International Journal of Livestock Research, Vol. 10 (9) Sep' 2020
http://www.ijlr.org
eISSN: 2277-1964
NAAS Rating 2020 – 5.36

Original Research

Histochemical Study of Hair Follicle of Assam Hill Goat (*Capra hircus*) During Pre-ruminant, Transitional and Ruminant Age Groups

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How to cite this paper: Das, S., & Sarma, K. (2020). Histochemical Study of Hair Follicle of Assam Hill Goat (Capra hircus) During Pre-ruminant, Transitional and Ruminant Age Groups. *International Journal of Livestock Research*, 10(9), 142-149. doi: http://dx.doi.org/10.5455/ijlr.20200608072637

Received : Jun 08, 2020
Accepted : Jul 30, 2020
Published : Sep 30, 2020

Abstract

Strong activity of acid phosphatase was noticed in the dermal papilla and matrix. The activity of acid phosphatase, ATPase and AKPase in the sweat and sebaceous glands were found to be increased with the age advanced. The strong activity for alkaline phosphatase was observed in dermal papilla and matrix. Variable activity for acid and alkaline phosphatase was observed in the outer root sheath. Activity for PAS in the dermal papilla, sweat gland, and sebaceous gland and surrounding connective tissue was observed. Mixed reaction was observed for PAS Alcian blue in the outer root sheath. Variable activity PAS and PAS alcian blue was observed in the Inner root sheath and outer root sheath.

Keywords: Assam Hill Goat and Hair Follicle

Introduction

The local goat population, the Assam Hill Goat, constitutes a major indigenous non-descript variety in the state of Assam. It is an important meat type animal with high prolificacy from the North Eastern region of India. They are distributed in the hilly terrain of North Cachar hill, Karbi Anglong districts of Assam and also in the adjoining hilly tract of Meghalaya state. Assam Hill goat is a meat type animal with high prolificacy. The average litter size is 1.6 (National Bureau of Animal Genetic Resources, Karnal, Haryana, India 2018, http://www.nbagr.res.in/).Assam Hill goats are mostly white with occasional black patches on backline and legs. These goats are short legged with small body size. They are poor milker. Hair is the outer most covering of the skin surface of all mammalians and plays a numbers of physiological roles such as thermoregulation, identification, camouflage, fiber production, insulation and secondary sexual characteristics.Paus *et al.* (2014) and Araujo *et al.* (2010) stated that hair follicle undergoes transformations from stages of rapid growth (anagen) to regression (catagen) and back to anagen, via an interspersed period (telogen). Hair follicles (HFs) are an integral part of mammalian skin and act as body's protective barrier against its external environment. Hair follicle also plays an important role in wound healing of skin, secretion of pheromones and as sensory apparatus. Dellmann (1993) stated that hair follicle is associated with secretory system of sweat and sebaceous gland, covered by various cell lineages. The hair shaft is composed of a three-layered structure *viz.* medulla, cortex and cuticle from innermost to outermost. The cellular activity of the hair follicular cell is arranged in different layer shows variability during the various stages of hair growth.

Since there is paucity of literature on histochemical study of hair follicle and its associated with structure's Assam Hill Goat (*Capra hircus*). So, the present study was designed to carry out histochemical observation about the hair follicle during (pre-ruminant (0-3 week), transitional (3-8 week) and ruminant (above 8 weeks) age groups of Assam Hill Goat.

