Nigerian Veterinary Journal Vol. 28(2) 2007:33-38

HISTOLOGY OF THE EXOCRINE GLANDS OF THE CANINE PERIANAL SKIN

OGUNKOYA*, Y. O., EMA, A. N., GHAJI, A. and ADOGWA, A. O.

Department of Veterinary Anatomy, Faculty of Veterinary Medicine, Ahmadu Bello University. Zaria, Nigeria.

*Correspondence: yoogunkoya@yahoo.com, **Current Address:** Southern University and Agricultural and Mechanical College, College of Sciences, Department of Biological Sciences, 244 James Hall, Baton Rouge, LA 70813.

SUMMARY

A histopathological study of the perianal skin of indigenous breeds of dogs in Nigeria was carried out in Zaria. The skin in this area had three types of glands: sebaceous, sweat, and hepatoid circumanal glands. Sebaceous glands in this area release their product by holocrine mode in which the whole cell is secreted with its oily secretion, sebum and the sweat glands release their secretion by apocrine, mini-apocrine, apical decapitation and or merocrine mode. The hepatoid circumanal glands were found in both male and female dogs and there was no evidence of ducts in or around these glands. The skin and glands had the normal histologic features reported by earlier workers.

KEY WORDS: Exocrine glands, Canine, Perianal skin

INTRODUCTION

The mucosa of the anal canal can be divided into three zones: the proximal columnar zone, the middle intermediate zone and the distal cutaneous zone. The distal cutaneous zone of the anus is covered by a thin hairless skin rich in sebaceous and sweat glands in all domestic animals (Akaevski, 1975; Miller, 1979; Sisson and Grossman, 1975 and Budsberg and Spurgeon, 1983). These glands release their secretory products by the exocrine mode.

Exocrine glands are multicelluar glands with a system of ducts through which their secretory products are transported to the sites of utilization. Exocrine mode of secretion are apocrine, merocrine, or exocrine and holocrine (Rhodin, 1974; Calhoun and Stinson, 1981; Budsberg and Spurgeon, 1983; Garguilo *et al.*, 1990; Atoji *et al.*, 1998; Meyer *et al.*, 2001 and Gesase and Satoh, 2003). Sebaceous glands release their secretory products by holocrine mode. In holocrine mode of secretion, the entire cell is extruded and constitutes the secretory product. The sweat glands release their secretory products by apocrine or merocrine. According to Gesase and Satoh (2003), in apocrine secretion the secretory materials may be contained in the secretory vesicles or dissolved in the cytoplasm that is lost during secretion. In merocrine or exocytosis, the secretory product enclosed within a unit membrane, is released as small secretory granules. These secretory products are usually referred to as granules or vesicles. The granulated vesicles are packaged within the cell. On reaching the cell membrane, the granulated vesicle fuses with the inner layer of the cell membrane and becomes incorporated with it, the secretory product is discharged without any disruption of the cell membrane (Rhodin, 1974; Montgomery *et al.*, 1985; Fawcett, 1986 and Gesase and Satoh, 2003).

Even though a lot has been done on the perianal skin of dogs in other parts of the world, little or nothing has been done on the indigenous breeds of dogs in Nigeria. The objective of this work is to undertake the histological study of the exocrine glands located in the cutaneous zone of this region.

MATERIALS AND METHODS

A total of 15 dogs consisting of 10 healthy puppies (5 females and 5 males) and 5 healthy adult dogs (2 females and 3 males) of indigenous breed of both sexes were utilized for this study. The dogs were injected intravenously with short acting general anesthesia, (Pentothal) administered to effect. The perianal skin area was shaved with sharp razor blade and cleansed with a swab already soaked in physiological saline solution. The circumanal tissue of 2 centimeters in length was removed from each of the dogs, starting from the mucocutaneous junction, extending away from the anal orifice. The tissue collected was fixed in 10% formol saline for 24 hours, and trimmed to obtain the relevant portion. The specimens were washed several times in phosphate buffered saline (PBS) and dehydrated in ascending grades of alcohol, cleared in undiluted xylene and infiltrated in wax. The specimens were embedded in wax, mounted on block and sectioned. The tissue sections were stained with Haematoxylin and Eosin stains and were examined under the light microscope.

RESULTS

The perianal skin of both groups of dogs had sparse hair distribution. The perianal or circumanal skin was made of the epidermis, dermis and the hypodermis. In the dermo-hypodermis were the hair follicles, sebaceous, sweat and the hepatoid circumanal glands, cutaneous muscle fibers (external sphincter ani muscle), loose connective tissue, numerous fat cells and the vascular elements.

