قسم: التشريح والهستولوجيا.
كلية: الطب البيطرى ـ جامعة أسيوط.
رئيس القسم: أ.د./حلمي محمد بدوى.

دراسات على البصيلات الشعرية والغدد الانبوبيه المتكاملة في جلد الجمل وحيد السنام

جمال كامل، رودولف شفارتز، عبدالهادى محمد

تم في هذا البحث دراسة توزيع وعدد والصفات الهستولوجية والهستوكيمائية لكل من البصيلات الشعرية والغدد الانبوبيه المتآكلة لعينات جلد الجمل وحيد السنام في عشرين منطقة تمثل مناطق الجلد المختلفه.

وقد اتضح من هذه الدراسة أن البصيلات الشعرية لجلد الجمل توجد في مجموعات وتختلف عدد هذه البصيلات في كل مجموعه باختلاف مناطق الجلد المختلفه.

وقد وجد أن الغدد الانبوبيه لجلد الجمل تتكون من جزء غدى وقناة مفرغة ، وقد قسمت القناة المفرغة الى جزء اسطواني وجزء كيسي يفتح في بصيلة الشعر قرب سطح الجسم مباشرة.

ويتركب جدار الجزء المفرز للغدد الانبوبيه من خلايا غدية مكعبة او عمادية محاطة بخلايا بشرية عضليه ويختلف شكل الجزء الغدى باختلاف مناطق الجلد المختلفة.

وقد تم ايضا دراسة وجود المواد الدهنية والمواد الكربوهيدراتيه وانزيمات الفوسفاتيز القاعدى والحمضي في البصيلات الشعرية والغدد الانبوبية المصاحبة لها في جلد الجمل.

Dept. of Anatomy & Histology,
Fac. of Vet. Med., Assiut University,
Head of Dept. Prof. Dr. H. Badawi.

STUDIES ON THE HAIR FOLLICIES AND APOCRINE TUBULAR GLANDS IN THE SKIN OF THE ONE-HUMPED CAMEL

(With One Table and 13 Figures)

By
G. KAMEL, R. SCHWARZ* and A.M.A. ALI

(Received at 3/7/1986)

SUMMARY

Twenty regions representing the covering skin of 7 adult camels of both sexes were examined for the distribution, number and histological peculiarities of the hair follicles and the tubular glands. The hair follicles of the skin of the camel are arranged in well defined hair groups. The number of the hair follicles in each group is subjected to regional variations. The lowest number of these follicles was present in the skin of the front, medial aspect of the thigh and the ventral aspect of the tail. However, the highest number was observed in the skin samples obtained from the hump, back and the flank regions.

The end-pieces of the tubular glands were highly coild in the skin of the medial aspect of the thigh and leg and less coild in the other studied regions. The excretory ducts were peculiarly composed of a narrow long cylindrical and a saceulated portion which opens into the hair follicle near the surface of the skin.

Histochemical investigations were also carried out to demonstrate the neutral lipid and mucopolysaccharide content as well as the alkaline and acid phosphatase activites with both the hair follicles and its accompanied glands.

INTRODUCTION

In Egypt, the camel have an economic value among other livestocks as they considered to be meat and hide producing animals.

Few studies on the hair follicles and the tubular glands of the camel have been reported (DOWLING and NAY, 1962; LEE and SCHMIDT-NIELSEN, 1962; SHAHIEN et al. 1974).

The present work aims to provide addational informations, on the hair follicles and the tubular glands within the covering skin of the camel, which may serve for comparative study.

MATERIAL and METHODS

Twenty regions representing the covering skin of 7 adult camels of both sexes were obtained from Bani Adi slaughterhouse. The specimens were clipped and fixed in Boiun's, fluid and formol calcium.

Serial horizontal and transeverse sections of 8 - 10 um thick, semithin sections and frozen sections (200 um thickness) were made. The following stains and staining methods were adopted:

Harris haematoxylin and eosin, Periodic acid schiff technique (McMANUS, 1945), Alcian blue (STEEDMANN,1950), Sudan black-B stain (LISON and DAGNELIE, 1933) Gomori's calcium cobalt method for demonstration of alkaline phosphatase (GOMORI, 1952) and Gomori's method for detection of acid phosphatase (GOMOR, 1952).