Materials and Methods

The present investigation was conducted on eighteen numbers of apparently healthy Assam Hill Goats (*Capra hircus*) during pre-ruminant (0-3 weeks), transitional (3-8 weeks) and ruminant stage (above 8 weeks). The skin samples were collected from the thigh region in an around the Guwahati city. For histochemical parameters, skin samples were collected and preserved in liquid nitrogen at -196^{o}C immediately after collection. Said samples were sectioned at 10µm thickness in cryostat microtome (Leitz) maintained at -20^{o}C at Central Instrumentation Facility, C.V.Sc, Khanapara. Slides were temporarily stored at -22^{o}C, and then treated for histochemical staining with the following methods-

a) Gomori's Alkaline Phosphatase cobalt method (Singh and Sulochana, 1978)
b) Gomori's method for Acid Phosphatase (Singh and Sulochana, 1978)
c) Lead Method for Adenosine Tri-Phosphatase (Bancroft, 2008)
d) PAS for carbohydrate (Mc Manus, 1946)
e) PAS-Alcian Blue for acid and neutral mucin (Mucosubstances) (Mc Manus, 1946) using the paraffin tissue sections

(The Research work was carried out as per the approval of the Institutional Animal Ethics Committee, Approval No: 770/ac/CPCSEA/FVSc/AAU/IAEC/16-17/373 dated 30.07.2016, Assam Agricultural University: Khanapara, Guwahati-781022)

Results and Discussion

Acid Phosphatase

In the present investigation intense reaction at the dermal papilla and a strong positive reaction at the keratozenous zone was observed for acid phosphatase (Fig.1a, 2c, and 3b). Cortex showed intense reaction (Fig. 1, 2a and 3a). Outer Root Sheath showed variably positive activity. In the outer root sheath nucleus were stained intensely (Fig. 1a, b). A positive reaction was observed at the lower bulb matrix region in all the age groups (Fig. 1a, c and 2c). Weak to moderate activity was seen in the sweat and sebaceous gland during pre-ruminant and transitional age groups. Whereas moderate to strong activity was seen in ruminant age groups (Fig. 2b and 3b, c). Hair matrix and dermal papilla showed intense reaction in all the age groups (Fig. 1a, 2c, 3b).

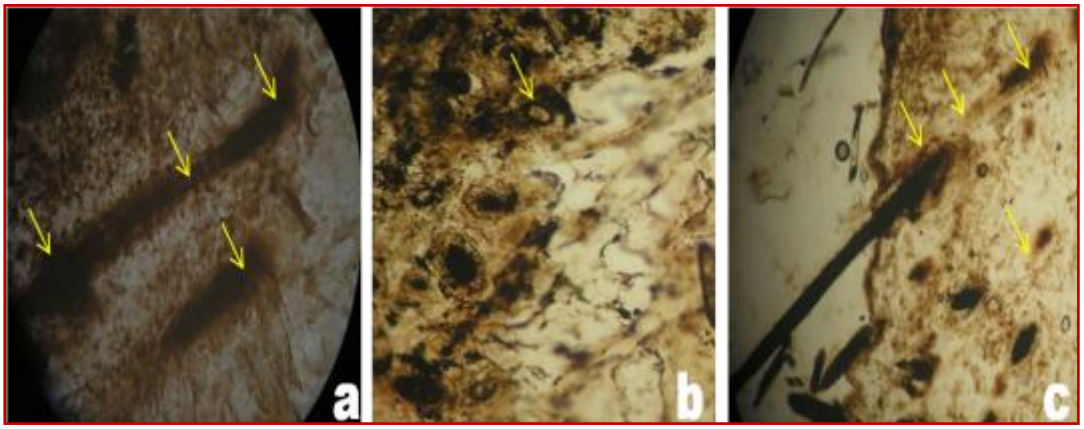

Figure 1 a, b, c: Photomicrographs showing activity (arrow) of acid phosphatase at various compartments of hair follicle during pre-ruminant age groups of Assam Hill goat. X 400

