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Histomorphological and histochemical studies of the Sebaceous gland of skin of Black Bengal goat

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ABSTRACT:

This study was carried out to see the regional and age-related histomorphological variations of the sebaceous gland of the Black Bengal goat. Study population was divided into pre-pubertal, pubertal and adult age groups. Tissue samples were collected from four anatomical regions; neck, thorax, abdomen and loin each having three sub-regions namely dorsal, lateral and ventral. Samples were examined by using a standard histological technique. The skin of the Black Bengal goat has two layers, the outer epidermis, and the inner dermis. The epidermis is composed of stratified squamous epithelium and comprises 4 layers where stratum lucidum was absent in all three age groups. The dermis comprises two layers, papillary and reticular dermis, and contains skin appendages like hair follicles, sebaceous gland and sweat glands. The diameter of the sebaceous gland doesn't maintain any specific enlargement pattern. The maximum diameter of the sebaceous gland was 26.67±4.6 µm. The density of the sebaceous gland varied among the twelve body regions and was highest in the neck and lowest in the loin region. Among all the twelve regions of the study, the long diameter (LD) of the sebaceous gland is highest (26.67±4.60 µm) in the abdomen lateral and lowest (7.5±5.24 µm) in the thorax ventral sub-region. The short diameter (SD) also maintains a similar pattern; highest (23.33±4.15 µm) in the abdomen lateral and lowest (5.42±4.67 µm) in the thorax ventral sub-region. The sebaceous gland of the neck ventral, thorax dorsal, thorax lateral, thorax ventral, loin lateral, and loin ventral is increased with the advancement of age. Whereas neck dorsal, neck lateral, and abdomen lateral sub-region is decreased with the advancement of age. But the rate is not significant. The present study concerning the sebaceous gland varies significantly according to different anatomical regions and ages. These results could provide significant consideration for the sorting of raw skin to produce quality leather.

Keywords: Black, Bengal, goat, skin, age, sebaceous gland, histomorphology

INTRODUCTION:

Bangladesh is a middle power and developing country in the third world. It has a vast population with limited resources. Livestock is a useful gift of God for this poor country. It plays an important role in the agricultural production system. Statistics show that about 2.9% of the national GDP is covered by the livestock sector and its annual growth rate is 5.5%. About 20% of the population of Bangladesh earns their livelihood through work associated with raising cattle and poultry (Livestock-Banglapedia, 2021). Goats play an important role in the livelihoods of smallholder farmers in Bangladesh as they serve as assets that can be easily liquidated to provide cash in times of need (Akhter *et al.*, 2006). Bangladesh has the second highest population of goats among the Asiatic countries which accounts for about 60.60 million heads representing 57% of total ruminant livestock (Husain, 1993; Amin *et al.*, 2001). Bangladesh has only one goat breed of its own, known as the Black Bengal goat (Paul *et al.*, 2011). The Black Bengal goat is a famous goat breed found throughout Bangladesh, West Bengal, Bihar, and Orissa regions of northeastern India. It is an important animal for the sources of animal meat and skin. There are about 14.8 million goats in Bangladesh. Black Bengal Goat comprises more than 90% of the total goat population; the remaining ones include the Jamunapari and their crosses (Husain, 1993). Though they provide about 30 thousand tons of meat and 20 million square feet of hides and skins, they are perhaps the most

misunderstood and neglected animal species (Amin *et al*., 2000). Skin of animals as a by-product has economic importance as a basic raw material in leather industries (Ozfiliz *et al*., 2002). Like other animals, the skin of goats is used as a raw material in the leather industry. There are about 113 tanneries in Bangladesh that produce 180 million square feet of hides and skins per year which contributes about 10.7% of the total export earnings (Rashid *et al*., 2008).