The follicles and the tubular glands were counted in horizontal sections at the sebaceous gland level (microscopic field area was 5.3 mm^2).

RESULTS

The hair coat of the one-humped camel is made up of compound hair follicles. They are arranged in a well defined groups (Fig. 2). Each group is formed of a large and several secondary smaller follicles. The larger follicle tends to extend more deeper than the smaller variety (Fig. 3). The compound follicle become branched just above the level of the sebaceous glands.

The number of the hair follicles in each group is subjected to regional variations fluctuating between a minimum of 3 and a maximum of 35 hair follicles (Table 1).

The hair follicles of each hair group open into a common follicle (Fig. 4) just above of the sebaceous glands. Both primary and secondary hair follicle is provided with two sebaceous glands. the internal root sheath of the primary and secondary hair follicle formed spiral folds, just below the opening of these glands (Fig. 5).

Several pigments are demonstrated within the cells of the hair pulps and the ducts of the tubular glands. The Arrector pili muscles are branched at its deeper portion and provide strands which connect each of the secondary follicle.

Each primary hair follicle is associatd with a single tubular gland (Fig. 3). The latter occupies the space between the corresponding hair follicle and the Arrector pili muscle.

The shape of the glandular portion of the tubular glands varies from one region to another (Fig. 1). They are less coilled at the front, back, lateral aspect of the abdomen, dorsal and ventral aspects of the tail, lateral aspect of the thigh and lateral aspect of the metatarsal. On other hand, they are highly coiled at the medial aspect of the thigh and leg as well as in the hump region. However they are moderately coiled in the other studied body regions. The secretory endpieces are composed of a single layer of glandular cells, myoepithelial cells and thick basal lamina (Fig. 6). The glandular epithelium is columnar or cuboidal in shape and range from 20 - 25 um in height. The cell boundaries are indistinct, the nuclei appear rounded or oval in shape and basally situated. The myoepithelial cells (3 um in diameter and 60 um in length), are spindle in shape. Some glandular tubules contained an irregular luminal surface due to uneven projection and pinched off appearance of the apical end of the cells (Fig. 7).

The excretory ducts of the tubular glands were composed of a narrow long cylindrical and short sacculated portions (Fig. 11). The long cylindrical portion is about 30 um in diameter. It follows a straight course parrallel to the hair follicles. it is lined with two layers of cells, viz., inner cuboidal, and outer slightly flattened pigmented cells. The sacculated portion is about 90 um in diameter. It opens into the common follicle near the epidermis (Fig. 8). The wall of the sacculated portion is formed of stratified epithelium of 3-4 cell layers. The superficial cells of the latter are large polyhederal, contain large rounded vesicular nucleus and the cytoplasm is lightly stained and contains basophilic granules of different sizes (Fig. 9). however, the basal cell layer is composed of highly pigmented cuboidal cells. The connective tissue surrounding the saculated portion is rich in blood capillaries.

The dermal papillae and the cells of the lower portion of the outer root sheath are positive for alkaline phosphatase activity. The Arrector pili muscle and the endothelium of the blood capillaries show strong enzymatic activity for this enzyme. The apical portion of the mycoepithelial cells of the glandular end-pieces of the tubular glands and the sebaceous glands also demonstrate strong alkaline phosphatase activity. The sacculated portion of the excretory ducts show strong reaction for this enzyme however, weak reaction is observed within the long cylindrical portion (Fig. 10).

The internal root sheat and the lower portion of the hair pulp showed strong reaction for acid phosphatase. the secretory end-pieces and the long cylindrical portion of the tubular glands showed moderate reaction for this enzyme, while the sacculated portion show strong reaction. The Arrector pili muscles showed negative reaction for this enzyme (Fig. 11).

