Comparative Histological Study of the Sebaceous and Sweat Glands Between the Gray Mongoose (Herpestes edwardsii) and the Domestic Cat (Felis catus)

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***Abstract*—** This study examines comparative histological and histochemical Study of the Sebaceous Glands and sweat glands between the Gray Mongoose (Herpestes edwardsii) and the domestic cat (Felis catus), the researcher design was based on an experimental Twelve samples were obtained from skin that gathered in the Middle Euphrates region for the current investigation, including 6 gray mongooses(*Herpestes edwardsii)* and 6 domestic cats (*Felis catus)*. Samples of skin were obtained from similar body regions in both groups to ensure uniformity in comparison analysis. Histological and Histochemical Staining Paraffin sections obtained from all examined skin regions (dorsal and foot pad) were subjected to routine histological and histochemical staining techniques.Hematoxylin and Eosin (H&E).Staining was performed to evaluate the general histological structure of the of the sebaceous and sweat Gland **.** The comparison included an analysis of the histological and chemical characteristics of the glands in terms of shape, distribution, density, and secretory activity between the two studied types. The gray mongoose had numerous, massive, well-formed glands for sebaceous that were positioned in the superficial layer of the skin and closely linked to hair follicles. On the basis of his they showed a standard alveolar (acinar) configuration made up of sebaceous clusters of cells with the vacuolated cytoplasm because of the amount of lipid and peripherally positioned nuclei.Sebocytes matured in a holocrine pattern, migrating through the lobule's center, accumulating lipid substance, and finally disintegrating to discharge sebum into the follicular canal as usual. Lipid obtaining throughout conventional tissue processing was reflected in the lobules' obvious nuclear morphology and light staining Sebaceous glands were identified in domestic cats, but they were a little widely dispersed, suggesting that comprehensive lipid-derived skin protection was not as necessary. The microscopic study of the gray mongoose's cutaneous layer reveals the existence of highly developed apocrine sweat glands, which are located in the dermis, typically in close vicinity to hair follicles. The glands were embedded in the dermal connecting tissue and resemble (coiled tubular forms). In cats, the eccrine sweat glands typically reside in the foot paw pads whereas they have an increasingly restricted distribution in the body.These glands were smaller in size than apocrine glands and composed of coiled tubular secretory portions inserted within the dermis. "Simple cuboidal epithelial cells" line the secretory region, and two separate layers of cuboidal cells line the ducts. compared to apocrine glands, the ducts of eccrine glands open up direct toward the surface of the epidermis. In overall, the lumina were smaller.

Keyword **-**Histochemical, sweat, sebaceous,mongoose , cat.

INTRODUCTION

In addition to operating as a sensory and endocrine organ, the mammalian skin serves as a physical, chemical, and biological barrier against the external environment(1). In terms of structure, it consists of the epidermis, which is a constantly renewing stratified epidermis, and the dermis, which is embedded in a fibroblast-rich stromal matrix and contains skin appendages including hair follicles, sebaceous glands . and sweat glands.(2). The dermis of most mammals contains hair follicles associated with exocrine sebaceous glands.called sebaceous glands (3). Sebum, which is secreted by the sebaceous gland, a holocrine gland, hydrates the body, minimizes water loss(4)and acts as a barrier against microbes and the environment.(5) .These glands are frequently located in close proximity to hair follicles(6)and the activity and density of these glands varies among animal species based on lifestyle and environmental factors(7) .The majority of mammal species share a similar general sebaceous glands microscopic structure (8,9). The secretory acini that make up the glands, which can be unilobular, bilobular, or multilobular, are joined to the distal part of the hair follicles by a keratinized duct.(10).The sebaceous gland and the make up the piloseba ceous unit, together with the arrector pili muscle(11). The region is located distal to the junctional zone, which is the area where the sebaceous gland

