AN EVALUATION OF PRODUCTION EFFICIENCY OF INDIGENOUS SHEEP BREEDS IN BALOCHISTAN, PAKISTAN

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Abstract

In the present study four native sheep breeds of Balochistan such as Balochi, Bivirigh, Harnai and Rakhshani production data of 410 sheep were used. The data were collected from multi purpose sheep research station Yetabad (under government control). The main objective of this study was to evaluate the performance of native sheep breeds for their production efficiency. This study investigated the effect of ewe age, lambing month, sex of lamb and breed on the birth weight, weaning weight, weight gain and survival of lambs to weaning. The effect of ewe age differences was not significant, the 4 year old ewes produced slightly heavier birth weight lambs, the differences were not significant (P>0.05), 5 year age group were observed best in term of weaning weight and weight gain to weaning weight. The lambing month has significantly influence the weaning weight and weight gain to weaning (P= <0.001). The effect of lamb sex showed a significant effect, males were heavier than females (P=< 0.001). The effect of breed showed significant differences (P= <0.001) for birth weight in the Balochi breed and weaning weight and weight gain to weaning weight in Bivirigh (P= <0.001).

Keywords: *breeds, ewe, lambing, production efficiency*

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INTRODUCTION

Animal husbandry is the mainstay of Balochistan rural economy. The role of livestock in rural economy can be judged from the fact that 80% of the rural population is involved in livestock sector directly and indirectly and drives 30-40% of its income from it (Sajjad, *et al*., 2007). On the other side, the income generation by the livestock producers is low and needs to address the way to uplift the socioeconomic conditions of the livestock farmers (Kakar and Bajwa, 2004; Winter, 2011). Balochistan consist of 43 percent small ruminant population of the country with sheep flock constituting the majority. The topography of Balochistan province is suitable for livestock farming. Due to increasing human population and rapid economic development in Pakistan, there is a challenge for the scientists to meet the animal protein requirement. Therefore, generally everywhere the production of livestock sector needs to be increased substantially (Morris, 2009). Both dry land farming and animal raising are co-dependent to minimize the risk of household's income and better source of utilization of surplus household labour (Scott, 2011).

Among animals, sheep has economic importance to the subsistence farming systems in providing meat, milk and by-product. The four sheep breeds are distributed thought out Balochistan. All breeds are carpet wool type breeds. The performance for better wool is found in the

Balochi, Harnai and Rakhshani breeds compared to the Bivirigh breed, but this breed performance is found better for the production of meat and as second rank goes to the Balochi breed (Kamalzadeh and Shabani, 2007).

The farming system in the Balochistan is mainly related to the human migration pattern such as nomadic and transhumant and also sedentary people. But in this study the improved environment from controlled data is used. In Balochistan small ruminant research is being conducted at two sheep farms; Karakul sheep breeding farm at Maslakh and Multipurpose Sheep Research Station Yetabad, to exploit the production potential of local sheep breeds of the province through selective and cross breeding practices. This study aimed to investigate the production efficiencies of the native sheep breeds in an improved environment.

MATERIALS AND METHODS

The four hundred and ten sheep were studied, out of which 107 were Balochi, 117 Bivrigh, 120 Harnai and 66 were Rakhshani, collected from the Multi Purpose sheep research station (under Government control) at Yetabad District Loralai Balochistan where four fat-tailed sheep breeds are being kept for research purposes. A semi farming system was adapted at the research station, the animals were fed in the ranges and also provided with supplementary feeding, depending on the conditions of the ranges and time of the year. The data collected were on the birth weight, weaning weight, weight gain and survival of lambs to weaning.

Statistical Analysis

The production data were estimated by using an analysis of variance, for effect of ewe age, lambing month, sex of lamb and breed, while the least significant difference *(LSD)* method was used to test the differences between specific means.