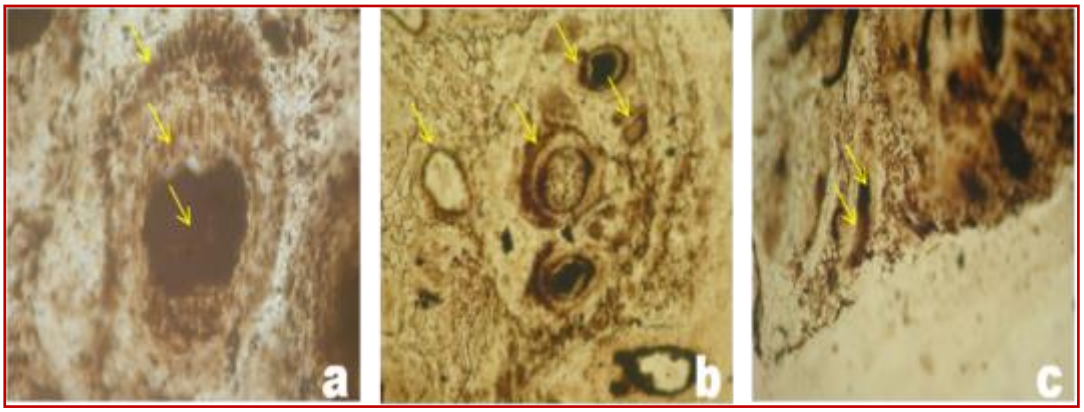

Figure 2 a, b, c: Photomicrographs showing activity (arrow) of acid phosphatase at various compartments of hair follicle during transitional age groups of Assam Hill goat. x 400

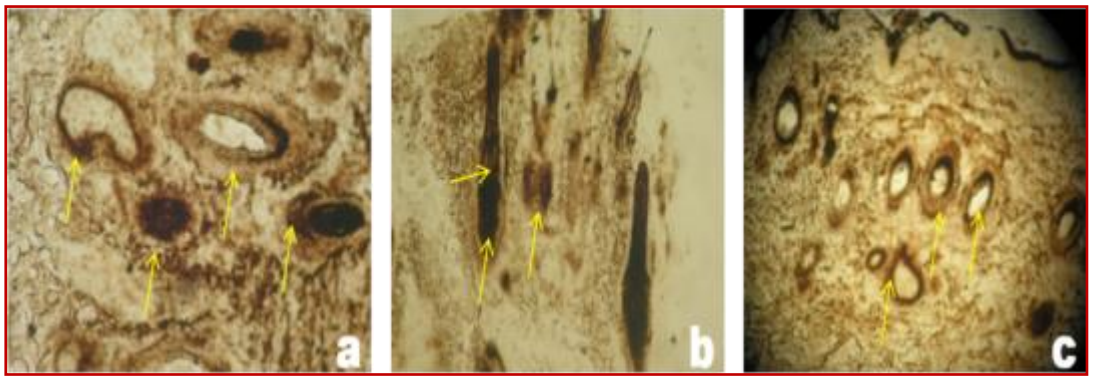

Figure 3 a, b, c: Photomicrographs showing activity (arrow) of acid phosphatase at various compartments of hair follicle during ruminant age groups of Assam Hill goat. x 400

Alkaline Phosphatase

In all the age groups an intense reaction was noticed at dermal papilla, matrix region of hair follicle for alkaline phosphatase (Fig. 4, 5 and 6). Cortex showed strong reaction. The connective tissue sheath showed moderate to strong activity during transitional and ruminant age groups. Inner root sheath and outer root sheath showed a weak to moderate reaction in all the age groups (Fig. 4, 5 and 6). Handjiski *et al.* (1994) reported the alkaline phosphatase activity in the dermal papillae and outer root sheath in mouse. In the present investigation variation in the activity of alkaline phosphatase was observed in the outer root sheath and sebaceous gland which might be due to various stages of hair follicle cycle (Fig. 4, 5 and 6). Findings were in agreement with Handjiski *et al.* (1994), Iida, (2007) in mouse and Bagdadi *et al.* (1978) in Beegal dog. Moderate to strong activity in the sweat and sebaceous gland was observed in the in all the age groups (Fig. 4, 5 and 6). Findings were supported by Iida *et al.* (2007) in mouse.

