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Morphological, Phenotypic and Performance Traits of Bakarwal Goats in Poonch District of Jammu and Kashmir

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ABSTRACT: A preliminary field survey was undertaken in Poonch district of Jammu and Kashmir to study Bakarwal goats. The goat is mainly reared by nomadic community of Poonch and Rajouri districts namely Gujjar, Bakerwals and Pahari tribes for mutton. This goat population is migratory in nature and the Bakerwal goat breed is highly variable with respect to morphological and production traits. The overall least squares means of 33.63±0.31 cm, 31.43±0.54 cm, 29.57±0.41cm and 2.99±0.07 kg for body height (BH), chest girth (CG), Paunch girth (PG) and birth weight (BW) in Bakawal kids were observed in current study. Similarly, overall least squares means (cm) of 22.54±0.10, 24.40±0.15, 9.59±0.06, 76.74±0.21, 74.37±0.20, 71.84±0.23, 76.20±0.15, 15.98±0.51 and 16.28±0.28 for face length (FL), ear length (EL), ear width (EW), body height (BH), chest girth (CG), body length (BL), paunch girth (PG), tail length (TL) and horn length (HL). The effect of sex and age was highly significant on all the traits with sexual dimorphism in favour of males. It is concluded that Bakarwal goat is an important goat genetic resource of country adapted to management and harsh environment of Jammu and Kashmir. Further, this is heaviest goat genetic resource of union territory of Jammu and Kashmir.

Keywords: Bakarwal kids, Biometric traits, Migratory, Pahari tribes, Poonch.

INTRODUCTION

Rearing of goats is a traditional practice in Jammu and Kashmir (J&K). The tribals *viz. Bakerwals, Gaddies* and *Changpas* have developed professionalism goat rearing in union territory (UT) of J&K. Changthangi (Shanaz *et al.,* 2020), Malra (Rather *et al.,* 2020a), non-descript goats, reared in Kashmir valley (Rather *et al.,* 2020a); Bakerwal (Rather *et al.,* 2022) are important goat genetic resources of J&K. Bakerwali goats have migrated from central Asia along with nomads and subsequently established in Kaghan Valley of Pakistan and sometimes called as Kaghani goats. This goat breed is highly variable with respect to morphological, production and reproduction parameters. Bakarwal goats are large and robust with huge structure when compared to other goats of J&K. Bakarwal goat shows high feed conversion and reproductive efficiency and they are distributed in hilly tracts of Poonch, Jammu, Rajouri, Udhampur and Kathua of Jammu and Kashmir (Rather *et al.,* 2022) and valley of the Hazara district of Pakistan (Anonymous, 2021). Bakarwal goat is mainly reared by nomadic community of Poonch and Rajouri districts namely; Gujjar, Bakerwals and Pahari. Bakerwali goats have migrated from central Asia along with nomads and subsequently established in Kaghan Valley of Pakistan and sometimes called as Kaghani goats (Anonymous, 2021).

Fig. 1-2. Bakerwal goat male (left) and female (right).

Fig. 3. Bakarwal Goat Flock.

MATERIALS AND METHODS

A field survey has been conducted in Poonch district of J&K to study the morphological, phenotypic and performance traits in Bakarwal goats. The goat is mainly reared by nomadic community *viz*., Gujjar, Bakerwals and Pahari tribes inhibiting from Rajori, Poonch, Reasi, Kathua and Samba districts of J&K. Poonch is a remote district (Swami and Sharma 2019) of UT of J&K, situated on LOC (Line of Control) between 33°25' to 34º01' N latitude and between 73°58' to 74º35' E longitude. It is surrounded by Baramula, Budgam, Shopian and Kulgam districts of Kashmir Valley in the north-east, Rajouri district in the south and POK in the west. Topography of Poonch is hilly and mountainous (Yadav *et al.,* 2017) and these mountains are forming many low lying beautiful valleys. The elevation varies starting from 800 m at Balnoi to 4,750 m at Pir Panjal. The sky touching peaks roofed with shining snow and lush green pastures give stunning scenery to Poonch. Pir Panjal range of mountains separates Poonch Valley from Kashmir Valley. Some important features of Poonch Valley are summarized in Table 1. The Bakarwals of Poonch district alternate with the seasons between high and low altitudes mainly follow a migration route through the foothills of the Himalayas of Kashmir.

