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## Comparative study on distribution of sebaceous glands in skin of Vechur and Crossbred cattle of Kerala

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### Abstract

Histomorphological studies were conducted on the skin of crossbred and Vechur cattle and the sebaceous glands were compared. Skin samples of 1 cm<sup>2</sup> size were collected from 15 different regions *viz.*, dorsal, ventral and lateral regions of head, neck, abdomen and tail respectively and muzzle, interdigital region of fore and hind limbs. Standard procedures were adopted for histoarchitectural and histochemical studies. The sebaceous glands appeared as simple, branched, or compound alveolar glands dispersed within the dermis. In certain regions, a single gland was associated with a single hair follicle, whereas in others, two glands were linked to a follicle of hair. In both cattle breeds, the muzzle lacked sebaceous glands. In the head and neck regions, the number of sebaceous glands was greater on the dorsal side, and this varied significantly from the lateral and ventral regions ( $p \leq 0.05$ ). In the abdomen region, the number of sebaceous glands was higher on the lateral side, and this varied significantly from the dorsal and ventral regions. In the tail region, the number of glands was higher on the lateral side, but there was no significant variation compared to other regions in both groups of animals. When the sebaceous glands were compared between both the groups of animals, in the head, neck, abdomen, interdigital forelimb and hindlimb, the number of sebaceous glands showed significant variation and was more abundant in Vechur cattle than in crossbred cattle ( $p \leq 0.01$ ). Sebaceous glands were more abundant in the interdigital forelimb compared to the hindlimb and exhibited significant variation ( $p \leq 0.01$ ) between the limbs. When comparing the number of sebaceous glands per field under low-power magnification of the microscope across different body areas, they were most abundant in the lateral abdomen compared to other regions in both groups of animals.

**Keywords:** Sebaceous glands, skin, crossbred cattle, Vechur cattle, Kerala

### Introduction

Among the native cattle breeds found in Kerala, the Vechur stands out as a dwarf cattle breed, recognized as the smallest in the world. Vechur cows are renowned for their resistance to diseases and ability to withstand heat, surpassing that of crossbred cattle. The skin, serving as the body's largest organ, plays a vital role in environmental interaction. It performs essential functions, such as acting as the primary defense against harmful microorganisms, preventing excessive water loss, and regulating body temperature through thermoregulation. A thorough examination of the integument is crucial for diagnosing skin-related health issues. However, there is a scarcity of literature on the sebaceous glands in the skin in Vechur and crossbred cattle, hence prompting the current study.

### Materials and Methods

For histological studies, fresh tissue pieces were collected from different regions of the skin and fixed in 10 percent neutral buffered formalin. Paraffin sections of 5-6 $\mu$ m thickness were obtained from the tissue pieces and subjected to following routine and special histological staining methods.

1. Haematoxylin and eosin (H&E) staining technique for routine histological studies <sup>[1]</sup>.
2. Crossman's Modification of Mallory's triple Stain for collagen and muscle fibres <sup>[2]</sup>.
3. Gomorie's one step trichrome method <sup>[2]</sup>.

The morphometric and micrometric data were analysed statistically <sup>[3]</sup> using software (SPSS version, 24). Independent-t-test was done to test the difference if any between the number of sebaceous glands in Vechur and cross breed cattle. Comparison between the dorsal, ventral and lateral regions within the head, neck, abdomen and tail was done by using repeated measure analysis of variance technique (ANOVA) followed by least significant difference test <sup>[4]</sup>.

In case of interdigital forelimb and interdigital hindlimb comparison between them was done by using paired t-test.

## Results and Discussion

The sebaceous glands appeared as simple, branched, or compound alveolar glands dispersed within the dermis. In certain regions, a single gland was associated with a single hair follicle, whereas in others, two glands were linked to one follicle (Fig. 1). In the skin of goats sebaceous glands were seen near all hair follicles [5]. In cattle, the sebaceous glands surrounded a single primary hair follicle [6]. Sebaceous glands were associated with secondary hair follicles in skin of goat [5]. The excretory ducts of these sebaceous glands emptied into the pilosebaceous canal, situated in the upper part of the primary hair follicles (Fig. 2). It was lined with a stratified squamous epithelium similar to the findings in domestic animal, in pigs, sheep, goat and buffalo [8, 9, 10, 11, 12, 13].

