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Seasonal Variation in the Epidermal Thickness in the Skin of Indigenous Goat of Assam

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Abstract: ***A comprehensive study on epidermal thickness of Assam indigenous goat were carried out in 23 distinct anatomical body regions in two different seasons viz. summer and winter. In adult Assam indigenous goat the mean thickness of epidermis was found higher during summer than winter values being 63.58 ± 2.721 µm and 57.94 ± 2.902 µm in summer and winter respectively. Also significant regional variation in the epidermal thickness was recorded in Assam indigenous goat. Epidermis was conspicuously thick in the regions of muzzle. The epidermis of the skin on the dorsal aspect of different anatomical was found to be slightly thicker than the lateral and ventral aspects of these regions. The thickness of stratum corneum was highest in the muzzle in both the seasons. However, variation in the thickness of stratum corneum among various regions was non-significant.***

Keywords: epidermis, seasonal variation, skin, stratum corneum and thickness

1. Introduction

Goats play an active role in the socio economic condition of rural people. Goats are well adapted to tropical and subtropical conditions. The skin is one of the most important parts of the body because it interfaces with the environment and is the first line of defense from external factors. The epidermis is composed of the outermost layers of the skin. It forms a protective barrier over the body's surface, responsible for keeping water in the body and preventing pathogens from entering. Though skin and its various aspects have been studied, however literature in respect of seasonal variation in epidermal thickness depicting its regional differences is scanty. Rao Sundara and Singh (1) reported that epidermal thickness was found to have no relationship with skin thickness. Same was also reported by Sharma and Bharadwaz (2), Bhattacharya et al. (3). Hence present study was undertaken to study the region wise variation in the epidermal thickness in the skin of indigenous goat of Assam.

2. Materials and Methods

A total of twelve numbers of apparently healthy goats were studied during summer (June to August) and winter (December to February). Skin samples from 23 anatomically distinct regions were collected from the animals under local anesthesia by shaving the sites. These tissue pieces were processed routinely for paraffin sectioning and sections were stained by Mayer's haematoxyllin and eosin method as per Luna (4). Subsequently measurement of epidermis of these stained sections were done by a Nikon 200 microscope and Image-Pro Express Version-6.0 software. Statistical analysis of data was done as per the method of Snedecor and Cochran (5). The work was carried out under the protocol approved by the institutional ethical committee.

3. Results and Discussion

The thickness of epidermis and keratin layer of different body regions of indigenous goat of Assam in summer and winter were enumerated in Table 1 and Table2.

In adult Assam indigenous goat the mean thickness of epidermis was 63.58 ± 2.721 µm and 57.94 ± 2.902 µm in summer and winter respectively. Epidermal thickness was found higher during summer than winter. However, this variation was non-significant. Kozlowski and Calhoun (6) reported that average total epidermal thickness of sheep skin collected from 35 body areas varied from 27µm to 42µm. Jagiwala et al. (7) reported that in patanwadi sheep thickness of epidermis was 35.117 ± 1.672µm at 1 month of age and 71.740 ± 1.169µm at 16-18 months of age. In Marwari sheep the value recorded at 16-18 month of age was 50.269 ± 1.615µm.

The thickness of epidermis varied significantly among the 23 selected anatomical locations ($P<0.05$) both in summer and winter. Epidermal thickness was recorded highest in perineal region in both the seasons being 98.05 ± 5.47 µm in summer and 91.12 ± 1.981 µm in winter respectively followed by muzzle with micrometrical estimates of 89.69 ± 1.264 µm in summer and 88.42 ± 1.565 µm in winter which was not in consonance with Bagi and Mudholkar (8) who reported the thickness range of muzzle epidermis in surti buffalo to be 299.48 to 454.62 µm and 242.58 to 448.56 µm in young and adult respectively. In the Assam indigenous goat, thickness was recorded lowest in lateral aspect of ear being 44.39 ± 3.275 µm in summer and 35.67 ± 0.871 µm in winter respectively. The epidermis of the skin on the dorsal aspect of different anatomical regions viz. neck, thorax and loin was found to be slightly thicker than the lateral and ventral aspects of these regions. Thickness was also found slightly higher in the lateral aspect of limbs compared to the medial aspect. This was in accordance with Bhayani et al. (9) in lion and Ahmad et al. (10) in Madras Red sheep.

Bhattacharya et al. (3) reported that in yak out of the 46 different anatomical regions, the epidermal thickness was found highest in the abdominal regions (557.53 ± 28.94µm) and lowest in the temporal regions (24.33 ± 0.73µm). Aslan et al. (11) also observed significant differences in terms of the thickness of the epidermis layer between regions like shoulder and abdomen; shoulder and neck; abdomen and neck, and abdomen and thorax ($P<0.05$) and opined that this may be due to differences of environmental factors. Thickness of epidermis was found mainly to be less in neck region but more in abdominal region. The maximum and minimum thickness of skin in Madras Red sheep was recorded by Ahmad et al. (10) on the selected regions of dorsal, lateral and ventral aspect of neck, thorax and loin. They found maximum thickness on dorsal neck region (2925.12 ± 119.00 µm) and minimum on ventral thorax region (1505.25 ± 79.53 µm).

