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RESEARCH ARTICLE

Reproductive Performance of Balochi Sheep in Different Ecological Zones of Balochistan, Pakistan

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ABSTRACT

The data on reproductive performance of Balochi sheep (n=150) kept at three Government sheep farms in Balochistan, Quetta (KSBFM) (n=50), Loralai (SRCY) (n=50) and Usta Mohammad (UMSF) (n=50), under semi-intensive management system, were analyzed. General linear model was used for analyzing the data. The fixed effects in the model included location of flock, age, type of birth, sex of lamb and their interactions. The overall findings of reproductive traits such as fertility, prolificacy, single lambing, twinning rate, lambs born alive and sex ratio (male: female) were 92.67, 101.33, 89.86, 10.14, 96.33% and 50.33:49.67, respectively. The highest value for twinning rate was recorded in UMSF (13.04%) and the lowest in KSBFM (6.52%). All traits were significantly different ($P<0.05$) from each other except lambs born alive and season of birth were non significant ($P>0.05$) between flocks. The overall results revealed that age of dam, age at first service (AFS), service period (SP), age at first lambing (AFL) and lambing interval (LI) were 1078±2.2, 579.61±0.6, 206.25±0.2, 731.67±0.3 and 256.60±0.3 days, respectively. The results of ANOVA showed that locations had significant effect ($P<0.05$) on AFS and SP; however lambing interval and age at first lambing were not affected**.** Age of ewe, type of birth, sex of lamb(s) born and interaction between these factors did not influence the traits significantly. It was concluded that reproductive performance of Balochi sheep was modest so it is vital to improve management, nutritional and breeding practices at the farm.

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INTRODUCTION

Livestock sector is among the important sectors, which can make an impact at the grassroots level in alleviating poverty in Balochistan. Small ruminants like sheep and goat are kept in every household. People are born herders and depend on flocks for their livelihood (Raziq *et al*., 2010; Nosheen *et al*., 2010; Tariq *et al*., 2011). However, lack of education and extreme poverty, generally in the whole area, specifically in shepherds and flock owners has dampen down the prospects for sheep rearing to emerge as a strong industry in the province. A scientific approach needs to be adopted for promoting sheep rearing in the province. Indigenous sheep and goats have a high adaptability to extreme climatic conditions. Role of sheep in the improvement of rural economy is well established in Pakistan (Sharif *et al*., 2011). The Balochi sheep is a fat-tail breed, well adapted to a wide range of harsh environmental conditions in the Eastern Iran and Balochistan. The population of this breed is 3.73 millions, higher than other indigenous breeds (Beverigh, 1.65, Harnai, 0.55 and Rakhshani, 0.04 million) in the province (Anonymous, 2006). Balochi sheep is found mostly in Kalat and part of Quetta division, and is thinly populated in most of the area of Balochistan province. Balochi sheep, with white body and black, brown, or spotted muzzle and legs, are medium in size, and their adult male and female weights are 37 and 32 kg, respectively. The male has a slightly Roman nose and horns. The fleece is white with pigmented head and legs. The wool is coarse with modulation and mostly used in carpet industry.

Eyduran *et al.* (2009) reported that for sheep breeding, animal products such as meat and milk are very important for people's nourishment all over the world. The productive and reproductive performance of sheep depends on many factors, especially genetic potential of a particular breed, availability of nutrition and environmental factors (Gbangboche *et al.*, 2006; Bano *et al.*, 2011). To increase the livestock production potential more emphasis is required on the selection of improved animal breeds with better performance (Matika *et al.*, 2003; Isani *et al*., 2012). By attaining this objective we can meet the country's ever growing demand, as well as supply to other countries (Middle East) through qualitative and quantitative increase in number of animals and related by-products (Tariq *et al.*, 2011).

In sheep breeding, reproductive performance is the key factor in connection with profitability (Bilgin *et al*., 2004). Reproductive performance of the Balochi breed was not studied previously. Therefore, the current study was designed to determine the reproductive performance of Balochi sheep thriving in different ecological zones in the province.

