

Studies on Attributes of Hair and Production Potential of Camel Reared in Semi-intensive Management System

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Abstract: Annual hair yield data from 1038 Indian dromedary camels of 3 breeds (Bikaneri, Jaisalmeri and Kachchhi) from 5 different age groups were recorded. The Bikaneri breed of camel produced significantly ($P<0.01$) higher annual hair yields than Jaisalmeri and Kachchhi breed camels and young camels had significantly ($P<0.01$) higher yields. The male camel produced significantly ($P<0.01$) heavier annual hair clip than females in all breeds and at all age groups. The longest staple length was found in Bikaneri breed followed by Jaisalmeri and Kachchhi breed. The breed and body site significantly ($P<0.01$) influenced the staple length. The mean hair diameter of Bikaneri breed was minimum followed by Jaisalmeri and Kachchhi. The hair of male camel was finer than that of female camel. The breed, sex and body site significantly ($P<0.01$) affected the hair diameter. The hair diameter in all types of hairs obtained from various sites was finest from Bikaneri breed camels followed by Jaisalmeri and Kachchhi camels. It can be concluded that Bikaneri breed is superior in hair quality attributes as compared to Jaisalmeri and Kachchhi breed and male camel of Bikaneri breed belonging to 3-year-age groups produced higher annual hair yield as compared to camels of other breed, age and sex.

Key words: Camel, hair attributes, management system, rearing.

Although draught is the primary utility of camel in India, but camel hair is also being utilized since ancient times by camel rearing communities for preparing rope, blankets, floor rugs, bags, mattresses, etc., in Rajasthan and Gujrat (Sahani and Khanna, 1993). The camel hair and its products can be an important source of additional income for camel keepers. The hair of dromedary camels is durable, strong and has low conductivity (Mukasa, 1981). It has been estimated that a 620 g camel hair fabric weight will be as warm as a pure wool fabric of 900 g weight (Khanna and Rai, 1991). The main body sites of

hair coverage in the dromedary camels are shoulders, mid portion of body, neck and hump regions. The hair is spun by camel keepers using traditional simple techniques. The coarse variety is spun by hand. The other method of spinning fine quality camel hair is by hand charkhas. In the recent times machine spinning for carpets, durries and clothing is becoming popular. Preliminary results of camel hair blends with wool, silk waste and polyester have shown encouraging results (Gupta *et al.*, 1987, 1989; Patni and Dhillon, 1988). Blended products may also be prepared with sheep wool, goat hair and cotton.

Therefore, analysis of hair quantity and quality characteristics of various breeds, sex, age group, year of production, etc., are of great importance in exploiting the hair production potential and quality of hair for its future utility as pure camel hair as well as blended with other animal fibers, synthetic waste fibers. Thus the present investigation was undertaken to evaluate the production potential and quality aspects of camel hairs of different breeds and to suggest suitable improvement strategies.

Material and Methods

The hair production from 1038 camels (*Camelus dromedarius*) belonging to the National Research Centre on Camel, Bikaner, were recorded and analyzed. All the experimental camels managed at farm were under uniform semi-intensive system of management and were daily sent for grazing/browsing for about 6 hours and offered dry fodder (@ 2% of body weight) in the evening time after return from grazing. The hairs were clipped during March of every year from all over body by using hand machine and collected in polythene bags after proper skirting (removal of dust and other vegetable matters) and weighed.

The data collected on annual hair yield was from three different breeds viz., Bikaneri (448), Jaisalmeri (423) and Kachchhi (167) and its age wise availability was 1 year (137), 2 year (123), 3 year (137), 4-6 year (193) and above 6 year (448). The break up of data for different years was 1998 to 1999 (159), 1999 to 2000 (204) and 2000 to 2001 (227), 2001-2002 (226) and 2002-2003 (222). For hair quality analysis the samples (60) of annual clip

were collected from shoulder, mid-side, hump and neck region of 15 adult camels belonging to three breeds and were analyzed for hair diameter, staple length and types of hair (pure, hetro, hairy and kemp). The staple length was measured before washing of the samples. The hair samples were washed thoroughly in petrol, dried overnight and further washed for evaluating different parameters. The individual samples were mixed thoroughly, slides prepared after proper sectioning, and were examined under the ermascope at 500 x magnification, for measuring diameter and assessing the hair types based on medulation percentage, 300 observations were recorded in each slide to minimize the error.

The recorded data were classified according to breed, sex, age, year of production, etc., and were subjected to analysis by applying mixed mode least squares and maximum likelihood computer program (Harvey, 1987).

