GENETIC POTENTIALS OF LOCAL BREED OF SHEEP HABITATING AROUND DERA GHAZI KHAN, PAKISTAN

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ABSTRACT

Genetic parameters of 280 Kacchi sheep kept in different flock sizes [<25 (small), >25 (medium) and >50 (large)] around district D. G. Khan, Punjab were evaluated during June 2004-May 2005. The mean body weight of adult ewe and ram was 35.19±0.85, 51.24±1.57 kg, respectively. The males were significantly (P<0.05) heavier than females. The adult body weight showed seasonal variations, maximum in May and minimum in January. The mean birth weight in male and female lamb was (3.80±0.31, 3.18±0.05kg), respectively. Three distinct phases of growth were seen in lambs. An initial phase of rapid growth (birth-4 months) in which body weight increased from, 3.80±0.02 to 16.2±0.26 kg @ 128 g/day, followed by moderate growth period (5-9 months) showing weight increase from 18.2±0.20 to 24.26±0.48 kg @ 65.39 g/day, and the third slow growth phase (9-12 months), 24.26±0.48 to 30.1±0.58 kg with mean growth rate of 35.55 g/day. Fertility rate in ewes was similar across the flocks and was 80.28%. Twice a year lambing was none and 13.60% lambing resulted in twin birth. Mean litter size was 1.5 per ewe. Lambing occured in two different season i.e. Novembre-February and May-June . In conclusion the local breed (Kacchi) has genetically better reproductive performance, birth weight and growth potentials. The lambs have better survival rate. These flocks have a good breeding potential and are well adopted to survive under the arid and irrigated condition of the area.

Key Words: Kacchi sheep, adult body weight, birth weight, growth rate, reproductive performance


INTRODUCTION

Sheep and goats contribute significantly to the subsistence, economic and social livelihoods of a large human population under low-input, smallholder production systems in developing countries. Increasing human population and urbanization, coupled with changing consumer preferences is creating more demand for these animals and their products (Kosgey and Okey, 2007). In Pakistan, there are 27.1 million heads of sheep estimated during 2007-08 and the mutton and milk production in the country at present is 578, 735 thousand tonnes respectively (Economic Survey 2007-08). There are 28 sheep breeds in the country, mostly kept by smallholders. Out of these, eight (Buchhi, Cholistani, Kajli, Latti, Lohi, Sipli, Thalli and Kacchi) are maintained in different tracts of Punjab (Hasnain, 1985). The Kacchi is thin tailed breed in southern Punjab. Coat colour is white with black head and legs. The wool is coarse.

These animals have lower feed and capital requirements than larger species, making them suited to smallholder producers (Devendra et al., 2002). They also have shorter generation intervals, small size and are better able to utilize a wide range of feedstuff, including crop residues which are of little value otherwise (Holst, 1999). These contributions of small ruminants ensure the well being of rural population and development of country, especially in the arid regions, where crop production is limited thus helping in saving the country from socio-economic problems (Hasnain, 1985).

The genetic potential of various breeds of sheep have been reported in various parts of world and Pakistan (Dag et al., 2003; Baber et al., 2004; Bahreini Behzadi et al., 2007; Mian and Khan, 1991) but there is little comparative information on this breed for reproductive traits. The objective of this study was to estimate the adult body weight, birth weight, growth rate and reproductive performance of local breed called Kacchi,
MATERIALS AND METHODS

