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Research Article

Histological Studies on the Skin in Greater Cane Rat (*Thryonomys swinderianus*) with Reference to Some Specialized Integument Structures

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ABSTRACT
The present study used light microscopy to describe the histomorphological characteristics of specialized structures of the integument of the cane rat, a precocial rodent widely distributed in moist parts of sub-Saharan Africa. Skin samples from specialized areas of the integuments were collected from seven (7) ethically euthanized cane rats, processed by routine paraffin techniques. The eyelid was lined by stratified squamous epithelium. Hair follicles of primary type were observed at the deeper portion of the reticular layer of the dermis. The tarsal gland was observed at the subepithelial area of the surface epithelium. The ear auricle was lined by stratified squamous epithelium, and the matrix of the auricular cartilage showed chondrocytes within a variable-shaped lacuna surrounded by perichondrium. The palmar surface of the forepaw was lined by stratified squamous epithelium, which was excessively keratinized in the hind paw. Pigmented cells were present at the stratum basale, on both surfaces. Our findings offer valuable insights into the basic histomorphology of specialized areas of the integument in cane rats, which were consistent with related rodent species inhabiting sub-Saharan Africa.

Keywords: Greater Cane Rat; Hair Follicle; Histology; Integument; Tarsal Gland

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INTRODUCTION

The skin is the largest organ system of the body both in weight and surface area (Young *et al*., 2014), and comprised of a superficial epidermis, an epithelial layer of ectodermal origin, and the underlying dermis, a layer of connective tissue of mesodermal origin (Leslie and James, 2000). It is a complex, integrated, dynamic organ that has multitudes of functions beyond its role as environmental barrier (Jo Ann and Brian, 2006). The skin displays an outstanding degree of functional and morphological variety, by the presence of highly specialized cutaneous appendages; including variety of glands and phalangeal covering (Hyttel *et al*., 2010). The basic anatomy of the rodent skin is largely comparable to that of other mammals, but species-specific differences need to be taken into account when evaluating the morphology of the skin and its appendages in biomedical research (Mecklenburg *et al*., 2013).

Cane rat (Grasscutter) described as a nocturnal hystricomorphic herbivorous rodent, belong to the family *Thryonomyidae* represented by a single species, *Thryonomys swinderianus* (Mustapha *et al*., 2020). The skin of cane rat around the head region as well as the limbs and tails are easily torn out due to thinness of the skin (Kingdon, 1997). A pilot study by Akpan *et al*. (2018) reported sexual dimorphism in hair follicular density and epidermal thickness, suggestive of adaptive features in the cane rat. The

authors (Akpan et al., 2020), further described the nature of interdigitating structural disposition of epidermal-dermal interface in the same species, a peculiarity that makes them intractable both in wild and captivity. The basic histomorphological characteristics of the skin of the cane rats was scantly described in both articles. Although, Adebayo *et al*. (2019) described the histology of the skin of the scrotum in male cane rats, most of the specialized structures of the integument were not covered. The aim of the present work is to builds on the aforementioned studies, to describe the histological features of the skin in cane rat with reference to some specialized integument structures.

MATERIALS AND METHODS

Sample collection

This study was conducted on seven (7) apparently healthy captive grasscutters (*Thryonomys swinderianus*) of both sexes obtained from a breeding colony of a local breeder in *Jikwoyi*, Abuja, Nigeria. They were transported in a customized wooden cage to the Department of Veterinary Anatomy, University of Maiduguri where the study was conducted. The rats were euthanized using ketamine hydrochloride at doses of 75mg/kg body weight and xylazine 2.5mg/kg, administered intraperitoneally as single dose (Molina *et al*., 2015), and fixed in 10% formalin for two (2) weeks. Specialized Structures of the integument were excised from the fixed specimen and processed as detailed below;

Ethical statement

Approval for the study was obtained from the committee on animal use and care (CAUC) of Ahmadu Bello University, Zaria. Approval No. ABUAU/2024/047.

Sample processing

Skin sample of approximately 5 mm^2 from the eyelids, ear auricle, dorsum of the trunk, medial thigh area, palmar and planter surfaces of the fore and hind limbs, were collected and processed by routine paraffin techniques for light microscopy. This involves; dehydration in ascending grades of alcohol, cleared in xylene and infiltrated in paraffin wax for embedding. Section-blocks were cut and stained with Hematoxylin and Eosin (H_E) (Bancroft and Stevens, 1997). Histoarchitecture of these sections were carefully studied and photomicrographs were captured at different objective magnifications using Leica DM750 P, light microscope.