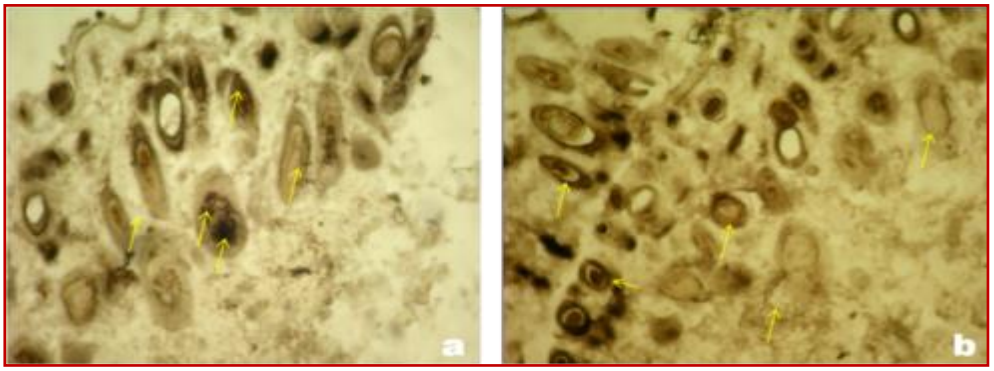

Figure 4 a, b: Photomicrographs showing activity (arrow) of alkaline phosphatase at various compartments of hair follicle during pre-ruminant age groups of Assam Hill goat. x 100

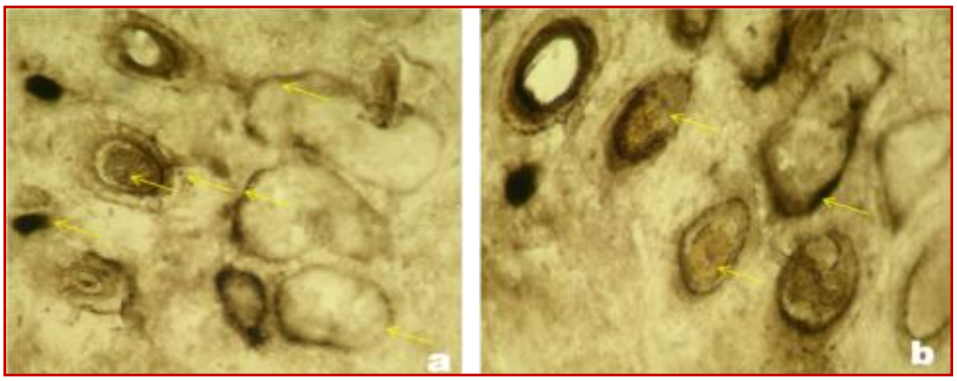

Figure 5 a, b: Photomicrographs showing activity (arrow) of alkaline phosphatase at various compartments of hair follicle during transitional age groups of Assam Hill goat. x 400

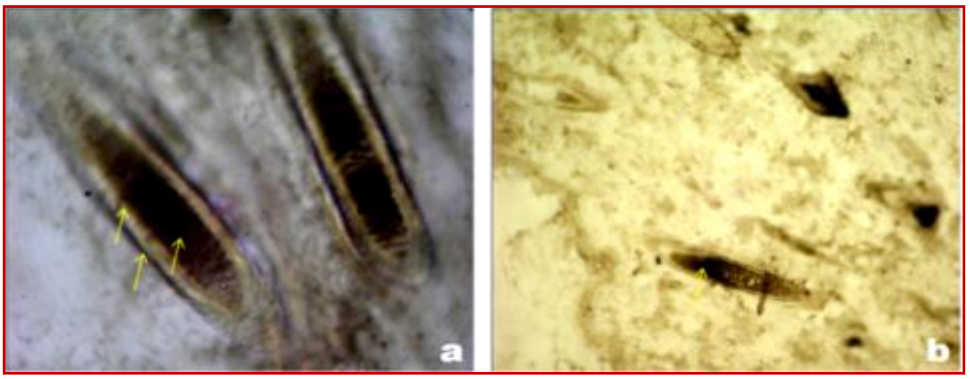

Figure 6 a, b: Photomicrographs showing activity (arrow) of alkaline phosphatase at various compartments of hair follicle during ruminant age groups of Assam Hill goat. x 400