MATERIALS AND METHODS

The reproductive performance of Balochi sheep (n=150) was studied from 2008 to 2010 at three different locations in Balochistan (Government Karakul Sheep Breeding Farm, Maslakh, (KSBFM) Quetta (n=50), Usta Muhammad Sheep Farm (UMSF) Usta Mohammad (n=50) and Sheep Research Centre Yetabad (SRCY) Loralai (n=50)). Performance traits like fertility, prolificacy, lambs born alive, single lambing, twinning rate, sex ratio, age at first service (AFS), service period (SP), age at first lambing (AFL) and lambing interval (LI) were recorded. Fixed effect model was used to analyze the data. The fixed effects of flock, age, type of lambing (single or twin), sex of lamb born was included in the model. The following model were used for analysis:

$Y_{ijklm} = \mu + Flock_i + Age_j + Sex_k + ToB_l + e_{ijklm}$

Where;

Y_{ijklm} = ith observation of traits

μ = Population mean

$Flock_i$ = ith flock

age_j = Age of ewe

Sex_k = Sex of lamb(s) born (1=male, 2=female)

ToB_l = Type of birth (single or twin)

e_{ijklm} = Random error associated with each observation

Analysis of variance was performed to test the significance and then means were separated using Duncan's Multiple Range (DMR) test. Qualitative data were analyzed using Chi square test.

RESULTS

The overall average values of fertility, prolificacy, single lambing, twinning rate, lambs born alive and sex ratio (male:female) were 92.67, 101.33, 89.86, 10.14, 96.33% and 50.33:49.67, respectively. Twinning rate was the highest at UMSF flock (13.04%) and the lowest in SRCY flock (6.52%). Flock significantly affected ($P<0.05$) all traits except number of lambs born alive. Season of birth had non significant ($P>0.05$) effect on these traits (Table 1).

The overall means for age of dam, age at first service (AFS), service period (SP), age at first lambing (AFL) and lambing interval (LI) were 1078±2.2, 579.61±0.6, 206.25 ±0.2, 731.67±0.3 and 256.60±0.3 days, respectively (Table 2), Flock differences for AD, AFS, SP and AFL were significant ($P<0.05$), however, LI was not significantly affected by it ($P>0.05$). Locations of flocks affected AFS and SP significantly ($P<0.05$); however lambing interval and age at first lambing were not affected ($P>0.05$)**.** The age of ewe, type of birth, sex of lamb(s) born and interaction between these factors did not influence any of the traits significantly ($P>0.05$) (Table 3).

DISCUSSION

Study of reproductive performance is an important part of characterization (Ndor *et al*., 2010). These traits possess more environmental and less genetic control. Therefore, the importance of non-genetic factors affecting reproductive performance needs exploration.

Sex ratio: The sex ratio in Balochi sheep as found in the present study resembled with the findings in Soay sheep as reported by Lindstrom *et al*. (2002) and Clutton-Brock *et al*. (1997) (48.26:51.68 and 50.87:49.13, respectively).

Table 1: Reproductive performance of Balochi sheep (%)

Location	F[1]	P[2]	LBA[3]	SoB[4]		ToB[5]		SR[6]	
				S[7]	A[8]	Single	Twin	Male	Female
UMSF[9]	92	104	97	87	13	86.96	13.04	49	51
KSBFM[10]	94	102	96	86	14	89.13	10.87	46	54
SRCY[11]	92	98	96	87	13	93.48	6.52	56	44
Mean	92.67	101.33	96.33	86.66	13.33	89.86	10.14	50.33	49.67

F[1]=fertility, P[2]=prolificacy, LBA[3]= lambs born alive, SoB[4]= season of birth, ToB[5]=type of birth, SR[6]=Sex ratio, S[7]= spring lambing, A[8]= autumn lambing, UMSF [9]=Usta Muhammad Sheep Farm, KSBFM[10]= Government Karakul Sheep Breeding Farm, Maslakh, SRCY[11]= Sheep Research Centre Yetabad, Loralai.