Results and Discussion

The Bikaneri breed of camel produced maximum hair, followed by Jaisalmeri and Kachchhi breeds (Table 1). The mean hair production in male Bikaneri, Jaisalmeri and Kachchhi were 1.04 ± 0.02 kg, 0.80 ± 0.01 kg and 0.68 ± 0.03 kg, respectively. Higher staple length may be one of the main reasons for higher annual hair production in Bikaneri breed. Yadav *et al.* (2000) reported that young Bikaneri camels had higher staple length as compared to young Jaisalmeri and Kachchhi camel. The male Bikaneri camels (1.04 ± 0.02 kg) produced significantly ($P < 0.01$) higher hair yield than female (0.87 ± 0.01 kg). Similar trend was observed in all other breeds. In all age

Table 1. Least squares means along with standard error for annual hair production (kg) in Indian camel breeds

	Breed		
	Bikaneri	Jaisalmeri	Kachchhi
Sex			
Male	1.04 ^a ±0.02 (153)	0.80 ^b ±0.01(188)	0.68 ^c ±0.03 (61)
Female	0.87 ^d ±0.01 (295)	0.71 ^e ±0.02 (235)	0.63 ^f ±0.02 (106)
Age (year)			
1	0.76 ^a ±0.03 (55)	0.61 ^b ±0.03 (58)	0.59 ^c ±0.05 (24)
2	1.18 ^d ±0.04 (48)	0.84 ^e ±0.03 (53)	0.70 ^f ±0.05 (22)
3	1.40 ^g ±0.03 (56)	1.01 ^h ±0.04 (50)	0.80 ⁱ ±0.04 (31)
4-6	0.85 ^j ±0.02 (87)	0.74 ^k ±0.03 (71)	0.65 ^l ±0.04 (35)
>6	0.67 ^m ±0.01 (202)	0.54 ⁿ ±0.02 (191)	0.51 ^o ±0.03 (55)
Production year			
1998-1999	0.91 ^a ±0.04 (70)	0.67 ^b ±0.04 (58)	0.55 ^c ±0.06 (31)
1999-2000	0.78 ^a ±0.03 (94)	0.60 ^b ±0.03 (80)	0.50 ^c ±0.06 (30)
2000-2001	0.80 ^a ±0.03 (101)	0.66 ^b ±0.04 (89)	0.68 ^c ±0.05 (37)
2001-2002	0.87 ^a ±0.03 (94)	0.70 ^b ±0.03 (98)	0.67 ^c ±0.06 (34)
2002-2003	0.86 ^a ±0.04 (89)	0.69 ^b ±0.03 (98)	0.65 ^c ±0.05 (35)

Breeds, sex and age significant at 1% level.

Similar superscripts of quantity parameters for breed, sex, age and production year indicate that observations do not differ significantly from each other.

Figure in parenthesis indicate number of observations.

groups, the male camels had higher hair yield than females. Age of camel also significantly ($P < 0.01$) affected the annual hair yield. The 3-year-age group produced (1.10 ± 0.02 kg) more hair, followed by 2 year (0.92 ± 0.02 kg), 4 to 6 year (0.74 ± 0.01 kg) and 1 year (0.64 ± 0.02 kg) age group. Above 6 year age group had lowest hair yield i.e., 0.55 ± 0.01 kg. The present results are consistent with the observations reported by Bhakat *et al.* (2002). The reason may be the protection provided by nature to the young animals.

In all the breeds the hair yield from all age group camels ranged from 0.63 ± 0.02 kg to 0.74 ± 0.02 kg. The skin coat of younger

camels (1 to 3-year-old) was softer and finer as compared to adult. The Indian dromedary camel breeds showed a wide color variation that ranged from light brown in Jaisalmeri breed to brown, dark brown and blackish in Bikaneri and Kachchhi breeds.

The highest staple length was found in Bikaneri breed followed by Jaisalmeri and Kachchhi breeds (Table 2). The hump region of all camel breeds possessed hair with the longest staple length followed by shoulder, mid-side, whereas neck region had the shortest hair staple length. The overall staple length of Indian camel was found to be 5.59 ± 0.25 cm. The factors

Table 2. Least squares mean \pm SE values for hair quality attributes in Indian camel breeds