RESULTS

Upper Eyelid

The anterior surface of the upper eyelid was lined by stratified squamous epithelium. The free surface of the epithelium was irregular showing protrusion at some places, whereas the basal epithelial surface was generally smooth with few areas having papillary pegs. The dermis presented a papillary layer of loose connective tissue immediately beneath the epithelium, and a deeper layer of dense irregular layer of connective tissue. At the deeper portion of reticular layer, hair follicles were observed. These hair follicles were of primary type, having a wide lumen surrounded by internal and external epithelium root sheath. The external epithelial root sheath comprised of cells that were large, having lightly basophilic nuclei. This layer was surrounded by homogeneous layer of connective tissue sheath. At some places, interfollicular muscles were observed (Figure 1).

Multilobular Sebaceous Tarsal Gland

The sebaceous gland was compound-tubular gland. It was surrounded by dense connective tissue (tarsal plate). Fine tissue septa divide the glandular parenchyma into polymorphic lobes and lobules. Each lobe and lobules were further divided by fine connective tissue fibers into smaller secretory units. These were lightly eosinophilic due to the presence of secretory sebum. The glandular ducts were lined by stratified cuboidal epithelium (Figure 2).

Ear Auricle

The ear auricle was surrounded by surface epithelium, underlying dermis and elastic cartilage. The surface epithelium was stratified squamous partly keratinized. The dermis comprises of the loose connective tissue, having connective tissue cells, few fine blood vessels, and sweat glands. The deeper portion of the dermis mainly presented a dense irregular connective tissue. The cartilage was elastic type, surrounded by perichondrium. The perichondrium comprised of outer fibrous layer that blend with the dense connective tissue of the dermis, and inner cellular layer. The core matrix of the elastic cartilage presented chondrocytes within a variable shaped lacuna. Some of the lacunae were

larger containing single cell, while some contained two or more chondrocytes (Figure 3).

Palmar Surface of the Fore Paw

The palmar surface of cane rat was lined by stratified squamous keratinized epithelium. The free surface of the epithelium was straight and presented flakes of keratin. The epithelium comprised of stratum basale, stratum granulosum and stratum corneum. Pigmented cells of melanocyte were observed at the stratum basale. The basal surface of the epithelium presented the dermal papilla and intervening epidermal pegs. The sub-epithelial area was occupied mainly by loose connective tissue of papillary layer of the dermis. At some places, fine blood vessels were observed. The deeper portion presented reticular layers of dense irregular connective tissue (Figure 4).

Plantar Surface of the Hind Paw

The plantar surface of the hind limb presented a stratified squamous heavily keratinized epithelium. The epithelium comprised of stratum basale, stratum granulosum, and stratum corneum. The basal area of the epithelium was irregular because of presence of numerous dermal papilla and epidermal pegs. There were numerous of melanocytes especially at the stratum basale. The dermis presented papillary and reticular layers as observed at palmar surface of the forelimb (Figure 5).

Dorsal Trunk

The skin at dorsal surface of the trunk showed a lining epidermis of stratified squamous partly keratinized epithelium. The outer surface of the epidermis was generally irregular, whereas, the deeper part presented numerous dermal papilla and epidermal pegs. The dermis comprised of loose papillary layer of irregular connective tissue and the deeper reticular layer of dense connective tissue (Figure 6).

Thigh Region

Medio lateral thigh skin region showed a surface epithelium of stratified squamous that become heavily keratinized toward the lateral surface area. The epithelium comprised of stratum basale, stratum lucidum and stratum corneum. At some places, the deeper portion of the dermis presented primary hair follicles, fine blood capillaries and sebaceous gland (Figure 7).

