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Effect of year and season on fleece weight of Changthangi sheep

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Abstract
A wool growth study was carried out at MRCSG, Shuhama on Changthangi sheep. The data were obtained from the records of 290 wool samples of Changthangi sheep, maintained at MRCSG, Shuhama. The data were spread over a period of five years i.e., from 2018 to 2022 to evaluate effect of year and season on fleece weight. Year and season were observed to have significant (p<0.05) effect on fleece weight of Changthangi sheep with autumn clip being heavier than spring clip. The objective of this study was to estimate the environmental influences on fleece weights in Changthangi sheep kept in environmental conditions typical for Kashmir Valley.

Keywords: Changthangi sheep, fleece weight, season, year, autumn, spring

1. Introduction
India holds 65.06 million sheep, producing 48.5 m kg of wool. The erstwhile state of Jammu and Kashmir (now UT of J&K and UT of Ladakh) possesses around 3.4 million sheep and is delineated under wool belt having eight well established sheep breeds. Changthangi/*Changluk* sheep is native to cold arid region, Changthang, which lies at an altitude of 3340 to 4560m in the Trans-Himalayan region with temperature ranging from -40 to 40 °C (Ganai *et al*., 2011; Malik *et al*. 2021) [7, 9]. Changthangi sheep are reared by *Changpa* community under transhumance production system. They continuously migrate for winter and summer pastures and *vice versa* for meeting the nutritional demands of their livestock (Malik *et al*. 2022) [22]. The breed has been underrated for its ability to produce wool. The wool quality specifies that it is medium type wool with a mean fibre diameter of about 31.19±0.71 µm with undercoat having a fibre diameter of 14.35 ± 0.50 µm (Malik *et al*. 2021) [9]. Wool quality and quantity traits are very essential as they are the principal indicators of wool production potential of the animal. Fleece weight is very important for evaluating the quantity of clean wool. Production traits are the main criterion for selection of animals. There are many non-genetic factors which influence the phenotypic expression of the wool production of sheep. Therefore, the present study was undertaken with the object to investigate the effect of various non-genetic factors on wool production traits in Changthangi sheep.

2. Material Methods
The data were obtained from the records of 290 wool samples of Changthangi sheep, maintained at Mountain Research Centre for Sheep Goats (MRCSG), Shuhama. The data were spread over a period of five years i.e., from 2018 to 2022. The Mountain Research Centre for Sheep & Goat, Shuhama, is located at 34° 12' N 74° 46'E with an average elevation of 1,619 m (5,312 ft) and is characterized by sub-humid temperate climate with mean annual rainfall of 744 mm and mean annual temperature of 13.4 °C. The farm followed intensive, semi-intensive or extensive system of housing depending upon the season. From April to June (spring season) and September to November (autumn season), semi-intensive system of housing is followed. The animals are left out for grazing during the day and kept confined in the sheds during the night. From June to September (summer season), the animals are reared under extensive/free range system in the alpine pastures wherein they are provided temporary shelters in the form of chain link fencing during night hours. Intensive system of housing is practiced from December to April (winter season).

3. Statistical Analysis
Data generated was subjected to statistical analysis by one-way ANOVA using the General Linear Model procedure of Statistical Package for the Social Sciences, Base 20.0 (SPSS Software products, Marketing Department, SPSS Inc. Chicago, USA) as per the standard procedures (Snedecor and Cochran, 1994) [15]. The significance of difference between means was tested via independent sample t test and post-hoc analysis by Duncan and LSD.

4. Results:
Results pertaining to effect of year and season on fleece weight of Changthangi sheep are presented in Table 1.Year was observed to have significant (p<0.05) effect on fleece weight of Changthangi sheep. Spring clip during the year 2021 was significantly (p<0.05) higher than spring clip of 2018, 2019 and 2020. Although spring clip of year 2021 was comparatively higher than that of 2022 but it was statistically non-significant. Similarly, autumn clip of 2021 was significantly (p<0.05) higher than autumn clip 2018 and 2019 while it had no significant difference with values of 2020 and 2022. The average value of fleece weight (gm), throughout the study period, during autumn season was observed to be 998.65±33.34 which was significantly (p<0.05) higher than in spring season (731.33±28.08).

Table 1: Effect of year and season on fleece weight of Changthangi sheep

Year	Fleece weight (gm)		
	Spring clip	Autumn clip	Average
2018	761.53±55.05 ^{BC} (48)	698.46±37.92 ^{A} (37)	732.23±30.86 ^{A} (85)
2019	655.55±42.80 ^{Ba} (37)	955.55±52.01^{Bb} (34)	794.36±38.94 ^{A} (71)
2020	490.38±44.55 ^{Aa} (26)	1246.15±54.34^{Cb} (23)	842.39±68.15 ^{A} (49)
2021	947.82±79.98 ^{D} (24)	1160.86±61.83^{C} (23)	1029.74±51.48 ^{B} (43)
2022	840.00±52.01 ^{CDa} (20)	1210.00±52.26^{Cb} (19)	1025.00± 46.92 ^{B} (39)
Average	731.33±28.08^{a} (155)	998.65±33.34^{b} (136)	852.35±21.20 (291)

Means across the rows in a same column with different upper case superscript differ significantly (p<0.05)
Means across columns with different lower case superscript differ significantly (p<0.05)
Number in parenthesis indicates number of samples

5. Discussion
In the present study it was observed that year played a significant effect (p<0.05) on fleece weight. The significant effect of year of shearing on fleece weight as obtained in the present study was similar to the early reports in the literature (Blackwell *et al*., 1955; Yazdi *et al*., 1998; Slavova, 2002; Cloete *et al*., 2004; Staikova and Stancheva, 2006; Devendran, *et al*. 2008; Qureshi *et al*., 2010; El-wakil *et al*., 2013; Baba *et al*., 2020) [3, 17, 14, 4, 16, 5, 12, 6, 12]. The disparity in fleece weight among different years may be due to variation in physical environmental conditions, forage availability prevailing in different years for grazing resources, source and time of shearing and sampling etc. Qureshi *et al*. (2013) [11] found non-significant differences due to year of shearing. In our study fleece weight (gm) during autumn season was significantly (p<0.05) higher than during spring season with an average value of 852.35±21.20. Malik *et al*., 2021 [9] reported lower value of fleece weight in Changthangi sheep. Similar findings were reported in New Zealand Romney sheep (Ross, 1964) [13]; Romney, Coopworth, Perendale, Cheviot, and Corriedale sheep (Bigham *et al*., 1978) [2]; Jaisalmeri sheep (Arora *et al*., 2007) [1] and Changthangi sheep (Malik *et al*., 2019) [8] wherein wool growth was better in autumn clip than spring clip. Better yield in autumn clip could be attributed to better feeding at lush green highland pastures during summer months.

6. Conclusion
Year and season play an important role in wool growth as nutrition, weather and other environmental factors vary throughout the years and seasons. All the environmental factors studied in the present investigation had significant effects on fleece weight in Changthangi sheep. Therefore, to obtain any real genetic gain, it is reasonable to consider these environmental factors to estimate the best linear predicted value (BLUP) of animals and selecting animals with the highest breeding value to improve the genetic capacity of the Changthangi sheep which is valued for its exceptional potential to thrive in the harsh environments of Ladakh.

7. Conflict of interest
Authors declare that there is no conflict of interest

8. Acknowledgement
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