The secretory unit of the sebaceous glands consisted of a dense mass of epidermal cells covered by a connective tissue sheath that fused with the surrounding dermis. At the basal part of the sebaceous glands, a single layer of squamous cells rested on a basement membrane (Fig. 3). Numerous mitotic cells were observed within this layer. In the central area of the glands, large polygonal cells with lipid droplets in cytoplasm and shrunken nuclei were visible. Cells near the ducts exhibited pyknotic nuclei. The ducts of the sebaceous glands were lined with a simple cuboidal epithelium (Fig. 4). In both cattle breeds, the sebaceous glands were not seen in muzzle. These observations concur with the earlier reports in cattle [14] and in deer, sheep and goat [15].

Sebum served as a protective layer and an insulator against heat. It acted as a barrier to deter foreign microorganisms from entering and helped reduce water loss. It was also considered a precursor for the synthesis of vitamin D [16]. Sebaceous glands were connected with hair follicles and secreted sebum, an oily substance, for moisturizing skin and hair [17].

In the head and neck regions, the number of sebaceous glands was greater on the dorsal side, and this varied significantly from the lateral and ventral regions ( $p \leq 0.05$ ). In the dorsal

region of the head and neck, the number of sebaceous glands showed significant variation and was more abundant in Vechur cattle than in crossbred cattle ( $p \leq 0.01$ ) (Fig. 5). In buffalo, the number of the sebaceous gland/mm were more in dorsal side in the head and neck region but it did not vary significantly from lateral and ventral side [13].

In the abdomen region, the number of sebaceous glands was higher on the lateral side, and this varied significantly from the dorsal and ventral regions. In addition, they were more numerous in Vechur cattle than in crossbred cattle ( $p \leq 0.01$ ). In abdomen, lateral area had significantly higher number of sebaceous glands/mm than dorsal and ventral sides in buffalo [13]. In the tail region, the number of glands was higher on the lateral side, but there was no significant variation compared to other regions in both groups of animals. In tail region, the number of sebaceous glands/mm was significantly higher in lateral area than dorsal and ventral region in buffalo [13].

Sebaceous glands were more abundant in the interdigital forelimb compared to the hindlimb and exhibited significant variation ( $p \leq 0.01$ ) between the limbs. The number of glands in the interdigital forelimb and hindlimb was higher in Vechur cattle than in crossbred cattle and showed significant variation ( $p \leq 0.01$ ) (Fig. 5). When comparing the number of sebaceous glands per field under low-power magnification of the microscope across different body areas, they were most abundant in the lateral abdomen compared to other regions in both groups of animals. There were marked species differences in location, size, shape and number of glands per single hair follicles [5]. The number of sebaceous glands/mm<sup>2</sup> was 2.47 mm<sup>2</sup> and 5.13mm<sup>2</sup> in buffalo and cow respectively [18]. The maximum number of sebaceous gland/mm<sup>2</sup> was found in goat (1.60±0.11), followed by horse (1.27±0.16), cattle (1.25±0.15), dog (1.07±0.17), buffalo (0.98±0.16), whereas the minimum number of sebaceous gland was observed in pig (0.44 ±0.06) [19]. The variations between the number of sebaceous glands in the present study and the reports made by other workers might be attributed to differences in the methods of measurement. In the present study the number of sebaceous glands were measured per field under low power magnification of microscope.

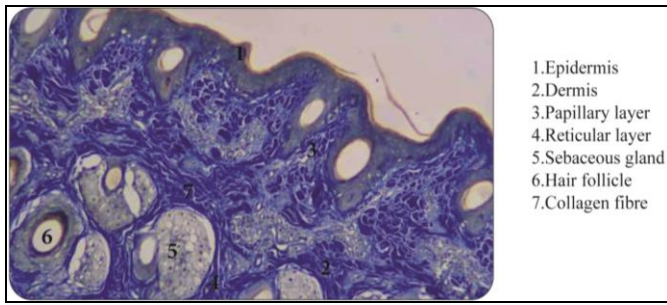
**Table 1:** Comparison of number of sebaceous glands per field under low power magnification of microscope