The Skin (cutis) derived from the Latin word meaning roof is a complex, integrated, dynamic organ having functions as a two-way barrier between the internal and external environment. It is the largest organ system of the body (Dellmann, 1992). The skin making up 12% of the body weight classified as thick or thin, represents a protective cover for the body (Banerjee *et al*., 2009). It consists of the epidermis, dermis, and hypodermis. The dermis is a connective tissue that supports the epidermis and cushions the body from stress and strain. It can be divided into a superficial papillary layer and a deep reticular layer (Dellmann, 1992; Kurtdede, 2002; Mobini, 2012a,b). The dermis was thicker than the epidermis which consists mainly of a multilayer of keratinocytes, hair follicles, sebaceous glands, and sweat glands, it plays important role in the temperature regulation of the body. The hypodermis acts as an energy store and the thermally insulating layer and protects the body from external influence (Mahgoub *et al*., 2010; Dellmann, 1992; Elizabeth and Fredric, 2010). Sebaceous glands are associated with hair follicles and secrete sebum, an oily substance; a form of holocrine secretion, usefulness of these glands is moisturizing skin and hair (Bovell *et al*., 2007). Basic histomorphology and histochemistry of the sebaceous gland of skin is an important aspect to know for better use of skin in leather industries. There is a paucity of information regarding the sebaceous gland architecture of the Black Bengal goats. Because of the lack of studies on this animal, conducting this study is necessary which aims to describe the histological structure and find out the differences of the sebaceous glands of various skin regions of the Black Bengal goats which will help in better selection of the skin in leather industries.

MATERIALS AND METHOD:

Research Animals Selection: Sample selection is an important step for successful research. In this study, a physically sound and healthy Black Bengal goat was selected for the collection of skin specimens for histomorphological study. Skin specimens were collected from 15 apparently healthy goats (05 from each group: pre-pubertal, pubertal, and adult). Sample Collection and Slide Preparation: Fresh intact skin samples (n=15) of Black Bengal goat was collected from different slaughterhouses retail shops, and community centers in the Sylhet Metropolitan area immediately after slaughtering. For the purpose of inter-regional variations of skin architecture representative samples from four major anatomical regions, namely the neck region, thorax region, abdomen region, and loin region were collected. After collection, the samples were preserved immediately in Bouin's fluid in the laboratory of the Dept. of Anatomy and Histology, Sylhet Agricultural University, where the slides were prepared for further histological studies. Microscopic observation: The stained tissue sections of the skin of the Black Bengal goat were studied under a compound binocular microscope (Abota Corporation, USA). The evaluation included the thickness of different layers of skin, density and diameter of the sebaceous gland. Ocular Photo Microscopy: Then Photomicrographs were captured using an Optika C-B5 Fluorescence microscope. Images were captured randomly from different focuses at different magnifications for an individual specimen. Then images were used for result illustrations.

Data Analysis: The data of histometric measurements were processed in Microsoft Office Excel 2010 for analysis. Data of different criteria of the species were analyzed with the help of the model of Analysis of Variance (ANOVA), without replication with all possible interactions like Mean value, Standard Deviation (S.D.). The level of significance was determined with the help of p-value at 95% confidence level and a value less than 0.05 was considered significant. Finally, the results were tabulated.

DECLARATION:

I confirm that the manuscript is the author's original work and the manuscript has not received prior publication and is not under consideration for publication elsewhere. The printer, publisher, and the editorial board are not responsible for the authenticity of this paper.

RESULTS:

Histomorphology of Sebaceous Gland

There are two types of glands embedded in the dermis, the sweat gland, and the sebaceous gland. The pear-shaped sac-like gland associated with or surrounded by the hair follicles and secret lipid substance sebum (Fig 1) is called the sebaceous gland. This gland is composed of sebaceous lobules and sebaceous ducts. They are mostly simple branched alveolar glands of holocrine secretion. This is lined by stratified squamous epithelium. The secretory unit is composed of solid epidermal cell mass enclosed by a connective tissue sheath. The periphery of the epidermal cell mass consisted of a cluster of three to seven polyhedral cells called sebocytes (Fig 1), a single layer of cuboidal cell present on the basal lamina called a basal cell (Fig 1). Another flattened cell present beneath the basal cell is called the myoepithelial cell

(Fig 1). All hair follicle doesn't contain sebaceous gland but all sebaceous gland are associated with the hair follicle (Fig 1). That means hair follicles may or may not contain a sebaceous gland.

Table 1. Long diameter (LD) and short diameter (SD) of sebaceous gland (µm) at different age groups of prepubertal, pubertal and adult in different regions, neck dorsal (ND), neck lateral (NL), neck ventral (NV), thorax dorsal (TD), thorax lateral (TL), thorax ventral (TV), abdomen dorsal (AD), abdomen lateral (AL), abdomen ventral (AV), loin dorsal (LD), loin lateral (LL) and loin ventral (LV) of Black Bengal goat (mean±S.D.).