duct enters into the pilar canal(8,12). Sweat glands are coiled tubular glands that play a crucial role in controlling the skin's physiological processes.(13). Eccrine and apocrine glands are the two primary types of sweat glands(14) .Eccrin sweat glands are essential for controlling body temperature through evaporation because they create watery sweat that contains water, salts, and certain waste materials.(15). Eccrine sweat gland development and sweat secretion.(16). In certain animal species, they are common, whereas in others, they are few.(17). The apocrine glands, on the other hand, are frequently connected to hair follicles and release more viscous secretions that are high in proteins and fats.(18). In addition to their secondary role in temperature control,(19). They may also play a role in chemical and behavioral processes such chemical communication among individuals.(20). One of the most common pets worldwide is the domestic cat (Felis catus), which is a member of the order Carnivora. It possesses unique skin glands that help maintain the health and varied functions of the skin, as well as a covering of fur that offers protection and insulation. The lifestyle of the cat, which blends household life, hunting, and activity, is reflected in its skin.(21). A member of the mongoose family, the grey mongoose (Herpestes edwardsii) is a feral animal. It lives in a variety of settings, including semi-deserts, deserts, and agricultural regions. The morphological and functional features of this animal's skin show its high level of activity and adaptability to many environmental circumstances. According to studies, the skin of wild animals frequently has unique tissue modifications that enable it withstand extreme climatic conditions and mechanical forces.(22). Because these variations reflect the functional and environmental adaptations of each species,(23). Comparative histology investigations are crucial in elucidating the differences between various species in the structure of the skin and its appendages.(24). Therefore, the present study aimed to compare the histological and histochemical characteristics of sebaceous and sweat glands in the skin of the gray mongoose and domestic cat

MATERIALS AND MTHODS

Samples collection

Twelve samples were obtained from skin samples collected in the Middle Euphrates region for the current investigation, including 6 gray mongooses and 6 domestic cats. Samples of skin were obtained from similar body regions in both groups to ensure uniformity in comparison analysis. After being collected, the animals were dissected, and the gray mongooses weighing 550–600 g while, the cat weighing (1600-1800) g were carefully removed to avoid damaging the tissues. Every animal in the experiment received I\m injections of a mixture composed of ketamine and xylazine [450 mg/kg ketamine and 45 mg/kg xylazine].(25). An electronic balance was used to determine the weight (26,27).

Histological and Histochemical Staining

Paraffin sections obtained from all examined skin regions were subjected to routine histological and histochemical staining techniques. Hematoxylin and Eosin (H&E) staining was performed to evaluate the general histological structure of the sebaceous Glands and sweat glands.(28).

Statistical analysis

The results are presented as mean values ± standard error (SE). The Levene test was used to determine the homogeneity of the variance between the groups. When the variance was homogenous, T test was applied to estimate the significance of the difference between the groups. The significance was determined at $p < 0.05$. Statistical analysis was performed using SPSS version 27 for Windows.(29).

RESULT AND DISCUSSION

Sebaceous Glands

The gray mongoose had numerous, massive, well-formed glands for sebaceous that were positioned in the superficial layer of the skin and closely linked to hair follicles. On the basis of his they showed a standard alveolar (acinar) configuration made up of sebaceous clusters of cells with the vacuolated cytoplasm because of the amount of lipid and peripherally positioned nuclei Sebocytes matured in a holocrine pattern, migrating through the lobule's center, accumulating lipid substance, had spherical nuclei located at the base of cell and finally disintegrating to discharge sebum into the follicular canal as usual Lipid loss during routine tissue processing was reflected in the lobules' obvious nuclear morphology and light staining (Figure, 1,2).Similar findings have been seen in animals with highly developed sebaceous glands relative to hair follicle density and activity. (8). that stated sebocytes are highly specialized epithelial cells that secrete sebum by cellular breakdown and membrane rupture (holocrine secretion). Although there are sebaceous glands.that are not connected to a hair follicle, these cells are most frequently seen in the skin in conjunction with hair follicles (creating the pilosebaceous unit), where they originate from hair follicle keratinocytes.Sebaceous glands were identified in domestic cats, but they were a little widely dispersed, suggesting that comprehensive lipid-derived skin protection was not as necessary (Figure,4).These results agreement with (30) that stated that the Fel d 1 accumulates more in the fur of anatomical areas like the face that have larger concentrations of sebaceous glands. Additionally, it has been noted that the neck has larger concentrations of Fel d 1 than the chest, back, and haunches.