The epidermis was the outermost layer of the skin and was made of a keratinized stratified squamous epithelium and the *stratum basale* was thrown into "folds or ridges". The layers of the epidermis encountered were: the distinct *stratum basale, stratum spinosum, stratum granulosum and stratum corneum. The stratum disjunctivum* was the most superficial portion of *stratum corneum.* The cells of the *stratum basale* were resting on the basement membrane. These cells appeared cylindrical and their nuclei were elongated or oval in shape but their cytoplasm and the cell membranes were indistinct. The *Stratum spinosum* was made of 3-4 rows of cells. The nuclei of these cells were observed to be round, large with scattered dark chromatin patches. The *stratum granulosum* was superficial to *stratum granulosum* and was represented by dark granules. Both the cellular and nuclear outlines were not discernible. The *stratum corneum* was the outermost layer of the epidermis and was represented by layers of dead keratinized cells while *stratum disjunctivum* was the detaching portion of *stratum corneum* (Plate. 1).

The dermis showed the superficial papillary layer and the deep reticular layer. The papillary layer had fewer fibres than the deep reticular layer. The hypodermis or the subcutis was represented by a layer of loose connective tissue with fat cells.

The structures observed in the dermo-hypodermal layers of the perianal skin were numerous striated muscle fibres, air follicles, sebaceous glands, hepatoid circumanal glands, sweat glands and vascular elements. Numerous striated muscle fibers were observed throughout the dermis close to the three glands (Plate 4). Many hair follicles appeared continuous with the epidermal cells as seen in Plate 1. From the epidermis to the hypodermis the set of glands encountered were the sebaceous glands, deeper to which were the hepatoid circumanal glands. The sweat glands were observed deeper to the hepatoid circumanal glands.

The sebaceous gland was attached to hair follicles via their ducts. The ducts of the sebaceous acini formed pilosebaceous canal with the hair follicle (Plate 2). These sebaceous glands were observed to consist of several lobes. A lobe was made of 7 or more lobules which in turn were made of acini. Each sebaceous gland was separated from the neighbouring dermal structures by connective tissues, which ramified into the sebaceous gland dividing it up into lobes, lobules and acini (Plate. 3).

A secretory sebaceous acinus is flask or gourd shaped. Each secretory acinus consisted of peripherally located undifferentiated, flat cells (myoepithelial cells) and the centrally located

vacuolated, polyhedral cells, demarcated from its neighbour by thin connective tissue. The nuclei of the peripheral (basal) cells were elongated, flat and basophilic but the outlines of the cytoplasm and the cell membrane were not distinct. The peripheral cells rested on a thin basement membrane and there was little or no intercellular matrix between them.

Next to the basal layer of undifferentiated cells was a layer of polygonal cells with round to oval nuclei, nuclear envelope was distinctly basophilic, nucleolus and other materials were very distinct while the cytoplasm and the plasmalemma were indistinct. It appeared as if the entire cell was occupied by the nucleus. After this layer was the row of cells with small vacuoles. The nuclei of these cells were round. The cell membrane and the cytoplasm could be observed while the nucleolus was indistinct.
The next row of cells had larger vacuoles, bigger cytoplasm with eccentric nucleus. These were followed by cells with pyknotic nuclei, and larger vacuoles until the cells were completely vacuolated. All the inner secretory cells of the sebaceous acini had polygonal shape. The cells closer to the centre and the duct of the sebaceous acinus were completely vacuolated (Plate 3). Vacuolated secretory cells of the sebaceous acinus may have up to 10 cell layers. Muscle fibers were observed close to the sebaceous acini and were separated from it by connective tissue fibers and cells.

Hepatoid circumanal glands were located in the deep layer of the dermis and the hypodermis. The cells of these glands appeared like cords of liver cells. There was no evidence of ducts in or around these glands and can not be regarded as an exocrine gland.

The secretory tubules of the sweat glands had larger lumina and they were either saccular or tubular. Each secretory acinus was surrounded by a connective tissue (Plate 4). In some acini, cytoplasmic protrusions of cells and 'pinched off' portions of cells were observed in the lumina. The secretory acini of the sweat glands were lined by simple cuboidal epithelium. Each secretory tubule had two types of cell: the peripheral basal cells (myoepithelial cells) were flat or elongated with no distinct cellular outlines. The inner secretory cells were cuboidal to low columnar depending on the stage of secretion. The ducts of the sweat glands were lined by stratified cuboidal epithelium with smaller lumen. The stratified cuboidal epithelium consisted of two rows of cells with large, round, basophilic nuclei.

