemental practices

Thalli sheep have been kept on the LES Rakh Ghulaman, Distt. Bhakkar since 1975. Generally, the ewes were bred once a year in autumn (August and September) and lambs were born during subsequent spring (February and March). The ewes which were not

bred during autumn season were mated in the subsequent spring season to lamb during the autumn season. The animals were shorn twice a year i.e., in spring and autumn.

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, 1996) and Kajli (Qureshi, 1996). Only normal and complete records were considered for analyses. The records from stillbirths or premature births were alsoexcluded from the study.

Pedigree records of all animals with records from 1975-2004 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 performance 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 (percent) increase in inbreeding coefficient. For these analyses, LSMLMW computer programme (Harvey, 1990) was used.

RESULTS AND DISCUSSION

The birth and weaning weights in this flock averaged 4.11 ± 0.82 and 18.95 ± 4.12 kg, respectively. The average values for weight at 60 and 90 day of age were 11.58 ± 3.57 and 14.92 ± 4.56 kg, respectively. The pre-weaning average daily gain was 0.12 ± 0.04 kg.

Effect of inbreeding on various performance traits

Analysis of pedigree records of 17250 animals with 17030 lambings having identification for the extent of inbreeding revealed that 295 (1.70 percent) animals were inbred, the minimum value for inbreeding coefficient was 10.15 percent, and the highest level was 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 incomplete pedigrees especially for animals born in the earlier years of the period under study.

Birth weight and 60 days weight

The pedigree analysis revealed that inbreeding had a significant effect on birth weight and weight at 60 days ($P<0.01$). Birth weight and 60 days weight decreased by 0.051 and 0.048 kg due to 1 percent increase in inbreeding. Thus, inbreeding had overall detrimental effect on birth weight and 60 days weight.

Wyk *et al*. (1993) analyzed 9551 pedigree and 8963 birth weight records, collected during 1941-1990 in the Elsenburg Dormer sheep stud and reported that the regression of inbreeding of lamb on birth weight was -0.008 ($P<0.01$). Khan *et al*. (1995) reported that birth weight of Rambouillet lambs averaged 3.67 ± 0.03 kg and it decreased by 0.008 ± 0.154 kg for each 1 percent increase in inbreeding. Mirza *et al*. (1999) reported that regression of birth weight due to inbreeding indicated a decrease of 0.007 ± 0.002 kg in birth weight for each percentage increase in inbreeding level. MacKinnon *et al*. (2003) studied effects of inbreeding on lamb birth weight by using REML and found it to be –0.027 ± 0.023 kg as per percent increase in inbreeding in crossbred lambs.

Weight at 90 days, weaning weight and pre-weaning average daily gain

The pedigree analysis revealed that inbreeding had a non-significant effect on weight at 90 days, weaning weight and pre-weaning average daily gain. The regression values for the said traits were 0.010, 0.083 and 0.105, respectively.

The findings of Lamberson *et al*. (1982), Khan *et al*. (1995), Mirza *et al*. (1999) and Akhtar *et al*. (2000) are in agreement with the findings of the present study. Lamberson *et al*. (1982) reported that the effect of inbreeding on lamb weight at 90 days was not significantly different from zero. Khan *et al*. (1995) found that mean weaning weight of Rambouillet lambs adjusted at 120 days was 21.11 ± 0.15 kg and it decreased by 0.01 ± 0.612 kg for each 1 percent increase in inbreeding level. The reduction in weaning weight due to inbreeding was found to be non-significant. According to Mirza *et al*. (1999), the average weaning weight adjusted to 120 days of age was 23.078 ± 5.64 kg (range 12.00 to 40.00 kg). This decreased at the rate of 0.069 ± 0.072 kg per percentage unit increase in inbreeding. The regression of weaning weight on inbreeding was not significant in Lohi sheep. Akhtar *et al*. (2000) reported that weaning weight and weight at 90 days increased with increase in level of inbreeding but statistically this increase was non

significant. Pre-weaning growth rates decreased with increase in level of inbreeding but again decrease did not reach a significant level in Hissardale sheep. Negussie *et al*. (2002) reported that a unit change in inbreeding percentage resulted in a non significant reduction of 6 gm in weaning weight in tropical fat-tailed Horro sheep.

However, the findings of Vanli *et al*. (1985) and Wyk *et al*. (1993) are not in line with the findings of 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. It was observed that inbreeding of the lamb significantly affected weaning weight and average daily gain. About 74 and 38 percent of the variation in weaning weight and average daily gain, respectively, was due to the factors studied. Similarly, Wyk *et al*. (1993) analyzed 9551 pedigrees and 7782 weaning weight records, collected during 1941 to 1990 to study the inbreeding in the Elsenburg Dormer sheep stud and reported that the regressions of inbreeding on weaning weight and average daily gain were -0.099 and -0.0009, respectively ($P<0.01$). The difference in the results of the present study and the other studies might be due to variation in the level of inbreeding.

Inbreeding significantly reduced the birth weight and body weight at 60 day of age and had a non significant effect on weight at 90 days, weaning weight and pre-weaning average daily gain. Thus, it was concluded that inbreeding showed deleterious effects in early ages but as the lambs grew older, the effect diminished.

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