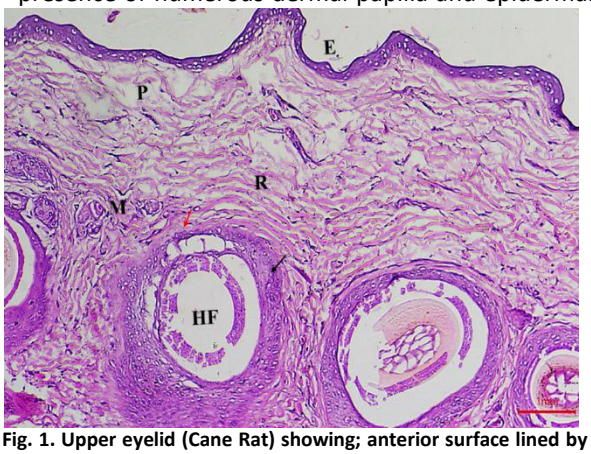

Fig. 1. Upper eyelid (Cane Rat) showing; anterior surface lined by stratified cuboidal epithelium (E), underlying papillary layer of loose connective tissue (P), dense irregular connective tissue (R), primary hair follicle (HF), external epithelial root sheath (black arrow), surrounded by homogenous dermal root sheath (red arrow), interfollicular muscle (M) H&E 100X

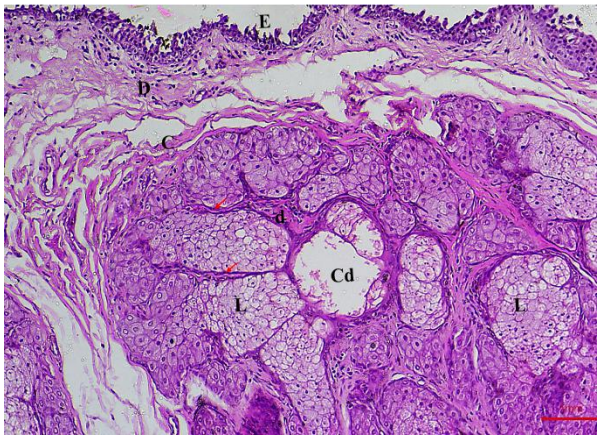

Fig. 2. Multilobular sebaceous tarsal gland (cane rat) showing; surface epithelium (E), dermis (D), connective tissue capsules tactile plate (C), surrounding parenchyma of sebaceous gland, fine septa (red arrows), dividing the polymorphic lobules (L), intralobular duct (d), central duct (Cd) H&E 100X

Fig. 3. Auricle (cane rat) showing; stratified squamous epithelium (E), dermis (D), sweat gland (yellow arrows), hair follicles (black arrows), blood vessel (Bv), auricular elastic cartilage (C), surrounded by perichondrium (pr) H&E 100X

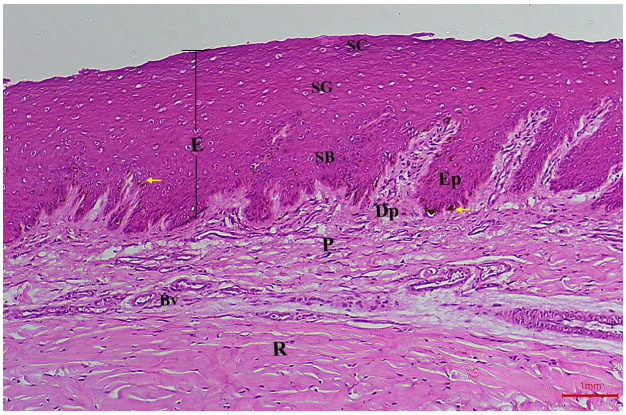

Fig. 4. Forelimb (cane rat) palmar surface showing; stratified squamous keratinized epithelium (E), having stratum basale (SB), stratum granulosum (SG), stratum corneum (SC), dermal papilla (dp), epidermal pegs (Ep), papillary layer (P), blood vessel (Bv), reticular layer (R) H&E 100X

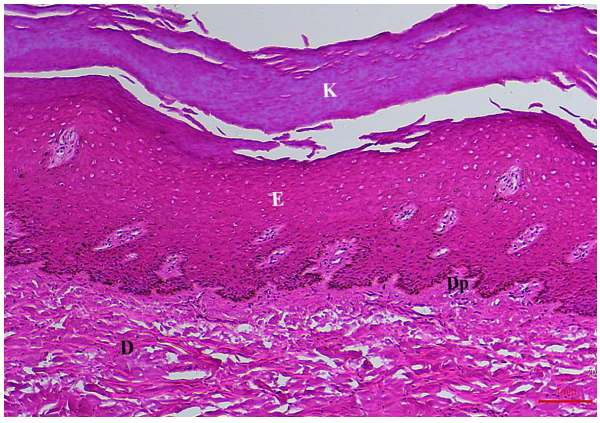

Fig. 5. Hindlimb (cane rat) plantar surface showing; stratified squamous epithelium (E), heavily keratinized (K), underlying dermis(D), few dermal papillae (Dp) H&E 100X

