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ASSESSMENT OF WOOL CHARACTERISTICS OF MENGALI SHEEP OF BALOCHISTAN

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ABSTRACT

The study was carried out to establish the environmental factors' influence on the wool production as well as analyzed the wool quality parameters of Mengali sheep. The wool production data on 3150 offspring sired by 38 rams in four flocks at three locations over a period of 5 years (Jan. 2005 to Dec. 2009) were included in the analysis. Data thus collected was subjected to statistical analysis by standard methods of analysis of variance. The average autumn fleece weight (AFW), spring fleece weight (SFW) and combined fleece weight (CFW) were 1.35±0.82, 1.17±0.75 and 2.50±0.64kg, respectively. Animal model was fitted with shearing season and location of flocks as fixed and animal as random effects. The heritability estimates for AFW, SFW, and CFW were 0.19±0.03, 0.22±0.06 and 0.18±0.04, respectively. Wool traits of sheep (n=90) were found as: coarse wool with diameter 41.62±4.57µ; black (85%) and white (15%) in color, true fiber 65.07±5.06%, modullated fiber 11.2±3.2%, Kemp 10.1±2.79%, heterotype 21.0±1.06% and staple length 6.25±1.12cm. Season of shearing and location of flocks had significant effects ($P<0.05$) on fleece weight in different years. Sex and type of birth of animal were not statistically different ($P>0.05$) for fleece traits. Mengali wool characteristics are best suited for carpet manufacturing but color would be a limitation. These findings suggested that Mengali sheep wool production and quality can be improved through selection, management, and favorable environment.

Key words: Wool traits, environmental factors, genetic parameters, Mengali sheep

INTRODUCTION

Livestock plays significant role in the economy of the country. Livestock sector contributed approximately 53.2 percent of the agriculture value added and 11.4 percent to national GDP during 2009-10.While other development sector experienced saturation and decline there has been an increase in livestock sector during 2009-10. Gross value addition of livestock at current factor cost has increased from Rs. 1304.6 billion (2008-09) to Rs. 1537.5 billion (2009-10) showing an increase of 17.8 percent as compared to previous year (GOP, 2011).

Small ruminants play an important role in animal production and rural economy in arid and semi arid regions of Pakistan especially marginal and sub marginal land holdings (Tariq *et al.,* 2010). Of the total 27.8 million sheep in the country more than 13.6 million sheep population found in Balochistan province. Pakistan produced approximately 42.5 thousand tones wool from sheep during (2010-11) (GOP, 2011).

The major features of Mengali sheep breed are compact body with remarkable height, pendulous belly, fat tail, body color is black/tan or brown with white patches on the belly or vice versa (Kakar and Ahmad, 2004; Khan *et al.,* 2007; Tariq *et al.,* 2010), black face with peculiar white spotted forehead, and ears are usually medium in size, big face with Roman nose, both males and females are polled. The animals are well adapted to the local conditions (districts of Quetta, Mastung, Khuzdar, Chaghai, Kalat, Awaran and Kharan) of Balochistan province. Origin of Mengali sheep is still unknown. This sheep breed is named after a native Baloch tribe "Mengal" (the most populated tribe of Kalat division) and the breed is famous for its adoptability and profitability (Tariq *et al.,* 2010)

Wool is very versatile fiber often used to make clothing such as sweaters, dresses, coats, suits, jackets, pants, skirts, scarves, gloves mittens, socks, and hats. It can also be used to make household item such as, carpets, draperies, upholstery, and blankets. Miscellaneous items include: handbags and jewelry (Khan, 1994; Tariq *et al.,* 2010). The quality of wool is determined by fiber diameter, crimp, yield, colour, and staple strength. Fiber diameter is the single most important wool characteristic determining quality and price **(**Braaten, 2005). The fiber diameter is dependent on the age and health (or nutrition) of the sheep. Staple length generally determines the end use of wool, that is, whether it will be used in weaving or knitting (Iman and Slyter, 1996). The study was conducted to establish the environmental control on the

wool production as well as to analyze the wool quality parameters of Mengali sheep.

MATERIALS AND METHODS

The data on wool production and characters of Mengali sheep (both Male and female) were recorded in four flocks maintained at three locations that included the Experimental Station CASVAB (ESC) Quetta, Mastung, Nushki and Quetta, over a period of 5 years (from Jan 2005 to Dec 2009). Ear tags were applied for identification of animals. The following pieces of information were collected: individual's identity, sire, dam, date of birth, sex of the lamb, type of birth (TOB), year of birth (YOB), season of shearing and wool production. The wool traits included: autumn fleece weight (AFW), spring fleece weight (SFW), combined fleece weight (CFW). Univariate fixed effect model was applied for data analysis. Season of shearing, sex of animal, type of birth and location of flock were used as fixed effects in the model. Sex and type of birth being non-significant were excluded from the final model. Significant means were separated using Duncan Multiple Range Test.