No sudanophilic substances could be demonstrated within the hair follicles or in the tubular glands. The sudanophilic materials are observed within the sebaceous glands and the common opening of the hair follicle (Fig. 12). PAS-strong positive materials are observed at the proximal portion of the glandular cells of the tubular glands (Fig. 13) the myoepithelial cells and the thick basal lamina show slight reaction for PAS.

The excretory ducts present negative PAS-reactions. The peripheral cells of the sebaceous glands and the cells of the outer root sheath of the hair follicles show PAS-positive granules. The connective tissue fiber are slightly reacted.

DISCUSSION

The histological examination of the skin of the one humped camel revealed that hair coat is made up of compound hair follicles. The compound follicle become branched just above the level of the sebaceous glands. branching of the hair follicle is similar to that found in sheep (HARDY and LYNE 1956).

The follicular folds were present in both primary and secondary hair follicles, possibly to mentain the sebum at upper level of the hair follicle to perform its protective functions. The present study revealed that the shape of the glandular portion varies from one region to another. Difference in hair growth may partly explain difference in the morphology of the tubular glands existing between body region (PAN, 1963).

The skin of the camel showed a much lower density of tubular glands than that reported in cattle (HAFEZ et al., 1955; JENKINSON and NAY, 1975).

The present study revealed that the wall of the secretory end-pieces is formed of single layer of secretory epithelial cells, myoepithelial cells and thick basal lamina. These

finding are similar to those described in other animals (LYNE and HOLLIS, 1967; JENKINSON, 1977; MAHGOUB et al. 1977).

It is well known that most of the large animals loss heat by evaporative cooling and consequently their water requirment are hgih when enviromental temperature are high. However, camels which live under severe adversed condition are well known for the ability to survive for long periods without water (DOWLING and NAY, 1962). The presence of the secretory end-pieces of the apocrine glands in the more superficial part of the dermis of the skin, which is better supplied with blood than the lower part allow a relatively higher rate of sweating (MAHGOUB et al. 1977). So the presence of the tubular glands in the deeper layer in the dermis in the skin of the camel is to minimize the rate of evaporation. On the other hand the mucopolysaccharide nature of the apocrine tubular glands lead us to conclud that these tubular glands do not play a major role in the control of body temperature. Moreover, the histological pecularities of the sacculated part of the excretory duct which has been reported for the first time may lead us to suggest that this part make reabsorption of the fluid content of the secretory material to minimize water evaporation.

Table (1)

Hair follicle and apocrine tubular gland population of the one humped camel

Regions	No. of hair follicles per group	No. of hair Groups per/cm^2	No. of apocrine tubular glands per/cm^2
Front:	6±2	95±3	152±10
Lateral aspect of the neck	11±3	48±5	130±9
Dorsal aspect of the neck	14±2	152±7	220±14
Ventral aspect of the neck	13±3	140±10	205±15
Lateral aspect of the shoulder	12±2	95±5	230±14
Lateral aspect of the forrarm	13±2	95±6	187±13
Medial aspect of the forearm	14±3	33±3	141±10
Lateral aspect of the thorax	12±4	40±6	130±7
Lateral aspect of the abdomen	11±3	45±9	135±12
Axilla	13±2	120±5	240±12
Hump	25±3	114±6	290±10
Back	20±5	96±12	224±16
Flank	35±3	75±9	234±12
Lateral aspect of the thigh	11±4	70±5	210±15
Merdial aspect of the thigh	5±2	65±12	200±13
Lateral aspect of the leg	12±3	90±5	180±10
Medial aspect of the leg	6±2	65±4	169±7
Lateral aspect of the metatarsal	12±5	34±9	160±12
Dorsal aspect of the tail	10±3	90±7	170±9
Ventral aspect of the tail	3±1	45±3	135±6

REFERENCES

Dowling, O.F. and May, T. (1962): Hair follicle and the sweat glands of the camel. Nature. Lond. 195: 578 - 580.

Gomori, G. (1952): Histochemistry of esterases. Int. Rev. Cytol. 1, 323 - 335.