RESULTS

The production efficiency of native sheep breeds was analyzed. The main results were related to the effect of ewe age, month of lambing, sex of lamb and breed. The specific traits investigated were birth weight, weaning weight, and lamb survival to weaning and live weight gain to weaning. In case of weaning weight and weight gain to weaning weight the best performance was seen in the 5-year ewe age group (P<0.01) (table 1, 2). The performances for the other ewe age groups 2 and 3 years were recorded poorest in terms of birth weight, weaning weight and weight gain to weaning weight. The 4 year old ewes produced slightly heavier birth weight lambs, the differences, however, were not significant P>0.05 (table 3).

Table 1: Showing the effect of ewe age on weaning weight

Ewes age (year)	Number of ewes	Mean weaning weight (kg)	Standar d error
2	57	9.8a	0.50
3	26	10.3ab	0.56
4	114	10.1a	0.48
5	161	10.5b	0.46

Significance: F= 2.21 P= 0.086
Mean with different superscripts are significantly different (P<0.01).

Table 2: Showing the effect of ewe age on weight gain to weaning weight.

Ewes age (year)	Number of ewes	Mean live weight gain (kg)	Standard error
2	57	7.4a	0.50
3	26	7.8ab	0.56
4	114	7.5a	0.48
5	161	8.0b	0.46

Significance: F= 2.21 P= 0.086
Mean with different superscripts are significantly different (P<0.01).

Table 3: Showing the effect of ewe age on birth weight.

Ewes age (year)	Number of ewes	Mean birth weight (kg)	Standard error
2	71	2.40	0.099
3	31	2.40	0.110
4	126	2.50	0.095
5	182	2.50	0.093

Significance: F= 1.93, P= <0.1.23

Ewes lambing in the month of January and February had significantly heavier lambs at weaning, and their lambs had a higher weight gain to weaning weight (P<0.001) (table 5, 6)

as compared to ewes lambing in March. The January lambs had the highest weight gains as compared to other lambing months, (Jan.>Feb.>Mar). (P<0.001).

The lambs obtained in month of March were ranked the poorest for both weaning weight and weight gain to weaning. There was no significant effect of specific time/month of lambing on the survival of lambs to weaning.

Table 4: Showing the effect of lambing Month on birth weight.

Months of lambing	Number of ewes	Mean birth weight (kg)	Standard error
January	17	2.22	0.090
February	201	2.35	0.028
March	189	2.34	0.031

Significance: F= 0.93 P= 0.446

Table 5: Showing the effect of lambing month on weaning weight

Months of lambing	Number of ewes	Mean weaning weight (kg)	Standard error
January	17	11.7a	0.44
February	187	10.2b	0.14
March	153	8.8c	0.17

Significance: F= 22.34 P= <0.001
Means with different superscripts are significantly different (P <0.001).

Table 6: Showing the effect of month of lambing on weight gain to weaning weight

Months of lambing	Number of ewes	Mean live weight gain (kg)	Standard error
January	17	9.4a	0.44
February	187	7.8b	0.10
March	153	6.5c	0.20

Significance: F= 22.79, P= <0.001
Means with different superscripts are significantly different (P<0.001).

The study has shown that the lamb sex had a significant effect on the birth weight (table 7), males were heavier than females. But on other hand it was observed that the lambs' gender had no effect on the weaning weight and weight gain to weaning. (table 8, 9).

Table 7: Showing the effect of lamb sex on the birth weight.

Lamb sex	Number of lambs	Mean birth weight (kg)	Standard error
Male	201	2.51a	0.095
Female	209	2.33b	0.093

Significant: F= 23.89, P= <0.001
Means with different superscripts are significantly different (P<0.001).

Table 8: Showing the effect of lamb sex on weaning weight.

Lamb sex	Number of lambs	Mean weaning weight (kg)	Standard error
Male	176	10.2	0.47
Female	182	10.1	0.46

Significant: F= 0.02, P= 0.892

Table 9: Showing the effect of lamb sex on weight gain to weaning weight.

Lamb sex	Number of lambs	Mean weight gain (kg)	Standard error
Male	176	7.6	0.47
Female	182	7.7	0.46

Significant: F= 0.81, P= 0.369

The Balochi breed was ranked heaviest for birth weight and was observed significantly heavier than the other breeds (table 10).

Table 10: Showing the effect of breed on birth weight.