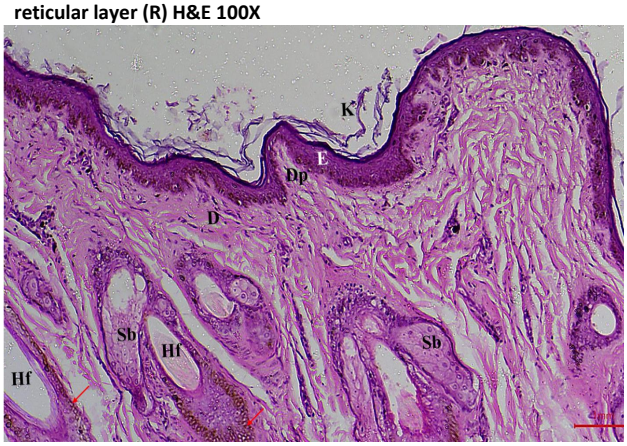

Fig. 6. Longitudinal section of skin (cane rat) showing; stratified squamous epithelium (E), with flakes of keratin (K), dermis (e) presenting dermal papilla (Dp), sebaceous gland (Sb), hair follicle (Hf), epidermal melanocytes (red arrows) at the dermal papilla .H&E 100X

Fig. 7. Medial-lateral thigh skin (cane rat) showing; stratified squamous keratinized epithelium (E), having stratum basale (SB), stratum lucidum (SL), stratum corneum (SC), Note; towards the

lateral surface (Lt) the skin is excessively keratinized, loose of connective tissue of dermis (D), secondary hair follicle (Hf), sweat gland (sg) H&E 100X

DISCUSSION

A number of specialized integumentary structures is present in rodents, that support their sensory, communication, and environmental adaptation needs. These structures evolve from series of reciprocal interaction between the epidermis and the underlying mesenchyme (Hyttel *et al*., 2010). The eyelids (palpebrae) are two musculofibrous folds of which the upper is the more extensive (Konig *et al*., 2007), drawn over the anterior surface to occlude light and protect the cornea (Dyce *et al*., 2010). It consists of skin, middle musculofibrous layer and mucous membrane. The epithelial covering varies with the area and species (Jo Ann and Brain, 2006). In the present study, the stratified squamous epithelial type was observed. The noticeable meibomian gland (tarsal) and sebaceous gland of Zies were the two periocular glands associated with the eyelids of the cane rat (Peter-ajuzie and Nwaogu, 2022).

The morphological characteristic of the tarsal gland was similar to our observation. This gland is modified sebaceous gland known to produce the oily superficial layer of the tear film (Leslie gatner), a crucial component of lacrimal apparatus essential for maintaining ocular surface health and the stability of the tear film (Osae *et al*., 2019). The skin covering of the ear auricle was generally smooth devoid of epidermal ridges (interpapillary pegs) as observed by (Akpan *et al*., 2018). The feet of cane rats were adapted for terrestrial locomotion and digging. The histomorphological features of the digital pads presented a specialized thickened cornified layer of skin as reported in African giant rats (Ibe *et al*., 2014), which reflects the need for durability, cushioning, and grip. The histological characteristics of the dorsal surface of the trunk in our findings was similar to earlier reports of Akpan *et al*. (2018). Our findings offer valuable insights into the basic histomorphology of specialized areas of the integument in cane rats, which are consistent with closely related species inhabiting the sub-Saharan Africa.

Conflict of Interest

The authors have no conflict of interest to declare.

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REFERENCES

Adebayo, AO., Adegbesan ZA, Okandeji, ME., Mustapha, OA., Olude, MA., Akinloye, AK. (2019). An anatomical perspective: Does the male greater cane rat (*Thryonomys swinderianus*) have a scrotum? *Anatomy Journal of Africa*, 8(2); 1523-1530.