Sweat glands

The microscopic study of the gray mongoose's cutaneous layer reveals the existence of highly developed apocrine sweat glands, which are located in the dermis, typically in close vicinity to hair follicles. The glands were embedded in the dermal connecting tissue and resemble (coiled tubular forms).(Figure,5). These finding corresponding with (31). Who stated that the skin glands, hair follicles are connected to sebaceous glands. Arrector pili contraction may aid in the expression of sebaceous gland secretions, and their oily secretions help maintain the hair coat's softness and water resistance.

The gland's secretory section has a broad lumen as well as is comparatively large. "Simple cuboidal to columnar "epithelial cells with rounded, centered or basally positioned

nuclei enclose it. Hematoxylin and staining reveals that the cytoplasmic cells' cell cytoplasm was somewhat eosinophilic. Myoepithelial cells attach to the secretory cellular units secretory compounds by forming a thin, rigid contractile layer between the epithelial cells.(Figure,5). These results disagreement with (32) that stated that the Simple cuboidal epithelium lined the duct part, which had a limited lumen. Stratified squamous epithelium bordered the higher ducts.

The duct component of the gland was more narrow than the secretory region and is lined by "stratified cuboidal epithelium". Instead of opening immediately onto the epidermal outer layer, these ducts usually open into the hair follicles. There may be gently colored secretory material in the glands' lumina (Figure,5). In general, the histological framework demonstrates a gland adapted for apocrine secretion, which in the majority of carnivores was corresponds to perfume generation and interaction rather than thermoregulation. These results agreement with (33) that stated that the sweat gland is a simple coiled tubular gland that is connected to hair follicles. It is found in the reticular layers of the dermis and is mostly found in clusters in the thoracic region. While dogs' lobular glands are dispersed across the dermis layers, these sweat gland conduits connect with the skin's surface.(34).

The most common kind of sweat glands in domestic cats were apocrine ones, which are found all over the body's hairy skin. They resemble coiled tubular glands with comparatively large lumina and are found in the deep dermis or close to the hypodermis. Simple cuboidal to columnar epithelial cells with round, basally located nuclei line the secretory portion. Myoepithelial cells that aid in secretion release surround these glands. Usually opening into hair follicles, their ducts are lined with stratified cuboidal epithelium (Figure, 6). These result akin with (14,35). Who reported the These cells are located among the basement membrane and glandular epithelial cells. They aid in the gland's discharge being expelled into the passageway when they contract out.

In cats, the eccrine sweat glands typically reside in the foot paw pads whereas they have an increasingly restricted distribution in the body. These glands were smaller in size than apocrine glands and composed of coiled tubular secretory portions inserted within the dermis. "Simple cuboidal epithelial cells" line the secretory region, and two separate layers of cuboidal cells line the ducts. compared to apocrine glands, the ducts of eccrine glands open up direct toward the surface of the epidermis. In overall, the lumina were smaller (Figure,6). These finding agree with (36). Who stated that the follicular drainage systems of apocrine glands normally supports localized, viscous-like substances responsible for scent and signaling, the direct epidermal opening of eccrine gland ducts allows for quick, extensive, and effective secretion appropriate for thermoregulation. This structural distinction emphasizes the significance of anatomical design in physiological specialization and supports the different functional roles of these two gland types.