Mafez, E.S.E., A.L. Badreldin and M.M. Shafei (1955): Skin structure of Egyptian buffaloes and cattle with particular reference to sweat glands. J. Apr. Sci., camb. 46, 19 - 30.

Hardy, M.H. and Lyne, A.G. (1956 a): The prenatal development of wool fllicles in Merino sheep. Aust. J. Biol., Sc., 9: 423 - 441.

Jenkinson, D.M. (1971): Myoepithelial cells of the sweat glands of domestic animals. Res. Vet. Sc. 12: 152 - 155.

Lee, D.G. and Schmidt-Nielsen, K. (1962): The skin, sweat glands and hair follicle of the camel (Camelus dromedarius). Anatomical Record 143, 71 - 77.

Lison, L. and J. Dagnelie (1935): Cited atter Bancroft, J.D. (1967): An introduction to histochemical technique. Sussex.

Lyne, A.G. and D.E. Hollis (1967): Asymeteric distribution of alkaline phosphatase activity in the hair and wool follicle of sheep. J. Invest. Dermatol., 48, 197 - 199.

Mahgoub, A.E., M.F.A. Fahmy and Y.S. Ghanem (1977): A histological study of the skin of some breeds of sheep. III. Sweat glands. Egyptian Vet. Med. J. Fac. Vet. Med. Cairo Univ. 25, 245 - 259.

McMannus, J.F. (1948): Histological and histochemical uses of periodic acid. Stain Tech. 23,99.

Pan, Y.S. (1963): Quantitative and morphological variation of sweat glands, skin thickness and skin shrinkage over various body regions of Sahiwal Zebu and Jersey Cattle. Aust. J. Agric. Res. 4, 425 - 437.

Shahien, Y.M., M.F. Fahmy and S.M. El-Shafei (1974): A histochemical study of the skin of the camel (Camelus dromedarius). Assiut Vet. Med. J. 1, 17 - 23.

Steedman, H.F. (1950): Alcian blue. A new stain for mucin. Quart. R. Micro., Sci. 91, 477.

LEGENDS

Fig. (1): Shows the variations in the shape of the tubular glands.
a- Front
b- Lateral aspect of abdomen.
c- Neck
d- Venteral aspect of abdomen.
e- Medial aspect of thigh
f- hump.

Fig. (2): Horizontal section of camel skin showing groups of hair follicles, back region. (H & E. x 160).

Fig. (3): Vertical section of camel skin. The coiled tubular gland accompanied the large hair follicle.
(H. E. x 1607

Fig. (4): Horizontal section of camel skin showing the commen hair follicle. (H & E. x 400).

Fig. (5): Vertical section of camel skin showing the follicular fold. (H & E. x 400).