1. Climate of Poonch: The climate of Poonch is humid subtropical with short and pleasant summers. However, at some places like Mandhar, hot conditions occur during the summer (Mughal *et al.,* 2017). The January is the coldest month in Poonch and rise in temperature is usually observed from mid March and maximum temperature is observed during the month of May. The winters are cool and rainy due to western disturbances and freezing nights are observed during January. Poonch observes on an average rainfall of 1389 mm with 56 to 73 days of rainfall annually. Maximum rain fall is observed during the monsoon and the month of March. January and February are the coldest months whereas May, June and July are hottest months with the variation of 20° to 40°C in average temperature.

2. Soil types of Poonch: The mountainous topography limits the development of soil. Therefore, mostly sub-mountainous and meadow soil are observed in Poonch with localized blocks of alluvial soil in some valleys near rivers. However, (Sudan *et al.,* 2022) reported loamy type of soil is present in the Poonch district.

3. Agriculture in Poonch: Agriculture is considered to be primary economic activity of sheep farmers of Poonch to meet the household necessities. Mixed crop-livestock farming system is practiced in Poonch district. The farmers are small and marginal with average land holdings of 3.95 kanal/farmer. Maize (Zea mays as stable crop), paddy and wheat are most important cereal crops cultivated by farmers in Poonch. The favourable agro climatic conditions in Poonch district are ideally suited for cultivation pear, peach, apricot and plum. Walnut is also an important dry fruit of Poonch.

Table 1: Some Important Features of Poonch Valley.

Sr. No.	Particular	Status
1.	Headquarter	Town of Poonch
2.	Tehsils	Balakote, Heveli, Mandi, Mankote, Mandhar, and Surankote
3.	Blocks, villages and municipalities	11, 178 and 2, respectively
4.	Total area	1674 Km^2
5.	Elevation	981 metres (3218 feet)
6.	Total population	476835
7.	Density	280/Km^2
8.	Urban	8.1
9.	Sex ratio	893/1000 (F/M)
10.	Literarily	66.74%
11.	Languages (Spoken)	Gojri, Pahari, Urdu, Kashmiri, Punjabi
12.	Languages (Official)	English, Hindi and Urdu
13.	Sheep breeding farm	Govt. Sheep Breeding Farm Balnoi (For production of elite Rambouillet germplasm for crossbreeding of native sheep of Jammu province)
14.	Major highways	NH-144A
15.	Forest cover	26689.84 Hectare
16.	Forest	951sq.km

Information/data on body weight and different body biometric parameters *viz.* body height (BH), chest girth (CG) and paunch girth (PG) in kids and face length (FL), ear length (EL), ear width (EW), body height (BH), chest girth (CG), body length (BL), paunch girth (PG), tail length (TL) and horn length (HL) were analyze by Harvey statistical software with age and sex as fixed factors. The age was determined by history and dentition. The animals with temporary set of incisors were divided in four groups *viz.* kids, three months age group, six months age group and twelve months age group based on farmers submission. The animals with 2, 4,6 and 8 permanent incisors were considered having two years, three years, four years and above, respectively.

RESULTS AND DISCUSSION

1. Origin, distribution and breeding tract: The bakarwal goat is scattered in hilly tracts of Poonch, Jammu, Rajouri, Udhampur and Kathua of UT of J&K. The breed originated from the valley of the Hazara district. They are also found in the North-West Frontier Province of Pakistan. The goat is named for its main home Kaghan valley. This goat is also known locally in poonch as Pahari goat and Desi goat.

2. Tribe responsible for rearing of Bakerwal goat: The Bakerwal goat is mainly reared by nomadic tribe *viz.* Bakerwal, Pahari and Gujjar tribes inhibiting at Pir Panjal and Himalayan mountains of South Asia. They are mainly goatherds and shepherds called as Dhangar in rest of India. They have developed perfect professionalism in Sheep & Goat rearing practice transhumance pastoralism, that involves cyclic movements from lowlands to highlands, to take advantage of seasonally available pastures at different elevations in Himalayas, Results relating to the socio-demographic and socio-economic status of the Bakarwal goat rearing families in Poonch are male dominated, illiterate belonging to middle age group (40–60 years), low social participation but had high experience in goat farming. Further, the farmers were mostly illiterate possessing low to marginal land holdings.