Region	Age						Variance among different body region
	Prepubertal		Pubertal		Adult		
	LD	SD	LD	SD	LD	SD	
ND	18.13±4.6	13.13±4.2	15±4.68	11.88±4.2	12.5±4.6	9.5±4.20	
NL	25.63±4.6	21.56±4.2	19.38±4.68	16.88±4.2	13.75±4.6	11.56±4.2	
NV	15.0±4.82	11.88±4.3	15.0±4.82	12.25±4.3	16.5±4.82	12.81±4.3	
TD	13.75±4.7	10.94±4.2	15.83±4.73	12.92±4.2	18.33±4.7	15.83±4.2	
TL	10.0±4.98	7.08±4.45	12.5±4.98	9.38±4.45	15.0±4.98	11.87±4.4	
TV	7.5±5.24	5.42±4.67	10.0±5.24	7.92±4.67	13.33±5.2	10.83±4.6	
AD	17.5±5.27	13.75±4.6	21.0±5.27	13.75±4.6	15.0±5.27	11.25±4.6	P=0.1 (NS)#
AL	26.67±4.6	23.33±4.1	20.31±4.6	16.88±4.1	15.31±4.6	12.81±4.1	P=0.1
AV	25.0±4.92	20.75±4.4	17.5±4.92	12.18±4.4	22.5±4.92	17.25±4.4	(NS)##
LD	11.25±4.8	9.38±4.25	18.0±4.85	14.5±4.25	16.0±4.85	13.5±4.25	
LL	14.06±4.7	11.88±4.3	16.67±4.7	14.58±4.3	23.33±4.7	20.0±4.31	
LV	11.25±5.3	8.75±4.86	18.75±5.3	15.0±4.86	25.0±5.3	21.67±4.8	
Variance among 3 age groups							P=0.8 (NS)# P=0.8(NS)##

NS for non-significant difference (p>0.05), # indicates variance of long diameter (LD) and ## indicates variance of short diameter (SD) of sebaceous gland.

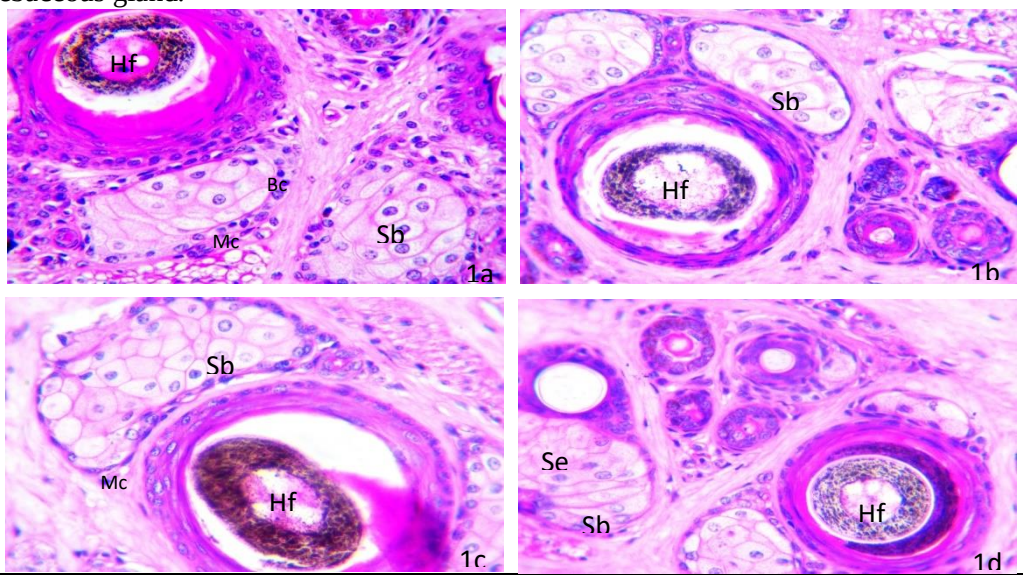

Figure 1. Histomorphological section of skin of Black Bengal goat in neck (1a), thorax (1b), abdomen (1c) and loin (1d) regions showing Sebaceous gland (Sg), Sebocytes (Sb), Sebum (Se), Basal cell (Bc), Myoepithelial cell (Mc) and Hair follicle (Hf). Hematoxylin and Eosin stain, x100.