Akpan, MO., Samuel, OM. and Emikpe, BO. (2018). Regional skin histomorphology in adult greater cane rats (*Thryonomys swinderianus*): A pilot study. *International Journal of Veterinary Science and Medicine*, 6(2); 219-226. http://doi.org/10.1016/j.ijvsm.2018.11.001.

Akpan, MO., Samuel, OM. and Emikpe, BO. (2020). Peculiar epidermal peg pattern in cane rat skin. *Sokoto Journal of Veterinary Sciences*, 18(2); 100-103. http://dx.doi.org/10.4314/sokjvs.v18i2.6.

Bancroft, JD. and Stevens, AA. (1997). Theories and practice of histological technique (4th ed.), Churchill Living Stone, Livingstone Edinburgh, London, New York (1997), pp. 109-145.

Dyce, KM., Sock, WO. and Wensing, CSG. (2010). *Veterinary Anatomy* 4th edition. W.B sounders company Philadelphia. Pp 149.

Hyttel, P., Sinowatz, F., Vejisted, M. and Betteridge, K. (2010). E*ssential of Domestic Animal Embryology*. Saunders Elsevier Toronto pp 317-18.

Ibe, CS, Salami, SO., Itopa, E. and Ajayi, IE. (2014). Trunk and paw pad skin morphology of the African giant pouched rat (*Cricetomys gambianus*, Waterhouse-1840). *European Journal of Anatomy*, 18 (3); 175-182.

Jo Ann, E. and Brian, LF. (2006). *Dallmann's Textbook of Veterinary Histology*, 6th Edition. Blackwell publishing, Wiley India Pvt. Ltd, New Delhi

Kingdon, J. (1997). *The Kingdon Field Guide to African Mammals*, London and New York: Nat. World Academic Press, p-45.

Konig, HE and Liebich, HG. (2007). *Veterinary Anatomy of Domestic Mammals*, Text book of Color atlas 3rd edition.

Leslie, P. and James, L.H. (2000). *Color Atlas of Histology*, 3rd Edition. Lippincott Willaims and Wilkins Baltimore, Maryland, USA. Pp 222-223.

MeckLenburg, L, Kusewitt, D., Kolly, C., Treumann, S., Terence Adams, E., Diegel, K., Yamate, J., Kaufmann, W., Müller, S., DiMitry Danilenko, D. and Bradley, A. (2013). Proliferative and Non-Proliferative Lesions of the Rat and Mouse Integument. *Journal of Toxicologic Pathology*, 26 (3 Suppl): 27S-57S

Molina, AM., Moyano, E., Manuel, SR. and Nuham, AS. (2015). Analyses of anesthesia with etamine combined with different sedatives in rat. *Veterinarni Medicina*, 60(7); 368-375 http://doi.org/10.17221/8384-VETMED.

Mustapha, OA., Teriba, EE., Ezekiel, OS., Olude, AM., Akinloye, AK. and Olopade, JO. (2020). A study of scientific publications on the greater cane rat (*Thryonomys swinderianus*, Temminck 1827). *Animal Model Experimental Medicine*, 22;3(1):40-46 http://doi.org/ http://doi.org/10.1002/ame2.12103.

Osae, EA., Steven, P., Redfern, R., Hanlon, SC., Smith, W., Rolando, E., Rumbaut, RE. and Burns, AR. (2019). Dyslipidemia and Meibomian Gland Dysfunction: Utility of Lipidomics and Experimental Prospects with a Diet-Induced Obesity Mouse Model. *International Journal of Molecular Science,* 20, 3505; 1-19 http://doi.org/10.3390/ijms20143505.

Peter-Ajuzie, IK. and Nwaogu, IC. (2022). Morphological evaluation of the orbit and peri-ocular glands of the African grasscutter (*Thryonomys swinderianus*). *Sokoto Journal of Veterinary Sciences*, 20 (Special): 54 - 62. http://dx.doi.org/10.4314/sokjvs.v20i5.6

Young, B., Lowe, SJ., Stevens, A. and Heath, JW. (2014). *Wheater's Functional Histology*. A Text and Color Atlas. 6th Edition, Churchill Livingstone. pp 167-168.