Adenosine Tri Phosphatase

Cortex, dermal papilla and matrix region of hair follicle showed strong reaction in all the age groups for ATPase. Outer root sheath and connective tissue sheath showed moderate activity. A strong reaction for ATPase at the keratogenous region of root sheaths was seen in all the age groups. In pre-ruminant age groups the sweat and sebaceous gland showed and weak to moderate reaction whereas in transitional and ruminant age groups moderate to strong activities were noticed (Fig. 7, 8 and 9).

PAS and PAS-Alcian Blue Staining

In the present investigation PAS activity was seen at connective tissue sheath, dermal papilla, sweat gland, connective tissue capsule of sweat glands in all the age groups indicated the presence of glycogen (Fig. 10, 11, and 12). PAS activity of outer root sheath and inner root sheath varied from place to place. Maximum activity for the PAS in the outer root sheath was seen during ruminant age groups (Fig. 12).

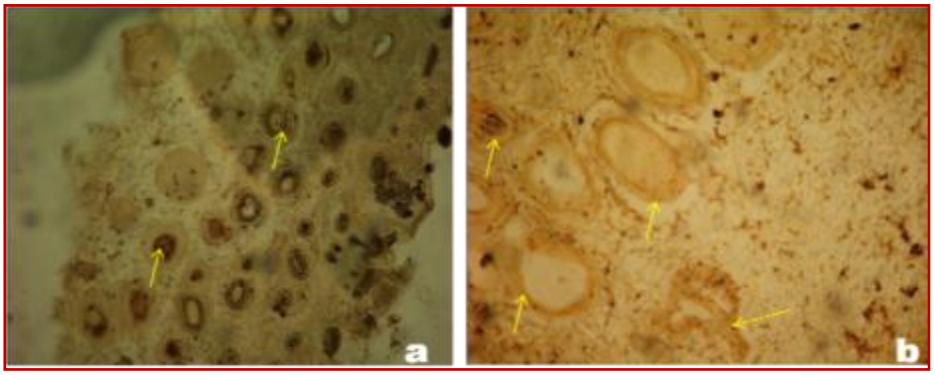

Figure 7 a, b: Photomicrographs showing activity (arrow) of at pase at various compartments of hair follicle during pre-ruminant age groups of Assam Hill goat. a X 100 and b X 400

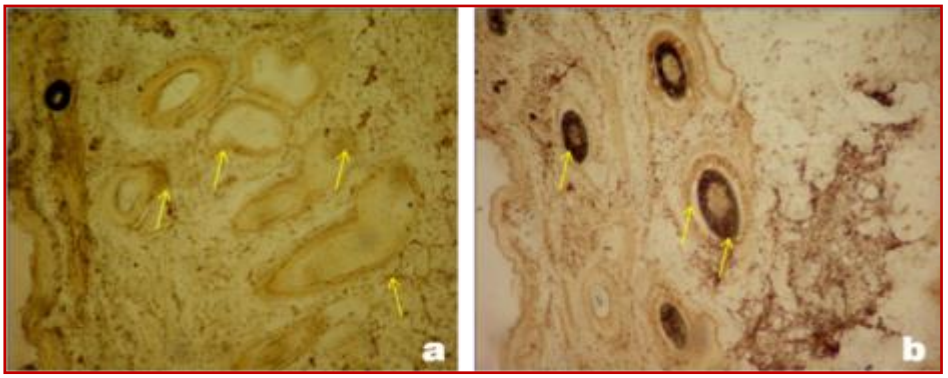

Figure 8 a, b: Photomicrographs showing activity (arrow) of at pase at various compartments of hair follicle during transitional age groups of Assam Hill goat. X400