Pre-pubertal Black Bengal goat

The LD of the neck, thorax, abdomen, and loin dorsal is 18.13±4.6 µm, 13.75±4.7 µm, 17.5±5.27 µm, and 11.25±4.8 µm; neck, thorax, abdomen, and loin lateral is 25.63±4.6 µm, 10.0±4.98 µm, 26.67±4.6 µm, and 14.06±4.7 µm; neck, thorax, abdomen, and loin ventral is 15.0±4.82 µm, 7.5±5.24 µm, 26.67±4.6 µm, and 14.06±4.7 µm, respectively (Table 1). The SD of thorax and loin dorsal is 10.94±4.2 µm and 9.38±4.25 µm; thorax and loin lateral is 7.08±4.45 µm and 11.88±4.3 µm; thorax and loin ventral is 5.42±4.67 µm and 8.75±4.86 µm. Both LD and SD are highest (26.67±4.6 µm and 23.33±4.1 µm) in the abdomen lateral sub-region and lowest (7.5±5.24 µm and 5.42±4.67 µm) in the thorax ventral sub-region (Table 1).

Pubertal Black Bengal goat

The LD of neck dorsal, lateral and ventral is 15±4.68 µm, 19.38±4.68 µm, and 15.0±4.82 µm; thorax dorsal, lateral and ventral is 15.83±4.73 µm, 12.5±4.98 µm, and 10.0±5.24 µm, respectively (Table 1). The SD of the abdomen dorsal, lateral and ventral is 13.75±4.6 µm, 16.88±4.1 µm, and 12.18±4.4 µm; loin dorsal, lateral, and ventral is 14.5±4.25 µm, 14.58±4.3 µm, and 15.0±4.86 µm. The LD is highest (21.0±5.27 µm) in the abdomen dorsal and lowest (10.0±5.24 µm) in the thorax ventral sub-region. The SD is highest (16.88±4.2 µm and 16.88±4.1 µm) in the neck and abdomen lateral and lowest (7.92±4.67 µm) in the thorax ventral sub-region.

Adult Black Bengal goat

The SD of the neck dorsal, lateral and ventral is 9.5±4.20 µm, 11.56±4.2 µm, and 12.81±4.3 µm; thorax dorsal, lateral and ventral is 15.83±4.2 µm, 11.87±4.4 µm, and 10.83±4.6 µm, respectively (Table 5). And the LD of abdomen dorsal, lateral and ventral is 15.0±5.27 µm, 15.31±4.6 µm, and 22.5±4.92 µm; loin dorsal, lateral and ventral is 16.0±4.85 µm, 23.33±4.7 µm, and 25.0±5.3 µm. Both LD and SD are highest (25.0±5.3 µm and 21.67±4.8 µm) in loin ventral and lowest (12.5±4.6 µm and 9.5±4.20 µm) in the neck dorsal sub-region (Table 1).

The density of the sebaceous gland varied among the twelve body regions. The highest density of the sebaceous gland was found in the neck and the lowest in the loin. Among all the twelve regions of the study, the LD and SD of the sebaceous gland are highest (26.67±4.60 µm and 23.33±4.15 µm) in the abdomen lateral and lowest (7.5±5.24 µm and 5.42±4.67 µm) in thorax ventral sub-region. The sebaceous gland of thorax dorsal; thorax and loin lateral; and neck, thorax, and loin ventral is increased, and neck dorsal and lateral is decreased with the advancement of age but the rate is not significant (Table 1). The other three sub-regions (abdomen and loin dorsal and abdomen ventral) do not show any specific enlargement pattern (Table 1).