Breeds	Number of ewes	Mean birth weight (kg)	Standard error
Balochi	107	2.74a	0.096
Bivrigh	117	2.25b	0.098
Harnai	120	2.27b	0.099
Rakhshani	66	2.42d	0.096

Significance: F= 38.81 P= <0.001
Means with different superscripts indicate significant differences (P<0.001).

The Bivrigh breed had the heaviest mean weaning weight (P<0.001) as shown in table 11. The same breed was ranked top in term of weight gain to weaning weight (table 12).

Table 11: Showing the effect of breed on weaning weight.

Breeds	Number of ewes	Mean live weight gain (kg)	Standard error
Balochi	95	10.6a	0.48
Bivrigh	101	11.3b	0.49
Harnai	106	09.8c	0.49
Rakhshani	56	08.9d	0.48

Significance: F= 23.75, P= <0.001
Mean with different superscripts are significantly different (P<0.01).

Table No 12. Showing the effect of breed on weight gain to weaning weight

Breeds	Number of ewes	Mean live weight gain (kg)	Standard error
Balochi	95	7.8a	0.48
Bivrigh	101	8.9b	0.49
Harnai	106	7.5a	0.49
Rakhshani	56	6.4c	0.48

Significance: F= 24.32, P= <0.001

Mean with different superscripts are significantly different (P<0.001).
No breed was superior in terms of lamb survival to weaning. (Table No 13).

No significant effect of lamb sex was observed on the survival of lambs to weaning.

Table 13: Showing the effect of Breed on survival of lamb to weaning

Breeds	Number of lambs	% of lambs survival
Balochi	105	96
Bivrigh	112	93
Harnai	109	90
Rakhshani	63	95

X2: NS.

Table No 14. Showing the effect of lambing month on birth weight

Months of lambing	Number of ewes	Mean birth weight (kg)	Standard error
January	17	2.22	0.090
February	201	2.35	0.028
March	189	2.34	0.031

Significance: F= 0.93 P= 0.446

Table 15: Showing the effect of lambing month on lamb survival to weaning.

Months of lambing	Number of lambs	% of lambs survival
January	17	100
February	203	96
March	192	90

X2: NS

Table 16: Showing the effect of lamb sex on the birth weight.

Lamb sex	Number of lambs	Mean birth weight (kg)	Standard error
Male	201	2.51a	0.095
Female	209	2.33b	0.093

Significant: F= 23.89, P= <0.001
Means with different superscripts are significantly different (P<0.001).

DISCUSSION

It is suggested that breed, age of ewe and lambing season influence overall production efficiency of ewes but that lamb husbandry and viability are also important. It was found that the age of dam had an effect on the lamb weights, the mean lamb weaning weight and gain in weight to weaning (table 1,2). The mean lamb birth weights was not, however, significantly different (table 3). The 3 year old ewes performed better in terms of weaning weight and gain in weight as compared to 2 year and 4 year old ewes. Similar results were also reported by Taiwo *et al.,* (1982). However older ewes has been reported with higher mean lamb weaning weight and gain in weight to weaning by Martin *et al.,* (1980), Gbangboche *et al.*(2006), Fall *et al.*(1982), Filius *et al.* (1986), Abassa *et al.* (1992), Vesely *et al.,* (1977) and Rahman, (2007). In Spain, Pérez *et al*., (2007) reported the technical efficiency of meat sheep production systems in same sort of conditions. Shomo, *et al*., (2010) explained the sources of technical efficiency of sheep production systems in dry areas in Syria. It may be due to more production of milk in older ewes as compared to younger ewes. Any how this needs further investigation in the local environmental conditions.

This study showed a highly significant affect of month of birth on weaning weight and weight gain to weaning (table 5, 6). These observations are vital for the future experiments and production systems in the

province. Mavrogenis (1988) also found similar results. The month of birth, however, did not show a significant effect on the birth weight (table 14). In addition with could be linked with dam parasitic load (Plant and Lewis, 2011). The mean weaning weight and weight gain to weaning were higher in January born lambs. This is probably because of the readily available spring fodder in early March and April and secondly because of the better body condition of ewes, gained in early winter, which may have increased the milk yield. The same has been reported by Gbangboche *et al.*(2006). These circumstances may also have contributed to the better survival of lambs born in January and February as compared to those born in March. The March lambs showed a lower (10%) survival rate to weaning compared to lambs born in other months (table 15). However, the differences were not significant statistically. Another contributing factor might be low number of ewes used for January which was 17.