Number of Sebaceous Glands				
Region		Cross bred	Vechur	t-value (p-value)
Head	Dorsal	7.00 ± 0.73 <sup>a</sup>	12.67 ± 0.88 <sup>a</sup>	3.202** (0.009)
	Lateral	4.50 ± 1.06 <sup>ab</sup>	6.50 ± 1.34 <sup>ab</sup>	1.174 <sup>ns</sup> (0.267)
	Ventral	4.00 ± 1.32 <sup>b</sup>	6.33 ± 0.88 <sup>b</sup>	1.472 <sup>ns</sup> (0.172)
	F-value (p-value)	4.794* (0.035)	5.452* (0.025)	
Neck	Dorsal	11.83 ± 0.95 <sup>a</sup>	15.00 ± 1.63 <sup>a</sup>	3.268** (0.008)
	Lateral	4.67 ± 0.42 <sup>b</sup>	5.33 ± 0.76 <sup>c</sup>	0.767 <sup>ns</sup> (0.461)
	Ventral	6.17 ± 0.95 <sup>b</sup>	9.33 ± 0.67 <sup>b</sup>	2.737* (0.021)
	F-value (p-value)	20.144** (<0.001)	27.677** (<0.001)	
Abdomen	Dorsal	6.67 ± 0.76	5.17 ± 1.28 <sup>b</sup>	1.010 <sup>ns</sup> (0.336)
	Lateral	12.83 ± 0.20	15.00 ± 0.52 <sup>a</sup>	3.274** (<0.001)
	Ventral	4.50 ± 0.76	9.50 ± 0.89 <sup>b</sup>	1.711 <sup>ns</sup> (0.118)
	F-value (p-value)	4.209 <sup>ns</sup> (0.076)	47.982** (<0.001)	
Tail	Dorsal	4.50 ± 0.43	8.00 ± 0.73	4.134** (0.002)
	Lateral	6.00 ± 1.58	11.00 ± 1.79	1.596 <sup>ns</sup> (0.142)
	Ventral	5.83 ± 0.60	7.50 ± 0.56	2.024 <sup>ns</sup> (0.070)
	F-value (p-value)	2.299 <sup>ns</sup> (0.18)	2.312 <sup>ns</sup> (0.150)	
Interdigital Limb	Fore limb	5.67 ± 0.88	10.67 ± 0.67	4.523** (0.001)
	Hind limb	2.67 ± 0.49	4.67 ± 0.33	3.354** (0.007)
	t-value (p-value)	4.392** (0.007)	8.216** (<0.001)	

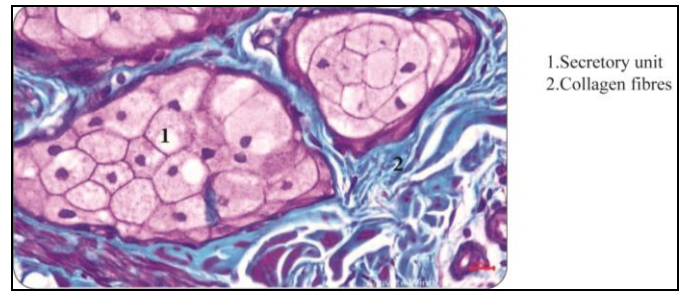
\*\* Significant at 0.01 level ( $p < 0.01$ ); \* Significant at 0.05 level ( $p < 0.05$ );

ns non-significant ( $p > 0.05$ )

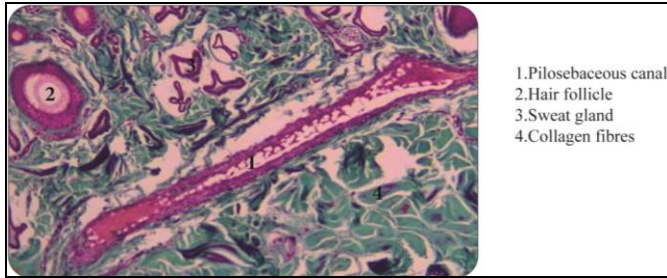
Means having different letter as super script differ significantly within a column within each region



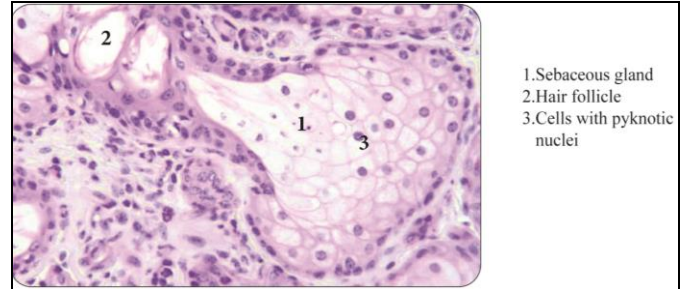
**Fig 1:** Section of skin in dorsal head region in Vechur cattle. Crossman’s modification of mallory’s triple stain x 100