Table 2: Reproductive performance (Mean±SE) of Balochi sheep kept at three locations in Balochistan (days)

Location	N	AD[1]	AFS[2]	WAFS	SP[3]	AFL[4]	WAFL	LI[5]
UMSF[6]	50	1024±2.3[b]	576±1.1[a]	25.5±0.77[a]	206.48±0.4[b]	733± 0.5[b]	30.0±0.45	254.32±0.5[a]
KSBFM[7]	50	1118±2.4[c]	582±0.9[b]	24.6±0.80[a]	207.10± 0.3[b]	730±0.2[a]	28.9±0.62	259.80±0.6[a]
SRCY[8]	50	1089±1.9[a]	580±0.8[b]	26.2±0.52[b]	205.16±0.3[a]	732± 0.3[b]	31.2±0.36	257.82 ±0.6[a]
Mean	150	1078±2.2	579.61±0.6	25.4±0.67	206.25±0.2	731.67±0.3	30.0±0.51	256 .60±0.3

AD[1]=Age of dam, AFS[2]= Age at first service, SP[3]=Service period, AFL[4]=Age at first lambing, LI[5]=lambing, WAFS=Weight at first service, WAFL= weight at first lambing, UMSF[6]= Usta Muhammad Sheep Farm, KSBFM[7]= Government Karakul Sheep Breeding Farm, Maslakh Quetta, SRCY [8]= Sheep Research Centre Yet Abad. Means values with different superscripts within column differ significantly ($P<0.05$).

Table 3: Analysis of variance for age at first service, service period and lambing interval

SOV	Sum of Squares	df	Mean Squares	F	Sig.
Age at first service (R^2 = 44.9)					
Location	542.916	2	271.458	6.558	0.002
AGE	1200.642	20	60.032	1.450	0.118
TOB	23.769	1	23.769	0.574	0.450
SEX	190.704	4	47.676	1.152	0.337
AGE * SEX	805.772	15	53.718	1.298	0.218
AGE * TOB	14.136	1	14.136	0.342	0.560
Error	4097.831	99	41.392		
Service period (R^2= 37.6)					
Location	51.361	2	25.681	3.820	0.025
AGE	167.462	20	8.373	1.245	0.235
TOB	0.0588	1	0.059	0.009	0.926
SEX	12.193	4	3.048	0.453	0.770
AGE * SEX	74.798	15	4.987	0.742	0.737
AGE * TOB	0.763	1	0.763	0.113	0.737
Error	665.563	99	6.723		
Lambing interval (R^2 = 28.0)					
Location	30.417	2	15.208	0.877	0.419
AGE	296.552	20	14.828	0.855	0.642
TOB	56.157	1	56.157	3.239	0.075
SEX	34.531	4	8.633	0.498	0.737
AGE * SEX	143.447	15	9.563	0.552	0.904
AGE * TOB	13.412	1	13.412	0.774	0.381
Error	1716.289	99	17.336		
Age at first lambing (R^2 = 45.0)					
Location	71.103	2	35.552	2.869	0.061
AGE	490.390	20	24.519	1.979	0.015
TOB	21.856	1	21.856	1.764	0.187
SEX	21.611	4	5.403	0.436	0.782
AGE * SEX	173.448	15	11.563	0.933	0.531
AGE * TOB	18.061	1	18.061	1.457	0.230
Error	1226.862	99	12.393		

Kent (1992) reported a sex ratio of 49.56% and more males were born with ewes bearing singles, which matched with present study. Kent (1995) also reported a sex ratio of 49.96. Sharif *et al.* (2011) showed that sex ratios in Balochi and Bibrik sheep breeds were 44:56 and 42:58, respectively. Tariq *et al.* (2011) reported sex ratio in Mengali sheep as 49.43:50.57. These differences in sex ratios might be due to genetic differences among breeds.

Twinning percentage: Lower twinning rates as compared to present study were reported by a number of workers in other breeds. Sharif *et al.* (2011) reported twinning rate in Balochi and Bibrik flocks as 1.0 and 2.0, respectively. Tariq *et al.* (2011) reported overall twinning rate in Mengali as 4.30%. Pakistani sheep breeds have low twinning potential as compared to other breeds of the world and this trait could be improved through selection, better management and nutritional practices. In fact the potential of Pakistani sheep breeds has not been exploited properly.