	Breed			Sex		Site			
	Bikaneri	Jaisalmeri	Kachchhi	M	F	Shoulder	Mid	Hump	Neck
Staple length (cm)	6.27 ^a \pm 0.36 (24)	6.06 ^b \pm 0.39 (20)	4.42 ^c \pm 0.51 (16)	5.44 ^a \pm 0.44 (40)	5.72 ^a \pm 0.28 (40)	5.39 ^a \pm 0.46 (15)	5.22 ^b \pm 0.45 (15)	7.45 ^c \pm 0.45 (15)	4.27 ^d \pm 0.45 (15)
Diameter (micron)									
Hair	42.13 ^a \pm 1.37 (24)	45.84 ^b \pm 1.46 (20)	48.48 ^c \pm 1.91 (16)	43.54 ^a \pm 1.63 (20)	52.10 ^b \pm 1.06 (40)	46.22 ^a \pm 1.72 (15)	43.90 ^b \pm 1.72 (15)	52.95 ^c \pm 1.72 (15)	48.21 ^d \pm 1.72 (15)
Pure	29.97 ^a \pm 1.14 (24)	38.43 ^b \pm 1.22 (20)	42.80 ^c \pm 1.59 (16)	33.49 ^a \pm 1.36 (20)	40.65 ^b \pm 0.88 (40)	36.43 ^a \pm 1.43 (15)	33.96 ^b \pm 1.43 (15)	40.42 ^c \pm 1.43 (15)	37.76 ^d \pm 1.43 (15)
Hetro	38.49 ^a \pm 1.39 (24)	40.92 ^b \pm 1.95 (20)	45.88 ^c \pm 1.49 (16)	38.89 ^a \pm 1.67 (20)	49.97 ^b \pm 1.08 (40)	44.17 ^a \pm 1.76 (15)	40.42 ^b \pm 1.75 (15)	48.44 ^c \pm 1.75 (15)	44.70 ^d \pm 1.76 (15)
Hairy	51.44 ^a \pm 1.80 (24)	65.25 ^b \pm 1.93 (20)	59.44 ^c \pm 2.52 (16)	55.34 ^a \pm 2.16 (20)	62.08 ^b \pm 1.39 (40)	58.45 ^a \pm 2.27 (15)	56.33 ^a \pm 2.27 (15)	60.56 ^a \pm 2.27 (15)	59.51 ^a \pm 2.27 (15)
Kemp	81.62 ^a \pm 2.04 (24)	86.01 ^a \pm 2.19 (20)	84.23 ^a \pm 2.86 (16)	78.23 ^a \pm 2.45 (20)	89.67 ^b \pm 1.58 (40)	83.69 ^a \pm 2.57 (15)	77.84 ^b \pm 2.58 (15)	88.61 ^c \pm 2.57 (15)	85.67 ^d \pm 2.57 (15)

Similar superscripts of quality parameters for breed, sex and body site in a row indicate that observations do not differ significantly from each other. Figure in parenthesis indicate number of observations.

like breed and body sites significantly ($P < 0.01$) influenced the staple length, whereas sex effect was non-significant. The mean hair diameter of Bikaneri breed was minimum followed by Jaisalmeri and Kachchhi. Gupta *et al.* (1989) found large variability in mean fibre diameter of camel hair. The mean hair diameter of male camel was lesser than that of female camel. The mid site of body region had lowest hair diameter followed by shoulder and neck whereas hump region had the highest diameter. The least square analysis indicated significant ($P < 0.01$) effect of all factors, viz. breed, sex and site on hair diameter. The mean hair diameter for pure, hetro, hairy and kemp revealed that the pure fiber had minimum hair diameter followed by hetro, hairy and kemp in all 3 breeds. A similar trend was observed in both sex and at 4 sites of body region of camel. The Bikaneri breed showed minimum

diameter of all types of hair followed by Jaisalmeri and Kachchhi camels. The ascending order of mean diameter in all types of hair was mid-site, shoulder, neck and hump region. The overall hair diameter (micron) were 37.07 ± 0.78 , 44.44 ± 0.95 , 58.72 ± 1.23 , 83.96 ± 1.39 for pure, hetro, hairy and kemp type hair, respectively. The factors like breed and sex had significant ($P < 0.01$) effect on pure, hetro, hairy diameter, whereas body site significantly ($P < 0.01$) influenced pure, hetro and kemp, but non-significant for hairy type.

The least squares means along with standard errors for different composition of hair are presented in the Table 3. From all camel breeds the overall percentage of hair types pure, hetro, hairy and kemp type was 29.27 ± 0.80 , 44.03 ± 0.65 , 24.14 ± 0.75 and 2.53 ± 0.20 , respectively. The breed significantly ($P < 0.01$) affected the hair type