Eight Kacchi sheep flocks with different flock size like < 25, > 25 and > 50 (n=280) during June 2004-May 2005 were selected from Dera Ghazi Khan, which lies between 29-34º to 31-20º north latitude and between 69-53º to 70-54º east longitude. Its total area is 11922 km² and is spread over more the 99.8 km in the north south and about 129.5 km in east west. It is divided into two parts; the mountainous area is in the west and the plain in the east. The climate of the district is exceedingly dry both in the hills and plains and in summer as well as in winter. The annual rain fall in the district is 125 mm. The selected flocks were under natural grazing with no supplement rationing/active feeding from cultivations. The new born lambs were maintained on mother’s milk exclusively for the first month of their lives, while from second month through 4-5 months of age, these were grazed separately from adults on natural vegetation, allowing them to suckle their mother in the morning, noon and in the evening till the weaning age. Each individual was assigned a number and was tagged. Sex, age and monthly observation on body weight, reproductive activity, mating, parturition and single/twin births were recorded regarding each individual. Common statistical techniques were used for the adult body weight and growth rate analysis. The growth rate (increase in weight per day) was calculated. The reproductive efficiency was judged through the proportion ewes lambed within the year. Standard descriptive statistics were used for the calculation of Mean ± SEM using the statistical package of Microsoft Excel. The results are expressed as Mean ± SEM and percentage. Student t-test was used for the comparison of ewes and rams mean body weight, birth weight and growth rate of lambs of different sex. P < 0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

Adult Body Weight

In the present study, the mean adult body weight of male and female recorded over the observation period was (51.24±1.57 and 35.19±0.85 kg), respectively (Fig. 1). There was significant (P<0.05) difference in adult body weight of male and female. Breeds have been reported to bear different body weights (Urk, 47 kg, 34; Randozai, 45 kg, 33 and Balali 44 kg; 32) (Mian and Khan, 1991). Mean weights of ewes and rams of Karakuli was 43, 34 kg, respectively (Mian and Khan, 1991). The actual body weight reported by Hasnain (1985) for Kacchi ewe and ram was 32 and 42 kg respectively, which were lower than found in the current study. This may suggest a general as result of the expected heterosis, may have happened under random breeding. The studies conducted at different times show different results on the same breed like the Afghan sheep flock maintained at Bahadurnagar Research Farm, Afghan males 85.00 kg, females 46.29 kg (Ahmad, 1985), while Ahmad and Ahmad (1987) reported the same Afghan males as 88.82 kg, females 48.74 kg. The adult body weight of the present flock appears greater than Salt range (40-20 kg, Hasnain, 1985) and lowers than Lohi (male 55 and female 32 kg Ahmad and Khan, 1985). Ahmad and Zafar (1983) have reported that ewes above two years of age are heavier. There is possibility that Hasnain considered < 2 years old as mature individuals whereas animal more than two years of age has been considered for the present study.

![Body weight (kg) vs Flock size](image1.png)

Fig. 1. Adult body weight (kg) of male and female sheep belonging to different flock size
The Kacchi breed has higher adult body weight than reported records regarding the other breeds, Kajli in Pakistan 37.4 kg (Qureshi, 1996), Sabi in Zimbabwe 23.5 kg (Matika et al. 2003) and Kermani in Iran 28 kg (Bahreini Behzadi et al., 2007). On the other hand the present study flocks are lighter in adult body weight than Dohne Merino 55.8 kg in South Africa studied by Cloete et al. (2003). The variations in the adult body weight may be due to sheep farming practiced which covers all features of environment, climatic conditions and seasonal variations that vary from year to year (Dag et al. 2003).

Fig. 2 presents the average adult body weights of different flock size during different calendar months. All the flocks and both the sexes present a uniform pattern of cyclic variation. Such a pattern can be associated with the vegetation supply in the area. Similar findings have already been reported by Bhattacharya and Herb (1973); Mian and Khan (1991) for the nomadic flocks in Lebanon and sedentary stocks in Balochistan, respectively.

**Birth Weight**

The sex of the newborn lamb also proves as significant factor in birth weight (Fig. 3), the male (3.80±0.06 kg) lamb was significantly (P<0.05) heavier than female (3.18±0.05 kg). There was no significant difference in single/twin birth weight of lambs. The mean values for birth weight of present study are higher than those studies of other breeds, 3.09±0.03 kg for Harnai and 3.18 ± 0.02 kg for Bibrik (Haider and Shah, 1974); 2.68±0.75 kg, 3.36±0.03 kg for Muzaffarnagri and Merino lamb in India (Joshi and Datta, 1985), 2.6 kg for Sibi in Zimbabwe (Matika et al., 2003) and 3.32 kg for Kermani lamb in Iran (Bahreini Behzadi et al., 2007). While the mean values of present study are lower than previous investigations 4.2 kg Akkaraman lambs in Turkey (Dag et al., 2003); 4.9± 0.83 kg for Targhee lambs in USA (Hanford et al., 2003) and 3.80±0.04 kg for Ripollesa (Cesellas et al., 2007). This variation in different studies might be due to the different breeds’ genetic makeup and environmental variations. Bahreini Behzadi et al. (2007) reported that lambs born to parity four or five ewes were heavier than lambs of younger ewes. They reported the body weight at birth of lamb from 2 years old ewes significantly lower than those of lambs from ewes of older age group.