Fertility: Fertility obtained in present study matched with the study of Tariq *et al.* (2011) that fertility in Mengali sheep was 91%. Higher fertility percentages as compared to present study were given by Sharif *et al.* (2011) who reported lambing percentage in Balochi and Bibrik sheep as 101 and 102, respectively. The wide variation in fertility percentage might be due to breed differences, breeding plan, nutritional and management practices**.**

Age at first service and lambing: Age at first service as obtained in present study was similar to that reported by Sharif *et al.* (2011) in Balochi and Bibrik (Beverigh) (587±2.90 and 595±1.51days, respectively), Khan *et al.* (2000) in Rambouillet X Kaghani cross bred sheep (583±1.05 days). Age at first service is a managemental trait and can be minimized by improving nutritional and other management practices**.**

The age at first lambing as found in present study was in agreement with Sharif *et al.* (2011) in Balochi and Bibrik (Beverigh) (731±3.70 and 744±2.34 days, respectively), Khan *et al.* (2000) in Rambouillet X Kaghani cross bred sheep as 735.67±1.13 days and Tailor *et al*. (2006) in Sonadi sheep as 709.6±8.38 days. Lower age at first lambing as compared to present study was reported by Berhanu and Aynalem (2009) as 404±65.4 days. The differences might be due to breed differences and management practices.

Service period: The service period as found in present study was in accordance with findings of Sharif *et al.* (2011), who reported SP in Balochi and Bibrik (Beverigh) as 209.80±2.51 and 214.90±3.45 days, respectively. Tailor *et al.* (2006) reported the SP of 124.98±4.22 days in Sonadi sheep. Higher SP as compared to the present study was given by Khan *et al.* (2000) (250.12±7.06 days in Rambouillet X Kaghani cross bred sheep). Variation in service period might be attributed due to inefficiency of heat detection, difference in feeding and breeding management.

Lambing interval: The lambing interval as obtained in present study was in line with findings of Tailor *et al.* (2006), who observed lambing interval in Sonadi sheep as 275.08±4.22 days. Berhanu and Aynalem (2009) reported lambing interval as 262±53.4 days in sheep. Lambing interval depends upon service period and gestation period. Former trait can be controlled but the latter is a biological trait and controlled genetically. Therefore, the variation in LI might be attributed to differences in feeding and breeding management practices.

High lambing interval as compared to present study was reported by different researchers. Sharif *et al.* (2011) reported higher values of LI in Balochi and Bibrik (Beverigh) sheep (359.40±3.34 and 365.10±4.11 days respectively). Similarly, Khan *et al.* (2000) reported LI in Rambouillet x Kaghani cross bred sheep as 399.88±7.21 days which was higher than present findings. These differences might be due to variation in flock management and feeding regime.

Non-genetic factors effecting reproductive performance: Environmental factors such as location of flock had significant effect on AFS, SP of Sonadi sheep (Tailor *et al.,* 2006), Mengali sheep (Tariq *et al.,* 2011) and Balochi sheep breeds (Sharif *et al.,* 2011). Tariq *et al.* (2011) also reported that flocks raised at different locations had significant effect on reproductive and productive performance. These findings were similar to the present study. These might be due to breeds, feeding and breeding management. Parity, type of birth and year of lambing significantly affected lambing interval (Berhanu and Aynalem, 2009). Lambing season significantly affected LI as reported in many studies (Adu *et al.,* 1985; Suleiman *et al.,* 1990) which contradicted the present results. On the

other hand, some researcher like Fahmy (1989), Galina *et al*. (1996) and Gatenby *et al*. (1997) produced findings similar to that of present study.

Conclusion: Reproductive performance of Balochi sheep was influenced by most of the non-genetic factors. Reproductive performance could be improved through genetics and environment. Therefore, genetic aspects should be explored to reveal the control of genes on the reproductive traits and emphasis should be laid on the improvement in management, nutrition and breeding practices. This study looks into all aspects of sheep production in Balochistan and gave recommendations for the improvement of the entire system.

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