In this study the mean birth weight of male lambs was higher than that of female lambs (table 16). This observation is in agreement with that made by Menzies, (2011) and Martin *et al.,* (1980), where he mentioned that this may be due to genetic differences, the male fetus probably beginning to liberate androgenic substances earlier and hence growing and developing faster than the female. The present study, however, showed that the female gained slightly more weight than males to weaning. Since weaning weights were not different.

The four range breeds showed a significant difference in birth weight, weaning weight and weight gain, but not in survival of the lamb. The Bivrigh proved to be superior to the other three breeds for weaning weight and weight gain. The same performance has been reported during a fattening trial among indigenous breeds (BLDP 1984).

The mean birth weight and weaning weight of the Balochi breed in this study was observed (birth weight; 3.20 Vs 2.74 kg and weaning weight; 14.8 Vs 10.62 kg) than those reported by Rafique *et al.,* (1991). The latter study was carried out in Zarchi (Kalat district) which has a colder climate than Yetabad, and also could be an effect of better supplementation. The survival rates to weaning in native breeds were quite acceptable under good nutritional conditions observed by (Makarechian *et al.,* 1982; and Farid *et al.,* 1989; Winter, 2011). The selection of breed can also help to increase the production efficiency as observed in the Bivrigh breed which had a significantly higher weigh gain to weaning and weaning weight than the three other breeds. But second rank goes to Balochi breed for same traits. In a recent study Corral *et al*., (2010) reported the associations between milk protein genetic polymorphisms and milk production traits in Merino sheep breed. In addition to this, in Italy, Tolone *et al*., (2012) explained the genetic diversity and population structure of Sicilian sheep breeds using microsatellite markers. The indication of this study suggests that more the advancement towards breeding, management, health and nutrition is important for a good production and profitability.

CONCLUSION

This study has quantified non genetic and breed effects on birth weight, weaning weight, weight gain to weaning and lamb survival. It is hoped that the findings of this study will assist the scientists, farmers and in general the farming system in the area. The month of lambing, January to March showed a significant effect on the weaning weight and weight gain to weaning with progressively poor performance in the later months. Therefore, fixing time of lambing may help ewes for more production of milk to their lambs and for a better growth and survival rate. The selection of breed can also help to increase the production efficiency as observed in the Bivrigh breed which had a significantly higher weigh gain to weaning and weaning weight than the three other breeds tested in this study. Second rank goes to Balochi breed for the same traits. These observations suggest that there is a room for betterment in breeding, management, health and nutrition for high production and profitability in future.