Table 3. Least squares mean \pm SE values for different composition of hair

	Breed			Sex		Site			
	Bikaneri	Jaisalmeri	Kachchhi	M	F	Shoulder	Mid	Hump	Neck
Pure	27.03 ^a \pm 1.17 (24)	27.54 ^b \pm 1.26 (20)	33.26 ^c \pm 1.65 (16)	28.85 ^a \pm 1.41 (20)	29.69 ^a \pm 0.91 (40)	28.52 ^a \pm 1.48 (15)	33.16 ^b \pm 1.48 (15)	29.96 ^c \pm 1.48 (15)	25.46 ^d \pm 1.48 (15)
Hetro	46.06 ^a \pm 0.95 (24)	38.68 ^b \pm 1.01 (20)	47.34 ^c \pm 1.32 (16)	45.34 ^a \pm 1.14 (20)	42.72 ^a \pm 0.73 (40)	44.95 ^a \pm 1.19 (15)	40.50 ^b \pm 1.19 (15)	44.95 ^c \pm 1.19 (15)	45.71 ^d \pm 1.19 (15)
Hair	24.64 ^a \pm 1.10 (24)	31.20 ^b \pm 1.18 (20)	16.58 ^c \pm 1.54 (16)	23.61 ^a \pm 1.32 (20)	24.66 ^a \pm 0.85 (40)	24.84 ^a \pm 1.38 (15)	24.22 ^a \pm 1.38 (15)	22.22 ^a \pm 1.08 (15)	25.27 ^a \pm 1.39 (15)
Kemp	2.30 ^a \pm 0.29 (24)	2.51 ^a \pm 0.31 (20)	2.77 ^a \pm 0.41 (16)	2.14 ^a \pm 0.35 (20)	2.88 ^a \pm 0.23 (40)	1.67 ^a \pm 0.37 (15)	2.03 ^b \pm 0.37 (15)	2.82 ^c \pm 0.37 (15)	3.58 ^d \pm 0.37 (15)

Similar superscripts of quality parameters for breed, sex and body site in a row indicate that observations do not differ significantly from each other. Figure in parenthesis indicate number of observations.

composition, whereas the sex factor had non-significant effect on all hair types. The body site was having a significant ($P < 0.01$) effect on per cent composition of pure, hetro and kemp type of hairs, but it had a non-significant effect on hairy type fiber (Table 3). The mid site of body region had finest hair diameter followed by shoulder, neck and hump region (Table 2) and this body region of all breeds of Indian camel showed maximum percentage of pure hair, whereas neck region had maximum hetro, hairy and kemp hair type (Table 3). The lowest percentage of kemp fiber was observed in Bikaneri breed of camel (Table 3). Male camel of all breeds had finer hair diameter than that of female (Table 2). Some of the traditional weavers charge Rs. 15 per kg for yarn making and Rs. 40 per kg for making carpets and blankets. These carpets and blankets are very cheap having life of 50 and 15 years, respectively.

It can be concluded that Bikaneri breed is superior in hair quality attributes as compared to Jaisalmeri and Kachchhi camel,

but per cent pure hair types are more in Kachchhi camels. Three-year-old male Bikaneri breed camel produced higher annual hair yield as compared to other age, sex and breed groups. The potentiality of camel hair production indicate scope for preparation of blends of camel hair with other natural and synthetic fibers in addition to its traditional use under village conditions. For improving the hair productivity efforts need to be made to select superior males within Bikaneri breed of dromedary camel.

References

- Bhakat, C., Mehta, S.C. and Sahani, M.S. 2002. Studies on hair production attribute in Indian dromedary camel managed in an organized farm. *Indian Journal of Animal Sciences* 72(3): 275-276.
- Gupta, N.P., Patni, P.C. and Sugumar, S. 1989. Properties and processing of camel hair in India. *Indian Textile Journal* 99(4): 180.
- Gupta, N.P., Pokharna, A.K., Arora, R.K. and Sugumar, S. 1987. Mechanical processing of wool, speciality hair and their blends. *Annual Report 1987*, CSWRI, Avikanagar.
- Harvey, W. 1987. *Mixed Model Least Squares and Maximum Likelihood Computer Programme*.

- United States Department of Agriculture, New York.
- Khanna, N.D. and Rai, A.K.1991. Camel rearing in the Indian arid zone. *Annals of Arid Zone* 30(1): 1-10.
- Mukasa, E. 1981. *A Bibliographical Review*. International Livestock Centre for Africa, P.O. Box 5689, Addis Ababa, Ethiopia.
- Patni, P.C. and Dhillon, R.S. 1988. Areas and prospects of utilization of camel hair and hide. *National Seminar on Perceptions and Potentials of Camel Research in India*, 9-10 October 1988, NRCC, Bikaner.
- Sahani, M.S. and Khanna, N.D.1993. The camel fiber and its prospective utility. *National Seminar on Production and Utilization of Animal Fibers*, Bikaner, December,13-14, 1993.
- Yadav, B., Mishra, B.P., Bhakat, C. and Sahani, M.S. 2000. Hair quality attributes of *Camelus dromedarius*. *Indian Journal of Animal Sciences* 70(2): 211-212.