The fixed effect model applied was: $Y_{ijk} = \mu + S_i + L_j + e_{ijk}$

Where Y_{ijk}= kth observation in ith season (shearing in autumn and spring) and jth location; S_i= ith season; L_j= jth location; e_{ijk}= random error associated with each observation.

Genetic parameter (heritability estimate) for fleece weight was estimated by using individual animal model. Fixed effects were season of shearing, location of flocks, sex of animals and type of birth while animal was used as random effect. Following animal model was used:

$Y_{ijklm} = \mu + S_i + L_j + Sex_k + BT_l + a_{ijklm} + e_{ijklm}$

Where Y_{ijk}= kth observation in ith season (shearing in autumn and spring) and jth location; S_i= ith season; L_j= jth location; Sex_k= kth sex (male or female), BT_l=lth type of birth, a_{ijklm} = additive genetic effect of animal as random effect and e_{ijklm}= random error associated with each observation.

The shearing was done twice a year (autumn and spring) sheep. After clipping, the wool was sorted, graded and cleaned for analysis. The fleece was analyzed at the Wool Analysis Laboratory, Central Sheep and Wool Research Institute, Islamabad. The wool fibres were visually observed and counted with the help of a projection microscope at 500 magnification. The fibre diameter was measured in accordance with the standard protocol as suggested by Von- Bergen (1963).

RESULTS AND DISCUSSION

Fleece weight (FW): The averages of autumn fleece weight (AFW) were 1.35±0.82, spring greasy fleece weight (SFW) 1.17±0.75 and combined fleece weight (CFW) 2.50±0.64 kg, respectively (Table 1). The analysis of variance of fleece weight of Mengali sheep revealed that, autumn, spring and combined fleece weight were significantly different from each other (Table 2)**.** Season of shearing and location of flocks in different environments showed significant effects ($P < 0.05$) on FW. Locations or flocks differed significantly for autumn fleece yield ($P < 0.05$). No significant difference was observed in spring fleece yield for Mastung and ESC, but fleece yield statistically varied in Nushki and Quetta flocks compared to other flocks. It was found that total fleece yields of Nushki and Quetta flocks were significantly different ($P < 0.01$) but ESC and Mastung flocks of were noticed to have non-significant differences as compared to other flocks.

The findings of the present study were similar to the finding of many investigators (Nawaz *et al.*, 1985; Khan, 1991; Babar, 1994; Qureshi and Ghaffar, 2002; Akhtar, 1996; Hussain, 2006). Nawaz *et al.* (1985) who analyzed wool yield of Awassi and Kachhi lambs obtained average estimates for two breeds as 2.81±0.05 and 2.65+0.08 kg, respectively. Khan *et al.* (1991) reported that the average wool weight in Awassi sheep was 3.02±0.04 kg; they found higher wool yield in single than in twin born ewes (3.04 vs. 2.94 kg). Babar (1994) reported CFW 2.70 kg in Lohi sheep, Qureshi (2002) also noted SFW as 1.0±0.05; AFW, 1.0±0.001 and CFW as 2.1±0.01 kg in Kajli sheep. Akhtar (1996) collected data on (n=5260) lambing of Hissardale sheep and reported that overall yearly fleece weight in the flock averaged 3.06±0.57 kg. Hussain (2006) analyzed data of wool production of Thalli sheep and found average weight for fleece in autumn and spring season as 1.46±0.12 and 1.53±0.06 kg, respectively.

Some studies reported higher means for FW as compared to the present study. For instance, Krajinovic *et al.* (1989) found average fleece weight as 4.99, 3.94 and 4.56 kg in different age groups for Tsigai sheep, Barina *et al.* (1990) in German Mountain sheep as 6.85 and 7.22 kg in male and females, respectively and Amores *et al.* (1998) reported average values for CFW as 4.32±0.05 kg in Merino sheep (n=1519).

Low average for FW as compared to the present study was observed by Mandokhail (2001) in Rakhshani sheep as 1.30 kg. Differences in average fleece yield in these breeds might be due to differences in genetic makeup of thee breeds.

Environmental factors: The findings of the performance of season (Autumn, Spring) and Combined Fleece

Weight (mean ±SE) of Mengali Sheep in different years (2005-2009) are presented in Table 3.