3. Management practices: This goat population is migratory in nature. With the beginning of summers every year, the nomadic tribes of Poonch, Rajouri etc. along with sheep and other livestock species migrate to upper ranges of Himalayas (Kashmir Valley and its environs *viz.* Wardwan Valley, Kargil, Gurez, Kishtawar, Doda, Badarwah) through various mountain passes (Gallis and Dheras) to highland pastures of Kashmir Valley and Poonch associated with Kashmir. After the grazing season is over the nomads return back along with the livestock through same routes during autumn season. During winters the livestock is managed using grazing during day and stall feeding during nights on dry fodders was prepared from wild grasses, straw of maize, wheat and mixed jungle hay, natural dry fodders, tree loppings and pods of leguminous plants. As the mountainous area soils deficient in essential minerals like sodium, iodine, phosphorous etc, therefore sheep are provided iodized salt throughout the year at regular intervals. The most common diseases in the area are peste des petitis ruminants, foot and mouth disease, pox and foot rot and the health facilities are provided by the Department of Sheep Husbandry.

4. Physical characteristic of Bakarwal goat: The Bakarwal goat is large, strong and robust in appearance having long hairs uniformly distributed throughout body particularly on the neck region, abdomen, hind limbs and tail. This goat is highly variable in coat colour and the coat colours are white, black, brown, grey, pie bald, skew bald, spotted animal etc. The goat possesses long, upward and laterally directed spiral horns and the horn length increases with the age. Aged animals posses longer horns than younger animals, although some individuals of this breed are even polled. The overall horn length of 16.56±0.28 cm (Table 2) was observed in the present study. The head profile of this goat is convex with narrow face and a quite mobile lower lip. The overall face length of 21.65±0.10 cm (Table 2) was observed in the present study. The face and horn length presented an increase with age. Beard is present both sexes. Tail is short with a tuft of hair and legs are long and stout.

5. LSM of biometric traits in Bakarwal goat: Morphological traits and body weight provides imperative evidences of breed standard, morphological structure and developmental ability of the animals. The least squares means for different biometric traits of Bakarwal goat are reflected in Table 2. Bakarwal goats are large and robust animals having distinctive long, upward and laterally directed spiral horns of average length of 16.28±0.28 cm. Dixit *et al.* (2013) reported average horn length of 13.73±1.29 cm and 11.89±0.40 cm in adult male and female Surti goats. Horn length of 12.31±0.71 cm was observed by Rather *et al.* (2020) in Kashir goat. The Bakarwal goats possess narrow face of overall length of 22.54±0.10 cm. Lower estimates for FL were reported by Dixit *et al.,* (2013) in Surti goats and Rather *et al.* (2020) in Kashmiri goat. These goats possess long and drooping ears with overall EL of 24.40±0.15. Lower estimates for EL were reported by Rather *et al.* (2020) in Kashir goat. Waiz *et al.* (2018) in Sirohi Goats reported that the overall estimates for body weights of 2.50 ± 0.39, 11.21 ± 0.36, 15.29 ± 0.41, 18.00 ± 0.57 and 21.86 ± 0.77 kg at birth, three, six, nine and twelve months of age, respectively. However, lower values for body weight and different body biometric traits were reported by Bhusan *et al.* (2012) in Jakhrana goats, Patil *et al.* (2013) in Sangamneri goats, Alex *et al.* (2010) in Malabari goats, Tyagi *et al.* (2013) in Surti kids. Sex of animal had significant effect ($P \leq 0.05$) on all the studied biometric traits except FL with sexual dimorphism in favour of males. These results were agreement with the finding of Dudhe *et al.* (2015); Kharker *et al.* (2014); Pathodiya *et al.* (2004). However, the non-significant effect of sex on CG, BH and BL was reported by Kharker *et al.* (2014). The results with respect age factors were in consonance with Rather *et al.* (2020) in Kashir Goat. Alam *et al.* (2023) reported overall lower estimates for Purgi goats in different age groups from birth to 24

months with respect to BH, BL and PG, since Purgi goat is dwarf goat population, therefore, the difference is prominent Sahoo *et al.* (2018) in Black Bengal reported lower for PG and BL traits. Birari *et al.* (2018) also reported lower overall estimate for body weight traits from 3, 6 and 12 months in Sangamneri breed. Haldar *et al.* (2014) reported similar values for PG and lower estimate for EL in Black Bengal. Jasmine *et al.* (2022) reported lower estimates for body weight from birth to 12 months of age in Black Bengal goat. Lower estimates for HL, FL and BL in Kotdhar goat were observed by Dinesh *et al.* (2024). Kuralkar *et al.* (2013) reported high mean estimate for CG and PG and low mean estimate in BL, HL, EL and TL in Berari goats. Rather *et al.* (2022) reported low mean estimate in Kashmiri goat for the traits; EL, BL, BH and TL and also reported similar mean estimate for BW and CG. Raskar *et al.* (2018) reported least squares means as low for EL and HL and high for CG and BL in Osmanabadi goat breed. Roy *et al.* (1997) reported similar mean estimate for birth weight and low mean estimate for 3, 6 and 12 months in Jamunapari goat.