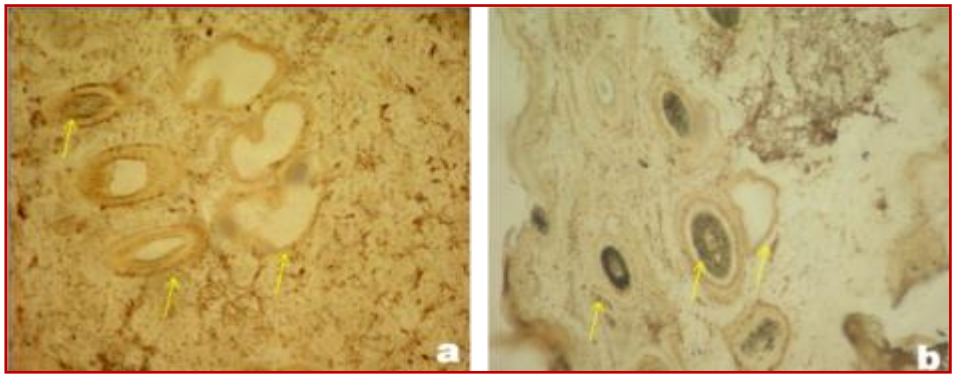

Figure 9 a, b: Photomicrographs showing activity (arrow) of at pase at various compartments of hair follicle during ruminant age groups of Assam Hill goat. X400

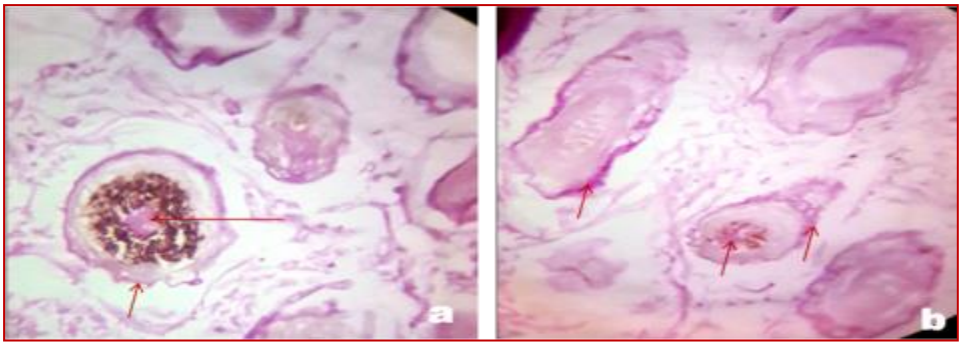

Figure 10 a, b: Photomicrographs showing PAS activity (arrow) at various compartments of hair follicle during pre-ruminant age groups of Assam Hill goat. PAS X 400

Dermal papilla found to be rich in PAS positive material (Fig. 10a, 11b, and 12a). PAS activity was seen at the

junction connective tissue of inner and outer root sheath (Fig. 11a and 12b). In ruminant age groups strong activity for PAS was observed in the connective tissue sheath, inner root sheath, and dermal papilla compared of pre-ruminant and transitional age groups (Fig.10, 11 and 12).

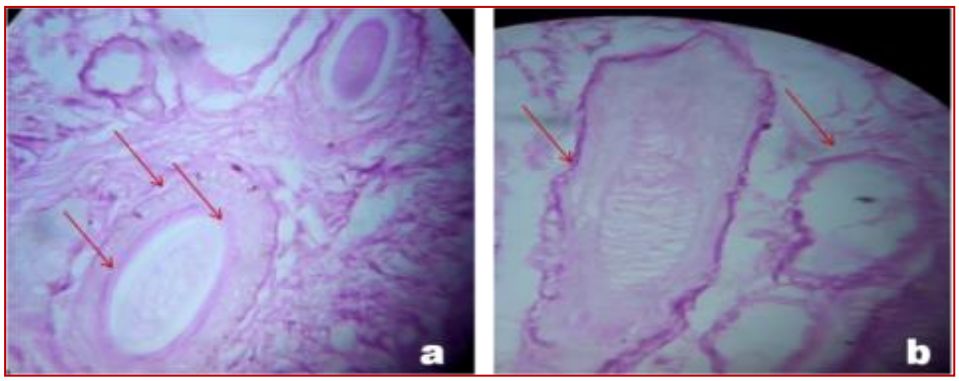

Figure 11 a, b: Photomicrographs showing PAS activity (arrow) at various compartments of hair follicle during transitional age groups of Assam Hill goat. PAS X 400