The significant effect of shearing of wool in different years on fleece production (Table 3) as obtained in the present study was in agreement with the findings of many workers (Barina *et al.*, 1990, Babar, 1994; Akhtar, 1996; Amores *et al.*, 1998; Qureshi and Ghaffar. 2002). The significant effect of season on FW as obtained in the present study was in agreement with the findings of several researchers (Kakar, 1993; Kharotee, 1995; Sharif, 2001; Qureshi and Ghaffar 2002). Kharotee (1995) analyzed the data on wool production of Karakul sheep and observed FW as (0.99±0.01 and 1.43±0.09 kg) for spring and autumn shearing, respectively. Sharif (2001), analyzed the FW of 50 Balochi and 50 Bibrik sheep breeds and reported means values for FW (1.025±0.51 and 0.56±0.67 kg) in spring and (1.36±0.091 and 1.06±0.063 kg), in autumn, respectively. They further concluded that autumn wool yield was higher than spring. Qureshi and Ghaffar (2002) reported SFW as 1.0±0.05; AFW 1.0±0.001 and CFW 2.1±0.01 kg in Kajli sheep. Variation in fleece weight in season indicated managemental as well as nutritional difference.

The significant effect of season and insignificant effect of type of birth on FW as obtained in this study was not in agreement with findings of Hussain (2006) and Akhtar *et al.* (1996), who analyzed the data for FW on Hissardale (n=3285) sheep and Thalli (n=6895) sheep and reported that, season had non-significant effect on fleece weight.

The insignificant effect of YOB on FW as obtained in present study was not in line with findings of many authors (Barina *et al.*, 1990; Babar, 1994; Qureshi, 1996; Amores *et al.*, 1998; Hussain, 2006; Akhtar, 2008). The yearly variation in fleece weight during different years indicated management as well as nutritional differences.

Wool characteristics: Wool characteristics of Mengali sheep (n=90) were analyzed and observed that Mengali sheep have coarse wool with the diameter 41.62±4.57µ; black/tan/brownish (85%) and white (15%) in color, true fiber 65.07±5.06%, modullated fiber 11.2±3.2%, Kemp 10.1±2.79%, heterotype 21.0±1.06% and staple length 6.25±1.12cm (Table 4).

The average staple length as obtained in the present study was in agreement with the findings of several researchers (Roldugina *et al.*, 1987; Kakar, 1993; Kharotee, 1995: Sharif, 2001). Roldugina *et al.* (1987) analyzed the data on wool of Karakul White and Karakul Rose and observed average staple length as 5.0-8.8 and 4.2-8.3 cm, respectively. Kakar (1993) found staple length in Balochi, Rakhshani, Beveigh and Harnai sheep as 7.3, 5.2, 4.8, and 7.0 cm, respectively, Kharotee (1995) in Karakul as 6.35 cm and Sharif (2001) in Blaochi and Bevirigh as 7.4 and 5.2 cm, respectively.

The findings of fiber diameter as attained in the present study were in agreement with the result of numerous researchers who analyzed data on different sheep breeds (Khemaria, 1990; Kakar, 1993; Kharotee, 1995; Memon 1998; Sharif, 2001). Khemaria, (1990) who calculated the wool characteristics of Magra and Chokla sheep breeds, observed the fiber diameter of wool as 35.4±3.7 and 29.2±0.59 µ, respectively. Kakar (1993) observed fiber diameter as 37 µ in Balochi sheep, Kharotee (1995) as 42.6 µ in Karakul sheep and Memon (1998) as 36.8, 41.8 and 35.7 µ in Kachhi, Kooka and Dumbi sheep, respectively.

The findings of true fiber, modullated fiber, heterotype, kemp percentage and fiber diameter as obtained in the present study are in agreement with the findings of many researchers (Khemaria *et al.*, 1990; Kharotee, 1995 and Sharif, 2001). Sharif, (2001) reported true fiber (69 and 59.3%); modullated fiber (6.2 and 12.9 %) heterotype (23.6 and 16.5 %); kemp 1.2 and 11.3) and average fiber diameter (30.73 and 43. 38 µ) in Blaochi and Beverigh sheep breeds, respectively. The findings of Amores *et al.* (1998) for Merino sheep on wool quality showed variation as compared to the results of the present study.