Type of birth had a significant effect on birth weight. Male lambs were heavier than females and the difference between two sexes increased with the age of lambs. The present results of birth type are in agreement with previous studies of several investigators on other breeds (Baber et al., 2004). Akhtar et al. (2001) also reported that the birth weight of Hissardale male lambs was 3.9±0.02kg and female lambs were 3.5 ± 0.02kg. This may be because of increasing differences in endocrine hormones and their secretions in males and females (Bahreini Behzadi et al., 2007). Matika et al. (2003) and Baber et al. (2004) reported that year of birth, sex, type of birth, rearing status of dams, and dam’s age were significant source of variation on birth weight. The lambs born as single were heavier than twins and triplets.
Growth Rate

The results of the present study suggest that lamb weight (Fig. 4) continuously increased till the age of 12 months. During first four months of age the growth rate of different flock size were 7.87 to 16.37 kg in < 25, 7.9 to 15.72 kg in > 25 and 7.2 to 16.84 kg in >50 flock size. The mean values of the growth rate of lambs belonging to different flock size did not show a (P > 0.05) significant difference. The general growth exhibits a triphasic pattern. The mean growth rate gradually increases during the first four months of age from 7.63 to 16.2 kg, followed by a subsequent gradual reduced till 5-9th month of age from 16.2 to 24.26 kg, and very low rates are met in 9-12th month of age from 24.26 to 30.1 kg. Mian and Khan (1991) reported the same pattern of growth rate of lambs where an initial period 4 months of age, increase in weight from 6 to 18 kg, followed by month 5 to 9, 18 to 27 kg and the final 10 months to onward 27 to 34 kg. Similarly Qureshi (1996) reported the weaning weight at the age of 120 days and yearling 20.7 kg, 37.4 for Kajli; 20.1 kg, 30.7 for Hissardle (Akhtar et al., 2001); 34.6 kg, 45.2 for Turghee in USA (Hanford et al., 2003); 17.2 kg, 33.5 Sabi in Zimbabwe (Matika et al., 2003); 21.31 kg, 32.92 Lohi breed (Shah and Khan, 2004), 21.98 kg, 34.86 Kermani sheep in Iran (Bahreini Behzadi et al., 2007). It shows that the growth rate was lower in present study breed. These variations can also be attributable to the rearing conditions available under different regimes, including the availability of pasture, additional rationing provided and the expertise of the breeders to provide suitable conditions. The effects of better pasture conditions on the general weight of the individuals has proved by the present study suggesting that under favourable pasture conditions, the individuals gain weight, while it was lost under unfavourable conditions. It was also reported that the weight of sheep increased till the age of two years, so that the mature females are heavier than the females of less than two years in age (Ahmad and Zafar, 1983).

The analysis of the growth rate at different ages, as exhibited by two sexes, suggests that though the males and females lambs are not significantly different in weight at comparative ages as judged by methods of maximum approximation/likelihood; yet the males were heavier than the females at all ages. The female lamb weight of the present study runs below the male at different age groups. The type of sex effects on growth rate is in agreement with Shah and Khan (2004) and Bahreini Behzadi et al. (2007) alongwith number of studies on different breeds of sheep in different areas, suggesting that males are heavier than females at birth, weaning as well as at adult stage.
Fig. 4. Growth pattern in male and female lambs belonging to Kacchi sheep