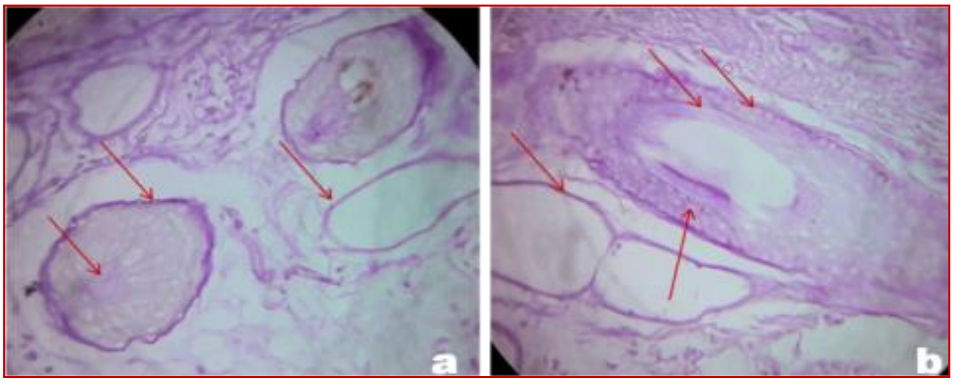

Figure 12 a, b: Photomicrographs showing PAS activity (arrow) at various compartments of hair follicle during ruminant age groups of Assam Hill goat. PAS X 400

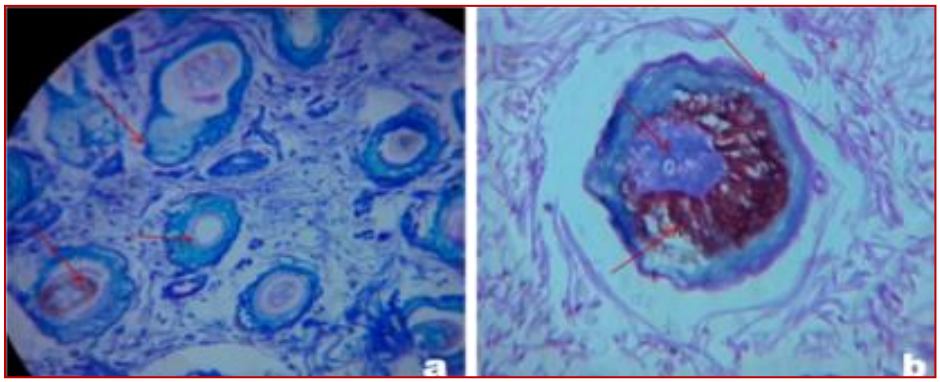

Figure 13 a, b: Photomicrographs showing PAS and alcian blue activity (arrow) at various compartments of hair follicle during pre-ruminant age groups of Assam Hill goat. a X 400 and b x 1000, PAS-Alcian blue combined stain

In PAS-Alcian Blue staining the outer root sheath showed mix reaction indicated the presence of both acid and neutral mucin. Findings were in agreement with Razvi *et al.* (2016) in Bakerwali Goat. Particularly the outer layer of the outer root sheath showed PAS positive activity might be indicative that the outer marginal layers contain glycogen and act as source of energy (Fig. 14 a and 15). Findings were supported by Paus (2008) in human. The inner root sheath showed PAS positive activity. The connective tissue, capsule supporting sweat and sebaceous gland were showed mild positive reaction for PAS (Fig. 14a and 15a). Similar observations were also recorded by Razvi *et al.* (2016) in Bakerwali Goat. Bhayani *et al.* (2005) in Patanwadi sheep. Razvi *et al*. (2016) reported that sebaceous glands with intense and its capsule showed mild PAS positive reaction in Bakerwali goat. The glandular secretions of sebaceous glands showed mild PAS reaction. Dermal papilla showed PAS positive activity (Fig. 13 b

and 14 b). Matrix showed positive activity for alcian blue (Fig. 14 b).