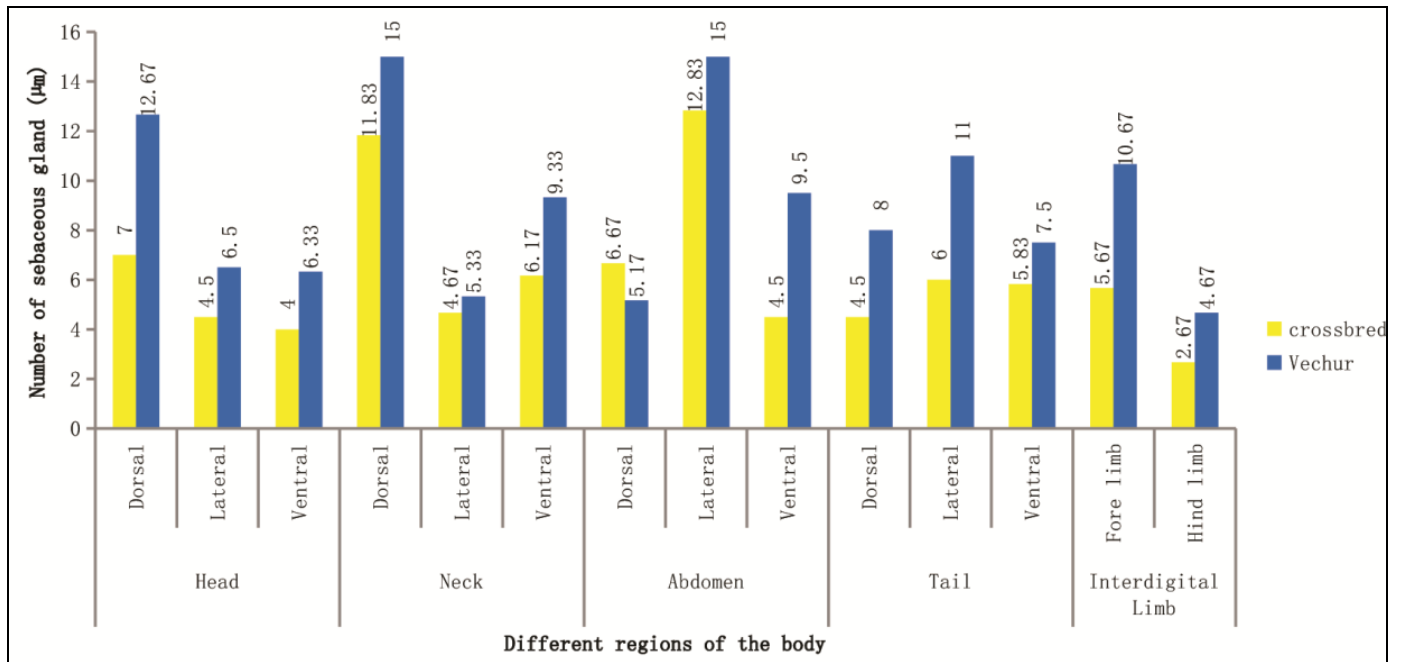
**Fig 3:** Section of skin in dorsal head region showing sebaceous gland in Vechur cattle. Gomorie’s one step trichrome method x40



**Fig 2:** Section of skin in dorsal neck region in Vechur cattle. Gomorie’s one step trichrome method x 100



**Fig 4:** Section of skin in interdigital hindlimb region showing sebaceous glands in Vechur cattle. H & E x 400



**Fig 5:** Comparison of number of sebaceous glands in different areas in crossbred and Vechur cattle.

**Summary and Conclusions**

Histomorphological examinations were carried out on the skin of crossbred and Vechur cattle, to compare the sebaceous glands. The sebaceous glands were observed to be simple, branched, or compound alveolar structures distributed throughout the dermis. The muzzle of both cattle breeds lacked sebaceous glands. In the head and neck areas, there was a higher density of sebaceous glands on the dorsal side compared to the lateral and ventral sides ( $p \leq 0.05$ ). Similarly, in the abdomen region, the lateral side had a higher gland count compared to the dorsal and ventral sides. In the tail region, while the number of glands was greater on the lateral side, there was no significant difference compared to other areas in both groups of animals. A comparison between the two groups revealed significant variations in the number of sebaceous glands in the head, neck, abdomen and interdigital

regions of the limbs, with Vechur cattle exhibiting a higher abundance than crossbred cattle ( $p \leq 0.01$ ). Moreover, the interdigital forelimb had a greater number of sebaceous glands compared to the hindlimb, showing significant variation ( $p \leq 0.01$ ) between the limbs. Under low-power magnification, the lateral abdomen exhibited the highest density of sebaceous glands compared to other regions in both groups of animals. It was concluded that the average number of sebaceous glands was higher in Vechur cattle than in crossbred cattle in various regions of the head, neck and abdomen. Since the sebum served as a protective layer to deter foreign microorganisms and an insulator against heat to reduce water loss. This suggested that the skin of Vechur cattle plays a more significant role in defense mechanism and thermoregulation.



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