**Turnover Rate**

The turnover rate (Fig. 5) as judged by the weight gained per day per animal at different ages in different flock size. The turnover rate of different flock size were 132, 127, 126 g/day in male lambs and 127, 122, 120 g/day in female lambs of < 25, > 25 and >50 flock size during first four months of age respectively. The mean values of the turnover rate of lambs belonging to different flock size were not significantly (P>0.05) different. The general growth rate of present stock appeared to increase @ 128, 123 g/day in male and female during the first four months of age respectively. The growth rate then decreased @ 65.39, 53.24 g/day in male and female during month 5 to 9 followed by very slow growth @ 55.55, 40.1 g/day in male and female in higher age groups of 9-12th months. The male exhibited more growth rate than female. Such a variation in the growth rate at different ages can be explained on the general feeding patterns. The lambs being maintained on mother’s milk alone for the first month exhibit a restricted growth. An accelerated growth between month 1 and 4 can be attributed to the mixed feeding (mother’s milk and natural grazing). After the 4th month, the lambs are generally weaned and are exclusively maintained on natural grazing, when the growth rate drops down. Present results suggest maximum growth rate falling around 128 to 55.55 g/day/animal. Pre-weaning growth rate of different breeds has been recorded 150g/day (Mian and Khan, 1991), 135g/d Issardle (Akhtar *et al.*, 2001), 143 g/d Kajli (Qureshi, 1996) 127.8 g/d Muzaffarnagri in India (Mandal *et al.*, 2003), 250 g/day Targhee in USA (Snowder and Vleek, 2003), 126±0.02 g/day Lohi (Shah and Khan, 2004). The low growth rates exhibited by present study flocks can be attributed to genetic differences, yet the fact that the stocks under references are being maintained on additional rationing and better grazing condition may suggest the importance of poor grazing conditions. Devendran *et al.* (2009) reported low growth rate in Madras Red sheep in India as 1 - 3 and 9-12 months of age were 73.74 and 23.81 g/d respectively. This contradiction may be due to genetic factors. A very significant effect of different rationing patterns has been suggested by Saleem and Shah (1983).
Breeding Performance

The different parameters relating to reproductive efficiency of sheep belonging to different flock size are presented in Table I. The female fertility rate of present flocks was 80%. There was no significant difference in sheep fertility rate of different flock size. Twin birth was 13.60%, and no triplet litter was observed. The postnatal mortality was 11.99%; Different studies available on stocks/breeds maintained in Pakistan suggest a wide variation in the fertility in sheep. Sheep in flocks under study stands high as compared to others reported by (Karakuli, 75%; Balali 69%; and Randozai 64%) (Mian and Khan, 1991); Horo, 70.1% and Menz, 79.5% (Berhan and Van Arendonk, 2006). The reported flocks show higher reproductive rate (96.1% in Lohi); (97.1% in Afghan) and 90% in general Lebanon nomadic flock the studies conducted by Bhattacharya and Harb (1978), Ahmad (1985) and Ahmad and Ahmad (1987). This difference could be attributed to genetic and environmental variations. This fact does not necessarily indicate a low reproductive efficiency of present stock and such a difference can be safely attributed to the available nutrition conditions for the different stocks under discussion. Present stock depended on natural grazing, without organized breeding regime and low nutrition plain, as compared with the stocks run under expert management with care at feeding and general management.

Table I  Mean ± SEM breeding performance of female sheep belonging to different flock size

<table>
<thead>
<tr>
<th>Parameters</th>
<th>&lt;25 flock</th>
<th>&gt;25 flock</th>
<th>&gt;50 flock</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility (%)</td>
<td>81.14±0.52</td>
<td>80.08±0.78</td>
<td>79.23±0.77</td>
<td>80.26±0.92</td>
</tr>
<tr>
<td>Lambing pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once/year</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Twice/year</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Litter size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single birth (%)</td>
<td>85.66±2.52</td>
<td>85.98±0.70</td>
<td>88.13±4.03</td>
<td>86.40±1.2</td>
</tr>
<tr>
<td>Twins birth (%)</td>
<td>14.34±2.52</td>
<td>14.01±0.70</td>
<td>11.87±4.03</td>
<td>13.60±1.2</td>
</tr>
<tr>
<td>Triplet birth (%)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>No. of lambs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lambs born /year /ewe</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Post natal mortality (%)</td>
<td>8.59±1.17</td>
<td>12.75±0.60</td>
<td>15.96±2.21</td>
<td>11.99±1.25</td>
</tr>
</tbody>
</table>