Table 1. measurements skin glands of cat and mongoose (Mean ±SE)

Species	dorsal	foot pad
Cat	30±1.58a	28.5±2.91a
mongoose	36.5±3.58a	23.5±2.17a
Calculated T value	1.65	1.37
Calculated P value	0.136(NS)	0.207(NS)

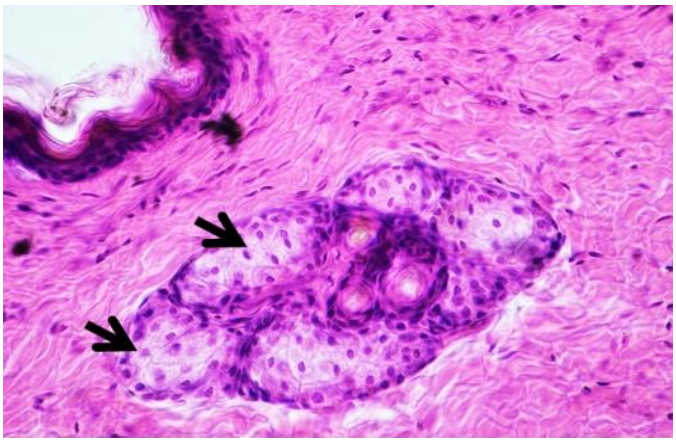

Figure 1. Photomicrography of skin in gray mongoose show general structure sebaceous gland (black arrows). H&E stain.40X.

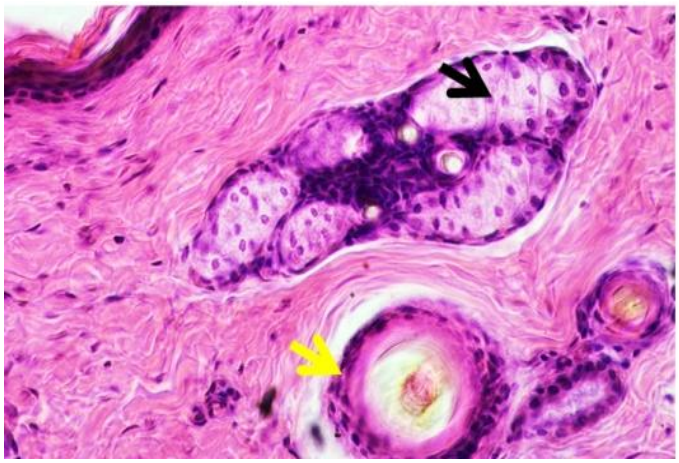

Figure 2. Photomicrography of skin in gray mongoose show sebaceous gland had light cells contain spherical nuclei located peripherally at the basement membrane (black arrows). The secondary hair follicle associated by. Apocrine gland (yellow arrow). H&E stain.40X.

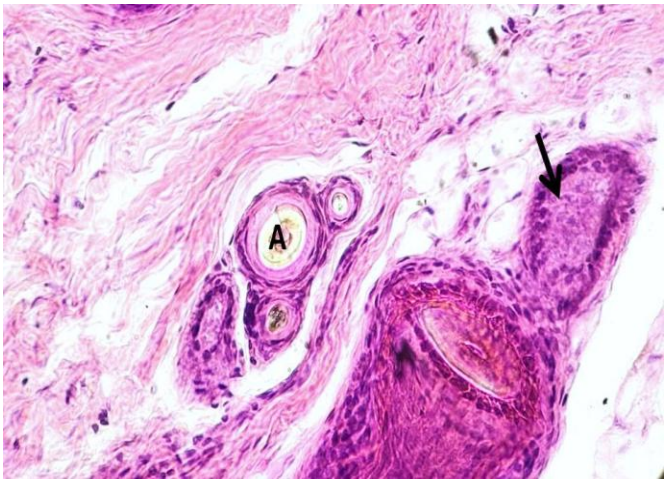

Figure 3. Photomicrography of skin in gray mongoose show the general structure sebaceous gland with explain placed of (black arrow). H&E stain.40X.

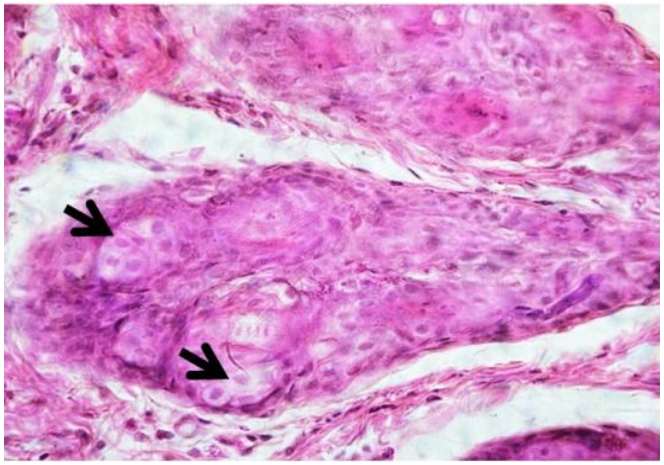

Figure 4. Photomicrography of skin in cat show the sebocytes in this gland present a less number than gland in mongoose and this cells had nuclei located more toward the central of cell (black arrow). H&E stain.40X.