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REFERENCES

- Abassa KP, Pessinaba J and Adeshola-Ishola A. (1992). Croissance pre-sevrage des agneaux Djallonke au Centre de Kolokope (Togo). Revue Elev. *Med. Vet. Pays trop.* 45: 49-54.
- BLDP. (1984). Balochistan Livestock Development Project. Report and Analysis of Bivrigh lamb fattening trial carried out at kid/lamb fattening centre Sariab Quetta.
- Corral JM, Padilla JA and Izquierdo M. (2010). Associations between milk protein genetic polymorphisms and milk production traits in Merino sheep breed. *Livestock Science.* 129 (1) :73-79.
- Fall A, Diop M, Sandford J, Wissocq YJ, Durkin J and Trail JCM. (1982). Evaluation of the productivities of Djallonke Sheep and N Dama cattle at the Centre de Recherches Zootechniques, Kolda, Senegal. ILCA Research Report No.3. ILCA, Adis Abeba.
- Farid A, Makarechian M and Sefidbakht. (1989). Reproductive performance of three Fat-tailed breeds of sheep mated to native, Corriedale and Targhee Rams. Tropical Animals Health Production. 21: 25-31.
- Filius P, Weniger J and Teuscher T. (1986). Investigation of the performance of Djallonke sheep. *Anim Res Dev*. 24: 85-97.
- Gbangboche AB, Adamou-Ndiaye M, Youssao AKI, Farnir F, Detilleux JF, Abiola and Leroy PL. (2006). Non-genetic factors affecting the reproduction performance, lamb growth and productivity indices of Djallonke sheep. *Small Ruminant Res*. 64: 133-142.
- Kakar MA and Bajwa MA. (2004). An evaluation of the livestock and dairy development in Balochistan. A Review Book, Published by EU-SLSP Quetta, Balochistan.
- Kamalzadeh AA and Shabani. (2007). Maintenance and Growth Requirements for Energy and Nitrogen of Baluchi Sheep. *International J. of Agri & Biology.* 4: 535–539.
- Makarechian M, Farid A and Sefidbakht N. (1982). Crossbreeding of Iranian fat-tailed sheep. IV. Reproductive performance and lamb production in Karakul, Mehraban and Naeini, In: *Iran Agriculture Research.* 1: 1-15.
- Martin TG, Sales DI, Smith C and Nicholson. (1980). Phenotypic and Genetic Parameters for lamb weights in synthetic line of Sheep. *Animal Production.* 30: 261-269.
- Mavrogenis AP. (1988). Adjustment factors for growth traits of Chios sheep. *Livest. Prod. Sci.* 19: 409-416.
- Menzies PI. (2011). Control of Important Causes of Infectious Abortion in Sheep and Goats. *Veterinary Clinics of North America Food Animal Practice*: *27(1):* 81-93.
- Morris ST. (2009). Economics of sheep production. *Small Ruminant Research.* 86 (1): 59–62.
- Perez JP, Gil JM and Sierra I. (2007). Technical efficiency of meat sheep production systems in Spain. *Small Ruminant Research.* 69 (3): 237-241.
- Plant JW and Lewis CJ. (2011). Treatment and control of Ectoparasites in Sheep. *Veterinary Clinics of North America Food Animal Practice: 27(1):* 203-212.
- Rafique S, Munir M, Sultani MI and Rehman A. (1991). Effect of winter supplementation on the performance of Balochi ewes grazing native ragelands in highland Balochistan. Arid Zone Research Institure, Pakistan Agriculture Research Council, Brewery Road, Quetta Pakistan.
- Rahman FMD. (2007). Prediction of Carcass Weight from the Body Characteristics of Black Bengal Goats. *International J. of Agri & Biology*. 3:431–434.

- Sajjad MK, Mouqarrab AK, Ahmad S and Mahmood S. (2007). Continuing Education Article: Genetic Resources and Diversity in Pakistani Sheep. *International J. of Agri & Biology*. 6: 941–944.
- Scott PR. (2011). Treatment and control of Respiratory Disease in Sheep. *Veterinary Clinics of North America Food Animal Practice. 27:* 175-186.
- Shomo F, Ahmed M, Shideed K, Aw-Hassan A and Erkan O. (2010). Sources of technical efficiency of sheep production systems in dry areas in Syria. *Small Ruminant Research.* 91(3): 160-169.
- Taiwo BB, Ngere LO and Adeleye. (1982). Comparative growth performance of Nigerian dwarf sheep and its crosses with Permer, Uda and Yankasa. *World Review of Animal Production.* 18: 57-63.
- Tolone M, Mastrangelo S, Rosa AJM and Portolano B. (2012). Genetic diversity and population structure of Sicilian sheep breeds using microsatellite markers. *Small Ruminant Research.* 102: 18-25.
- Vesely JA, Kozub GC and Peter HF. (1977). Additive and nonadditive genetic effect on growth traits in mating among Romnelet, Colubia, Suffolk, and North Country Cheviot Breeds. *Can J Anim Sci.* 57:233-238.
- Winter AC. (2011). Treatment and control of Hoof Disorders in Sheep and Goats. *Veterinary Clinics of North America Food Animal Practice. 27:* 187-192.