6. Reproduction traits: Age at first kidding is of 18 to 24 months and gestation period of 147 to155 days was reported by farmers. More or less similar estimates for reproduction traits were reported by Rather *et al.* (2020b); Alam *et al.* (2023).

7. Constraints and threats: The males attain higher body weights at different ages. However, male animal are sold for meat at younger ages (1.5 to 2.5 years). Crossbreeding with Beetal through AI (artificial insemination) is main threat**. The farmers reported an average milk production 0.75 litter milk/ animal/ days which is sufficient** for kids. The farmers rearing this goat prefer buffalo milk over goat milk. This may be one reason for low milk production of this goat. As no selection pressure has been applied for selection for milk traits. Further, scarcity and high cost of feed and fodder during winter season and lack of scientific houses with provision of adequate light and ventilation for livestock are important constraints which constrain goat development. Random mating and lack scientific knowledge regarding management, feeding and breeding along with non-availability of good quality sires are also among constraints which impede goat development. Goat breeding farms need to be established by the Department of Sheep Husbandry in its breeding tracts on the lines as established for Kashmir Merino sheep to make this goat viable for both milk and chevon traits.

Table 2: Least square means of for body weight and body measurements of Bakarwal goats.

Particulars	N	HL (cm)	FL (cm)	EL (cm)	EW (cm)	BH (cm)	CG (cm)	BL (cm)	PG (cm)	TL (cm)	BW (kg)
Overall	309	16.56±0.28	21.65±0.10	23.630±0.15	9.14±0.06	71.35±0.21	69.00±0.20	66.89±0.23	70.37±0.15	15.74±0.51	36.15±0.58
Sex		0.000	0.231	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Male	111	20.44±0.52	21.89±0.19	25.42±0.18	10.35±0.08	73.26±0.40	73.11±0.37	67.04±0.44	71.91±0.17	15.77±0.60	38.09±1.12
Female	198	12.12±0.36	21.41±0.11	21.83±0.30	7.92±0.12	69.44±0.24	64.88±0.23	66.73±0.27	68.83±0.28	15.71±0.69	34.20±0.68
Age		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Birth			15.37±0.63	18.20±0.65	9.09±0.18	33.63±0.31	31.43±0.54	31.83±0.36	29.57±0.41	14.01±0.55	2.99±0.07
3M	54	8.34±0.85	19.38±0.19	20.70±0.45	7.54±0.19	68.75±0.40	61.25±0.37	60.00±0.44	53.46±0.44	14.38±0.98	15.00±1.12
6M	26	9.38±0.54	21.58±0.29	23.10±0.24	7.54±0.19	69.41±0.63	68.38±0.59	67.65±0.66	68.75±0.28	15.87±0.55	20.05±1.76
12M	26	11.66±0.85	22.17±0.29	23.20±0.34	8.16±0.14	73.09±0.63	69.12±0.59	70.15±0.70	69.04±0.44	16.02±0.55	31.95±1.76
2T	29	18.22±0.44	22.83±0.28	24.38±0.30	9.49±0.10	74.41±0.60	79.12±0.56	74.95±0.36	79.71±0.32	16.35±0.48	49.95±1.29
4T	87	23.61±0.44	23.42±0.22	25.70±0.47	11.29±0.20	80.20±0.32	79.46±0.31	75.15±0.51	85.96±0.42	16.41±0.80	52.35±0.91
6T	58	20.53±0.63	23.52±0.28	26.80±0.47	12.46±0.20	84.41±0.46	82.62±0.43	77.35±0.70	88.01±0.23	16.42±0.14	56.95±1.68
Fm	29	24.16±0.82	24.89±0.15	26.95±0.45	7.54±0.19	86.91±0.60	80.62±0.56	77.65±0.66	88.46±0.42	16.42±0.48	59.95±1.68

CONCLUSIONS

It is concluded that Bakarwal goat is an important goat genetic resource of country adapted to management and harsh environment of J&K. Further, this is the heaviest goat genetic resource of union territory of Jammu and Kashmir.

FUTURE SCOPE

Future research could focus on implementing genetic improvement programs aimed at enhancing desirable traits in Bakarwal goats. This could involve selective breeding based on morphological and phenotypic characteristics to develop strains with improved performance traits such as higher milk yield, better disease resistance, and increased fertility.

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Conflict of Interest. None.

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