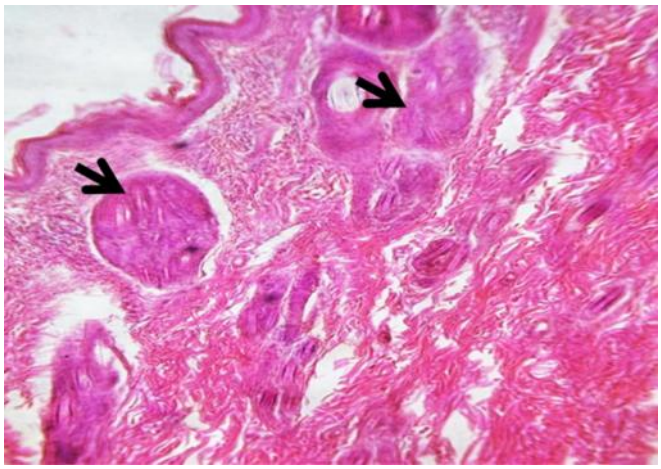

Figure 5. Photomicrography of skin in gray mongoose show the dermis layers contain primary hair follicles (A). Apocrine Sweat gland (simple coiled had large lumen (black arrow). H&E stain.400X

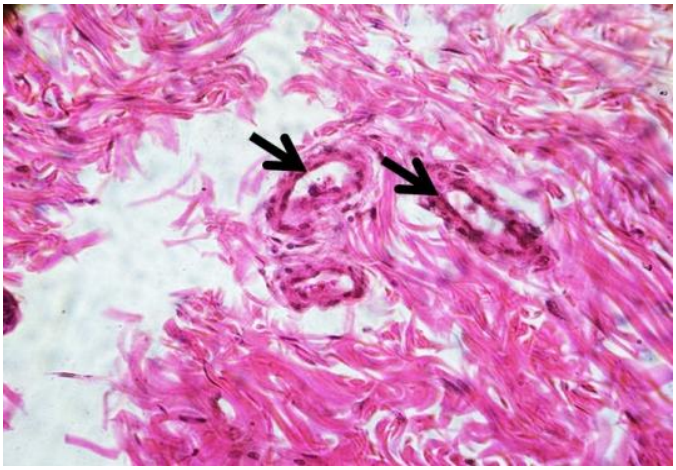

Figure 6. Photomicrography of skin in domestic cat show the dermis layers contain a large amount of collagen fibers surrounded the apocrine Sweat gland (simple coiled had large lumen (black arrow). H&E stain.400X**.**

CONCLUSION

The gray mongoose has more developed and widely dispersed sebaceous glands than domestic cats. A higher amount of sebum production is suggested by this enhanced glandular growth, which may improve skin lubrication, barrier function, and defense against environmental stresses. The gray mongoose's adaptation needs in response to unpredictable and sometimes severe ecological circumstances are probably linked to this structural specialization. Domestic cats, on the other hand, displayed much less extensive sebaceous gland development, indicating that the two species differed in their integumentary adaptability. In comparison to the domestic cat, the gray mongoose's sweat glands showed more noticeable structural differentiation and a more specialized organization, suggesting a possibly more effective thermoregulatory capacity. The location, structure, and organization of cutaneous glands, particularly sweat and sebaceous glands, were shown to differ significantly between species. Interestingly, apocrine glands were strongly linked to hair follicles in both species, especially in cats, indicating their role in secretory processes connected to follicles and skin physiology unique to each species.

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