In the present study, all the ewes exhibited once a year lambing pattern and none lambed twice. Present findings are in agreement with Ahmad and Zafar (1983), Ahmad, (1985), Bhattacharya and Harb, (1973), Mian and Khan, (1991) for Lohi, Afghan, Lebanon nomadic flock and Randozai, respectively. The frequency of twin birth was 13.60%, and the rate of triplet birth during the study period was none. The present study flock exhibits low twin birth on comparing with the breeds like Randozai (14%), Urk (15%) and Balali (31%), while the frequency of twin birth is higher than Karakuli 0% (Mian and Khan, 1991). This may be due to the genetic variations. Similarly the reported twin birth in Lohi: 28%, Hasnain, 1985,
9.3%, 1.6% Triple births, Ahmad and Khan, 1985; Afghan: 8.53, Ahmad, 1985) collected on the stocks maintained under organised farming conditions at Bahadurnagar Farm, suggests the importance of present stocks, which were being maintained under stressful natural grazing. The number of lambs born per ewe per year appeared to be a comprehensive parameter regarding the overall reproductive efficiency of the stock. The computed value regarding present stock suggested that the average number of the lamb produced /ewe/ year was 1.5 lambs. Similar manipulation of the data reported different figures in literature, (Balali: 1.31, Urk 1.04 and Karakuli: 0.83, Mian and Khan, 1991, Lohi: 1.89, Saleem and Shah, 1983, Afghan: 1.07, Ahmad and Ahmed, 1987 and 1.7, Casellas et al., 2007) maintained under controlled farming conditions. This may suggest that the local stocks maintained good breeding potential.

Wide variations in the number of the lambs produced per ewe per year might be due to environmental factors, apart from the genetic ones, which collectively contribute in the overall potentials of a breeding stock to produce the number of lambs. Under better breeding conditions supported by supplemented rationing, it has been shown that the litter size will increase from 1.06 lambs produced per ewe per year to 1.89 in Lohi sheep (Saleem and Shah, 1983). Different stocks appeared to have different potentials of breeding during summer and winter. In the present study stock 50% partition occurred in May-June and other 50% lambing during November-February. Current study stock appears to have two reproductive seasons, and a good proportion of the flock lambing during summers and also in winters. The reproductive activity occurs in November and December, some extending up to early January. This information confirms the concrete finding that sheep are short day animals. This pattern also appears to fit in the general vegetative cycle being followed in the area, so that newborn are produced during the periods, when the vegetation are sufficiently available. Few studies were in hand suggesting monthly variation in the reproductive activity in sheep to support our present findings as reported by Bhattacharya and Harb (1973). The available data suggested that the flocks maintained in the study area remain reproductively active between the age of 2 and 7 years. Limited fertility has been exhibited in the ewes of more than 7 years of age, and those of less than 2 years of age; however, ewes of different ages exhibit variable fertility as studied by Ahmed and Zafar (1983); Ahmad and Khan (1985) and Mian and Khan (1991).

Survival of the Lambs

The present study suggests that 88.1 % of the lamb enters weaning stage. The survival rate in lambs at pre-weaning stage appears to be lower than the stocks maintained in Balochistan 93.75 % (Mian and Khan 1991) 94.38 % Ripollesa ewes in Spain (Casellas, 2007). The survival rate is to be higher than that suggested for Lohi breed 56.54 % (Ahmed and khan, 1985), Afghan breed 81.01 % (Ahmed and Ahmed) and in Lebanon nomadic stock 91 % (Bhattacharya and Harb, 1973). This may suggest good genetic potentials of present stocks to survive under the available condition.

CONCLUSION

The Kacchi breed has better reproductive performance, birth weight and growth potentials. The lambs have low mortality rate. Moreover these flocks have a good breeding potential and are well-adapted to survive under arid and semi-arid conditions of the region.

REFERENCES