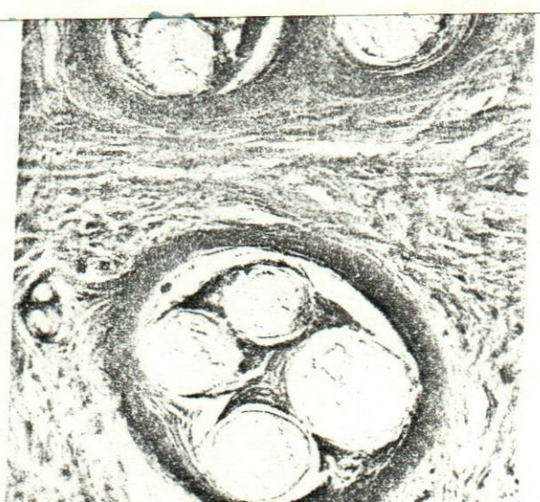

FIG. 6

FIG. 7

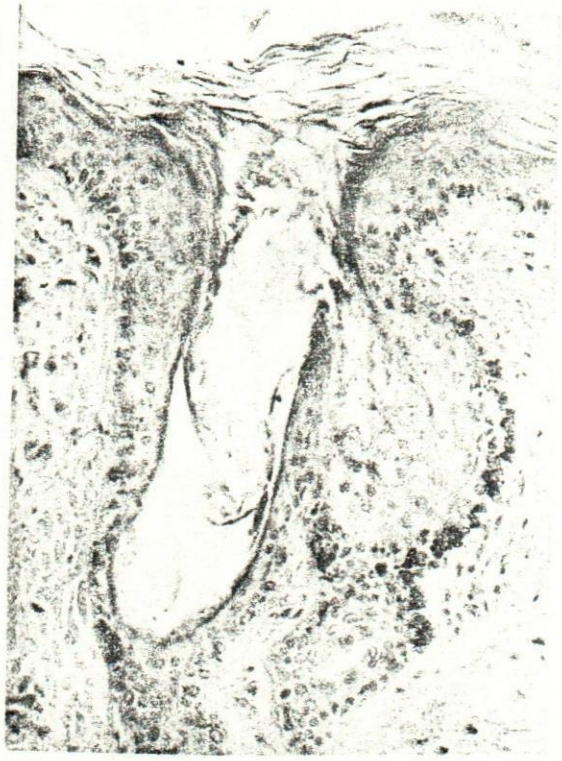

FIG. 8

FIG. 9

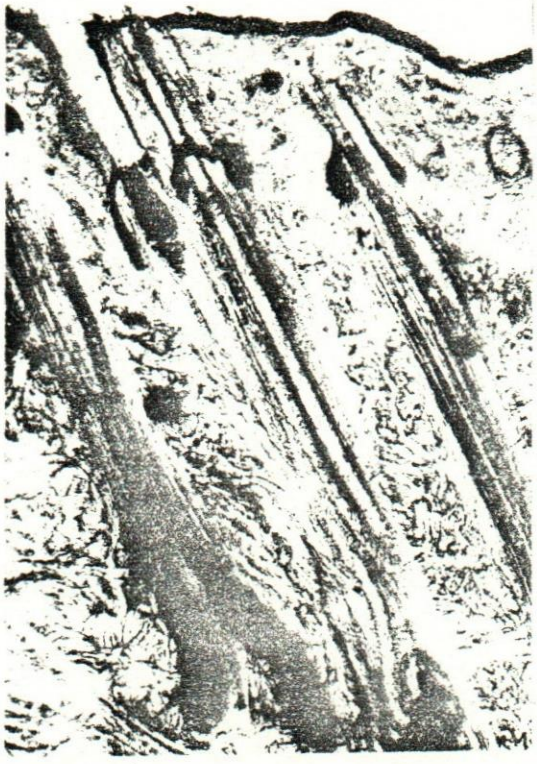

FIG. 10

FIG. 11

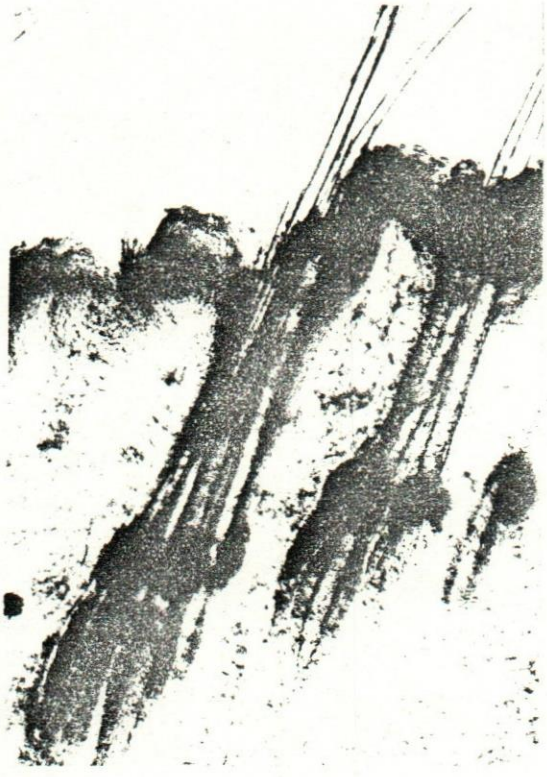

FIG. 12

FIG. 13