Heritability estimate: The analysis of wool production of 3150 offspring of 38 rams in the present study indicated that the heritability estimate for AFW, SFW, and CFW were 0.19±0.03; 0.22±0.06 and 0.18±0.04 respectively. The heritability estimate of FW as obtained in the present study was in agreement with many researchers as McManus and Miranda, (1998) reported heritability estimate of Bergamasca grade sheep of CFW

Table 1: Least mean square and Standard error (LMS±SE) values of fleece weight (FW) of Mengali sheep

Name of Season and Location of Flocks		N[1]	LMS±SE (kg)
	ESC	520	1.37±0.70[b]
	Quetta	845	1.34±0.64[c]
AFW	Mastung	911	1.41±0.61[a]
	Nushki	880	1.29±0.89[d]
	Total	3156	1.35±0.82
SFW	ESC	520	1.24±0.43[a]
	Quetta	845	1.14±0.60 [b]
	Mastung	911	1.22±0.27 [a]
	Nushki	877	1.08±0.81 [c]
	Total	3153	1.17±0.75
CFW	ESC	519	2.60±1.38 [a]
	Quetta	845	2.48±0.72 [b]
	Mastung	910	2.62±0.67 [a]
	Nushki	876	2.36±0.64 [c]
	Total	3150	2.50±0.79

N [1] = Number of observations**;** ESC= Experimental station CASVAB. [abcd] Means followed by
different letters in the column are different at (P< 0.05); ESC= Experimental station CASVAB

as 0.19±0.07, Hussain, (2006) in Thalli sheep for AFW, SFW, and CFW as 0.11±0.02, 0.24±0.09 and 0.16±0.07, respectively, Ali (2008) in Karakul sheep for CFW as 0.12 and Mokhtari *et al.* (2008) in Kermani sheep as 0.15.

A low estimate of heritability for FW was documented by Qureshi and Ghaffar (2002) who analyzed the fleece weight of Kajli sheep and found estimate of heritability as (0.04±0.01 and 0.09±0.02) for AFW, SFW, respectively; these findings were not in agreement with the present study. Many researchers reported a high estimate of heritability for FW. These previous studies were not in agreement with the present study. Cloete *et al*. (1992), who collected data on flocks of South African Merino sheep, and reported heritability estimate of 0.41±0.06 for CFW and Babar (1994) using paternal half-sib analysis on Lohi sheep, found the heritability estimate for CFW as 0.63±0.12. Moderate heritability estimates observed in the present investigation suggested that the direct selection for fleece production traits could be successful if environmental conditions are more tightly controlled or accounted for the selection programme.

Table 2: Analysis of variance for fleece weight (FW) of Mengali sheep

Source of Variation	D.f.	Means Square	F
AFW	1	1.35	17.41*****
SFW	1	4.77	47.41*****
CFW	1	10.82	128.65*****
Error	3147	8.41	-
Total	3150	-	-

*****= Significant; (P<0.01)

Table 3: Autumn, spring and combined fleece weight of Mengali Sheep in different years (Mean±SE)

Years of Shearing	AFW(kg))		SFW (kg)		CFW (kg)
	Male	Female	Male	Female	
2005	1.50±0.82 (80)	1.20±0.80 (90)	1.19±0.74 (80)	1.15±0.65 (90)	2.55±0.76 (340)
2006	1.37±0.84 (145)	1.17±0.55 (171)	1.20±0.64 (134)	1.14±0.53 (188)	2.48±0.67 (638)
2007	1.35±0.69 (141)	1.19±0.62 (186)	1.19±0.77 (137)	1.17±0.58 (191)	2.51±0.69 (655)
2008	1.43±0.76 (167)	1.25±0.62 (247)	1.21±0.62 (165)	1.20±0.63 (205)	2.46±0.65 (784)
2009	1.39±0.73 (155)	1.26±0.67 (234)	1.15±0.64 (151)	1.17±0.53 (193)	2.54±0.64 (733)
Mean	1.41.5±0.81 (688)	1.22±0.73 (928)	1.20±0.72 (667)	1.15±0.61 (867)	2.50±0.79 (3150)
Overall means	1.35±0.82[a] (1616)		1.17±0.75[b] (1534)		2.50±0.79 (3150)

[ab]Means followed by different letters in the rows are different at (P< 0.05)

Table 4: Wool characteristics of Mengali sheep

N[1]	Color (%)	Staple length (cm)	Diameter (µ)	True fiber (%)	Modullated fiber(%)	Kemp (%)	Heterotype (%)
90	B[2] = 85 W[3] = 15	6.25 ± 1.12	41.62± 4.57	65.07± 5.06	11.2±3.2	10.1± 2.79	21.0 ± 1.06

N[1]= Number of observation, B[2]=black/tan/brownish color, W[3]= White color

Conclusions: Environmental factors had significant effects on over all performance and fleece production. Season of shearing and location of flocks at different environment observed had a significant effect on FW. While, sex and type of birth of animal was not statistically different. Mengali wool is best suited for carpet manufacturing but color would be a limitation. Moderate heritability estimate suggested that Mengali sheep breeds can be improve in production as well as in quality of wool by selection and favorable environment.

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