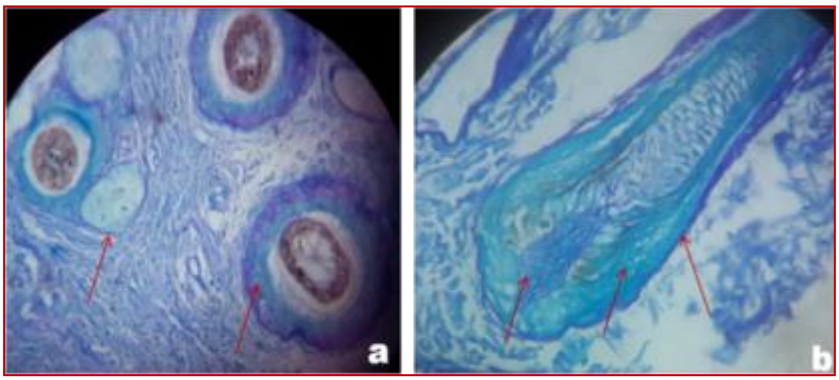

Figure 14 a, b: Photomicrographs showing PAS and alcian blue activity (arrow) at various compartments of hair follicle during transitional age groups of Assam Hill goat. a X400 AND bx1000, PAS-Alcian blue combined stain

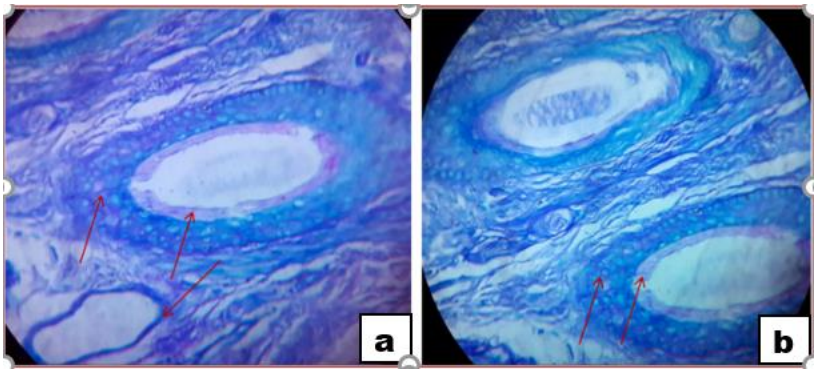

Figure 15a, b: Photomicrographs showing PAS and alcian blue activity (arrow) at various compartments of hair follicle during transitional age groups of Assam Hill goat. a X 400 and b X 1000, PAS-Alcian blue combined stain

Conclusion

The active compartment of the hair follicle like dermal papilla, matrix irrespective of age showed strong enzymatic activity indicating the rapid metabolic activity and mitotic activity. The variable activity in the compartments of the hair follicle like inner root sheath and outer root sheath might be due do the hair growth cycles through anagen, catagen and talogen. The glycogen activity was detected in the connective tissue sheath, sweat and sebaceous gland. In all age groups the intensity of the enzymatic activity was increased with the age advancement in Assam Hill Goat (*Capra hircus*).

Acknowledgement

Authors duly acknowledged the Head of the Department of Anatomy & Histology, College of Veterinary Science, Assam Agricultural University, Khanapar, Guwahati Assam, India for providing all the facilities of laboratory. The author would like to thank the Dean, DPGS of faculty of Veterinary Science, Khanapara, AAU, Khanapara, Guwahati, Assam**.**

Conflict of Interests

There is no conflict of interest.

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