Stratum corneum represented the most important interface between the internal and external environment of the organism (Bhattacharya et al., 12). In the indigenous goat of Assam, the mean thickness of stratum corneum of epidermis was found to be 27.63 ± 1.321 µm and 26.27 ± 1.216 µm in summer and winter respectively. However, Hafez et al. (13) reported that in the skin structure of Egyptian buffaloes and cattle the average thickness of stratum corneum alone was reported 5µm and thickness of epidermis was almost uniform with an average of 51µm in cattle. Bhayani and Vyas (14) stated that in Gir cattle the minimum thickness of stratum corneum and epidermis was found to be 9.98 ± 0.91 µm and 23.68 ± 2.82 µm in back and abdominal regions respectively. The maximum thickness of epidermis and stratum corneum was 13.77 ± 1.37 µm and 35.23±2.89 µm in forehead region respectively. Difference among various regions was non-significant. Thickness of each region did not vary significantly between the seasons. The thickness of stratum corneum was highest in the muzzle in both the seasons and the values recorded were 45.19 ± 3.821 µm and 40.15 ± 1.571 µm in summer and winter respectively. In summer, the lowest value was recorded in neck dorsal region (20.04 ± 0.718 µm), but during winter, lowest thickness was recorded on back region (17.25 ± 2.743 µm)

4. Author's Contribution

Sarma conceived and designed the review. Pathak executed the experiment and analyzed the data. Both the authors interpreted the data and critically revised the manuscript.

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Table 1: Micrometry of epidermal thickness (µm) of different anatomical locations of adult indigenous goat of Assam

Anatomical locations	*SUMMER*		*WINTER*	
	MEAN	*±SE*	*MEAN*	*±SE*
Forehead	54.57[a]	2.693	46.30[b]	0.980
Muzzle	89.69[a]	1.264	88.42[b]	1.565
Face	50.87[a]	1.836	43.41[b]	1.431
Ear	**44.39[a]**	3.275	**35.67[b]**	0.871
Neck dorsal	61.86[a]	2.626	56.33[b]	1.334
Neck lateral	58.09[a]	2.910	48.83[b]	1.539
Neck ventral	52.77[a]	1.720	48.71[b]	0.675
Back	65.70[a]	3.308	64.56[b]	1.213
Chest lateral	64.34[a]	1.222	56.84[b]	0.816
Chest ventral	61.90[a]	3.494	50.88[b]	2.025
Axilla	72.69[a]	1.996	73.12[b]	2.043
Arm	68.44[a]	2.456	68.42[b]	2.825

Forearm lateral	78.24a	4.405	68.31[b]	1.888
Forearm medial	71.82[a]	3.110	60.30[b]	2.672
Loin	66.90[a]	1.281	57.09[b]	1.671
Abdomen lateral	60.28[a]	1.836	51.56[b]	3.091
Abdomen ventral	56.87[a]	2.324	50.26[b]	0.880
Croup	49.39[a]	0.790	48.41[b]	2.665
Thigh	49.97[a]	2.601	49.89[b]	5.376
Groin	48.51[a]	2.045	42.59[b]	2.114
Leg lateral	72.84[a]	2.430	67.22[b]	2.480
Leg medial	65.13[a]	1.060	63.38[b]	1.121
Perineal	**98.05[a]**	5.470	**91.12[b]**	1.981
TOTAL	**63.58**	**2.721**	**57.94**	**2.902**

Values bearing different superscripts varied significantly ($P<0.05$).

Table 2: Micrometry of thickness (µm) of stratum corneum of different anatomical locations of adult indigenous goat of Assam

Anatomical locations	SUMMER		WINTER	
	MEAN	±SE	MEAN	±SE
Forehead	22.58	1.084	22.33	2.575
Muzzle	**45.19**	3.821	**40.16**	1.572
Face	30.78	2.839	28.76	2.280
Ear	20.29	1.241	18.27	0.542
Neck dorsal	**20.04**	0.718	17.97	1.148
Neck lateral	32.25	1.248	28.76	0.980
Neck ventral	20.07	1.008	18.06	0.573
Back	22.52	0.959	**17.25**	2.743
Chest lateral	20.32	0.882	19.98	0.964
Chest ventral	40.94	5.012	21.83	2.009
Axilla	28.27	1.096	26.15	1.548
Arm	26.74	0.654	26.51	1.725
Forearm lateral	28.27	1.863	33.37	1.751
Forearm medial	25.48	1.041	32.06	1.485
Loin	28.25	0.908	29.47	1.276
Abdomen lateral	22.47	1.227	23.50	0.946
Abdomen ventral	29.76	0.655	30.35	1.998
Croup	28.63	1.323	26.38	0.849
Thigh	26.50	1.101	26.32	0.881
Groin	26.95	1.145	24.86	0.935
Leg lateral	29.08	0.717	32.81	1.678
Leg medial	25.69	0.745	28.70	1.514
Perineal	34.36	2.227	30.48	1.516
TOTAL	27.63	1.321	26.27	1.216