DISCUSSION:

There are two types of glands embedded in the dermis, the sweat gland, and the sebaceous gland. The pear-shaped sac-like gland associated with or surrounded by the hair follicles and secret sebum (lipid substance) is called the sebaceous gland. This gland is composed of sebaceous lobules and sebaceous ducts. They are mostly simple branched alveolar glands of holocrine secretion. These findings was in harmony with Al-Umeri and Al-Mamoori, (2016); Saleemm *et al.*, (2016); Gbolagunte, (2016); Dahlhoff *et al.*, (2015); Niemann and Horsley (2012); Requena and Sangueza, (2017); Yousef *et al.*, (2022); Ibrahim and Hussin, (2017). All hair follicle doesn't contain sebaceous gland but all the sebaceous glands are associated with the hair follicle. That means hair follicles may or may not contain a sebaceous gland. That was similar to that of Al-Umeri and Al- Mamoori, (2016); Saleemm *et al.*, (2016). This is lined by stratified squamous epithelium. The secretory unit is composed of solid epidermal cell mass enclosed by a connective tissue sheath. At the periphery of the epidermal cell, the mass consisted of a cluster of three to seven polyhedral cells, a single layer of cuboidal cell present on the basal lamina called a basal cell. Another flattened cell is present beneath the basal cell called the myoepithelial cell. This was in agreement with the findings of Muhammad *et al.*, (2016) in prenatal sheep and Niemann and Horsley, (2012) in humans. The density of the sebaceous gland varied among the twelve body regions. The highest density of the sebaceous gland was found in the neck and the lowest in the loin. These results agreed with the cattle mentioned by Hossain *et al.*, (2016). The diameter of sebaceous gland of neck ventral, thorax dorsal, thorax lateral, thorax ventral, loin lateral, and loin ventral is increased, and neck dorsal, neck lateral, and abdomen lateral are decreased with the advancement of age but the rate is not significant (Table 1). The other three sub-regions (abdomen dorsal, abdomen ventral and loin dorsal) do not show any specific enlargement pattern (Table 1). These findings are similar to previous studies on adult Iranian native sheep by Mobini, (2013).

CONCLUSION:

The present data concerning the density and diameter of the sebaceous gland vary significantly or insignificantly according to different anatomical regions and ages. The

present results could provide significant consideration for better utilization of Black Bengal goat skin in the leather industry. Based on the above concluding remarks, the following recommendations are forwarded: Future investigation in the content may be taken up considering the variation in the breed, sex and season of the animal. For better quality leather attention should be paid to find out factors affecting skin quality, as well to the use of advanced techniques for leather processing. The significant variations observed in the physical parameters of Black Bengal goat can be used in the leather industry.

REFFERENCES:

1. AKHTER, S., HUSAIN, S.S., CHOWDHURY, A., MUNZU, M.M., DEV, G.K. 2006. Estimation of variance components and prediction of breeding value for some economically important traits of Black Bengal goat, Bangladesh Journal of Animal Science, 35, 20-26.
2. AL-UMERI, S.K.W., AL- MAMOORI, N.A.M. 2016. Comparative histological and histochemical study of flank region skin, in camel, cow and buffalo, AL-Qadisiyah Journal of Veterinary Medicine Sciences, 15(2), 102-107.
3. AMIN, M.R., HUSAIN, S.S., ISLAM, A.B.M.M. 2000. Evaluation of Black Bengal goats and their cross with Jamnapari breed for carcass characteristics. Small Ruminant Research. 38, 211-215.
4. AMIN, M.R., HUSAIN, S.S., ISLAM, A.B.M.M. 2001. Reproductive peculiarities and litter weight in different genetic groups of Black Bengal Does, Asian-Australasian Journal of Animal Sciences, 14, 297-301.
5. BANERJEE, R., MANDAL, P.K., BOSE, S., BANERJEE, M., MANNA, B. 2009. Quality Evaluation of Meat, Skin and Wool from Garole Sheep-a Promising Breed from India, Asian Journal of Animal Sciences, 3, 39-46.
6. BOVELL, D.L., CORBETT, A.D., HOLME, S., MACDONALLD, A., HARKER, M. 2007. The absence of apocrine glands in the human axilla has disease pathogenetic implications including axillary hyper-hidrosis, British Journal of Dermatology, 150(6), 1278- 1286.
7. DAHLHOFF, M., FROHLICH, T., ARNOLD, G.J., MULLER, U., LEONHARDT, H., ZOUBOULIS, C., SCHNEIDER, M.R. 2015. Characterization of the sebocyte lipid droplet proteome reveals novel potential regulators of sebaceous lipogenesis, Experimental Cell Research, 332(1), 146-155.
8. DELLMANN, H.D. 1992. Textbook of Veterinary Histology. 4th edition, 285-299.
9. ELIZABETH, A., FREDRIC, L. 2010. Comparative Veterinary Histology with Clinical Correlates, Manson Publishing, 84-88.
10. GBOLAGUNTE, G.D. 2016. Reclassification of the sweat glands of the one-humped camel (Camelus dromedarius) as apoeccrine based on mode of secretion and extrusion, American Journal of Research Communication, 4(5), 151-170.
11. HOSSAIN, M.E., UDDIN, M., SHIL, S.K., KABIR, M.H.B., MAHMUD, M.S., ISLAM, K.N. 2016. Histomorphometrical Characterization of Skin of Native Cattle (Bos indicus), Bangladesh, American Journal of Medical and Biological Research, 4(3), 53-65.
12. HUSAIN, S.S. 1993. A study on the productive performance and genetic potentials of Black Bengal goats, PhD Thesis, Bangladesh Agricultural University, Mymensingh.
13. IBRAHIM, R.S., HUSSIN, A.M. 2017. Comparative histological study on the glands of skin in Buffalo and Cow, Diyala Journal of Agricultural Sciences, 9 (Special Issue), 40-46.
14. KURTDEDE, N. 2002. Investigation on the skin structure of Lincoln longwool x Konya merino cross-bred (f1 and b1) sheep, Turkish Journal of Veterinary and Animal Sciences, 26, 709-714.
15. LIVESTOCK-BANGLAPEDIA. 2021. http://en.banglapedia.org/index.php?title=Livestock .
16. MAHGOUB, O., KADIM, I., AL-SHAHAB, AL AMRI, I., AMBUALI, A. 2010. An assessment of Omani native sheep fiber production and quality characteristics, Agricultural and Marine. Sciences, 15, 9-14.
17. MOBINI, B. 2012a. Effect of age and sex on fiber and follicle characteristics of an Iranian native sheep, Sokoto Journal of Veterinary Sciences, 10(1), 1-4.
18. MOBINI, B. 2012b. Histology of the skin in an Iranian native breed of sheep at different ages, Journal of Veterinary Advances, 2(5), 226-231.
19. MOBINI, B. 2013. A quantitative evaluation of different regions of skin in adult Iranian native sheep, Veterinarni Medicina, 58(5), 260-263.
20. MUHAMMED, M.M., YUSUF, N.D., HASSAN, D.I. 2016. MicroMorphological studies on the epidermis, hair follicles and skin glands of prenatal

Balami sheep, International Journal of Agriculture and Earth Science, 2, 9-17.
21. NIEMANN**,** C., HORSLEY, V. 2012. Development and homeostasis of the sebaceous gland, Seminars in Cell and Developmental Biology, 23(8), 928-36.
22. OZFILIZ, N., BALIKCIER, M., ERDOST, H., ZIK, B. 2002. Histological and morphometric features of the skin of native and hybrid sheep, Turkish Journal of Veterinary and Animal Sciences, 26, 429-438.
23. PAUL, S., KHANDOKER, M.A.M.Y., MOINUDDIN, M.A., PAUL, R.C. 2011. Characterization of Black Bengal goat, Journal of Bangladesh Agricultural University, 9(1), 61-66.
24. RASHID, M.H.O., SIDDIQUE, M.P., ZINNAH, M.A., HUQ, M.A., SAMAD, M.A., RAHMAN, M.M. 2008. Compliance efficacy of modified curing methods to control Black Bengal goat skin deterioration, Bangladesh Journal of Veterinary Medicine, 6, 191-196.
25. REQUENA, L., SANGUEZA, O. 2017. Embryology, Anatomy, Histology and Physiology of the Sebaceous Glands, In book: Cutaneous Adnexal Neoplasms, 755-764.
26. SALEEMM, M.A., HABEEB, R.S., ABDULLAH, M.A. 2016. Comparative histological study of the skin layers of black goats in north Iraq, Al-Qadisiyah Journal of Veterinary Medicine Sciences, 15(2), 25-30.
27. YOUSEF, H., MIAO, J.H., ALHAJJ, M., BADRI, T. 2022. Histology, Skin Appendages. National Library of Medicines, National Center for Biotechnology Information.