PLATE 1: Light micrograph of part of the skin
D=Dermis, E=Epidermis, HD=Hypodermis, HF=Hair follicle
LMX 63

PLATE 2: Light micrograph showing part of the layers of the skin
HF=Hair follicle, P=Pilosebaceous canal, Sg=Sebaceous gland
LM X 63

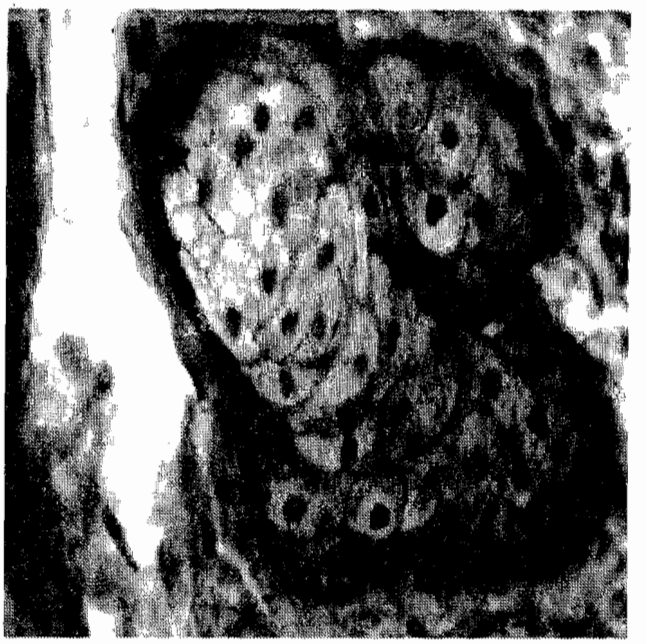

PLATE 3: Light micrograph of the sebaceous gland sebaceous gland with its multilobulation LM X 63

PLATE 4: Light micrograph of sweat gland tubules Note: the cytoplasmic protrusions of some glandular cells of the sweat gland, pinched off structures in the lumen of the tubules a cell about to decapitate LMX63

DISCUSSION

As described by Parks (1950), Nielsen (1953), Calhoun and Stinson (1981), the canine perianal skin consists of the usual two layers encountered in any normal integument with three different glands. Both the sebaceous and sweat glands are epidermal derivatives and both have been reported to be exocrine glands (Copenhaver *et al.,* 1971; Rhodin, 1974 and Fawcett, 1986). These reports are consistent with the observation of the present authors. From this work, the sebaceous glands appear to have a holocrine mode of secretion. Parks (1950), Nielsen (1953) and Budsberg and Spurgeon (1983) reported that these glands have holocrine mode of secretion.

There is a lot of controversy as to the mode of secretion of the sweat glands. Maximow and Bloom (1954) and Jenkinson (1967) reported that sweat glands release their secretion by apocrine mode. This mode is based mainly on the observation of the authors on the different stages of cellular configurations of the secretory cycle of the glands, in which epithelial cell of the secretory tubule increases in size from cuboidal to columnar, the luminal apex then forms a bleb which breaks off to form the secretion and the cell finally reverts to its original cuboidal form. This report is consistent with the current observation of pinched off bleb as seen in Plate 4. Hashimoto *et al* (1966) made a postulate based on their electron microscopic observation that the sweat glands secrete by exocytosis or "pinching off" of the microvilli. Kurosumi *et al* (1963), Hashimoto *et al* (1966) and Montgomery *et al* (1985) also observed in their histological preparation, cells with ruptured apical membranes and concluded that in addition, secretion may occur by a process of apical decapitation. All the above modes of secretion are consistent with the observations of the current study as seen in Plate 4. (apocrine, mini-apocrine, apical decapitation and rupturing of cell membrane). Nuclei, pinched off blebs, and the process of apical decapitation can be observed in the lumen of some secretory tubules of Plate 4.

The idea of apical decapitation has been refuted by Biempica and Montes (1965) on the grounds

that rupturing of the cell membrane will lead to finding of secretory granules and nuclei in the lumen. Montgomery *et al* (1982) observed that equine sweat glands secrete by micro-apocrine mode and by exocytosis.

Exocytosis or emicytosis or merocrine mode of secretion occurs when the mature secretory granules in the apical portion of exocrine cells and the boundary membrane of the secretory granules fuses with the cell membrane, and the content of the granule is discharged into the lumen of the acinus of the exocrine glands (Rhodin, 1974).

The location and the morphology of both the sebaceous and sweat glands do not differ from what has been described by earlier workers, but numerous skeletal muscle fibres were observed at the zones of these three glands. Baker (1967) and Isitor (1978) observed striated muscle fibres at the zone of the hepatoid circumanal glands. The importance of the striated muscle fibres was not discussed by these authors but we think the striated muscle fibers to be part of external anal sphincter muscle. The observation of smooth muscle fibres in this study agrees with the report of Baker (1967) whereas Isitor (1978) reported to the contrary the presence of smooth muscle fibres.

ACKNOWLEDGEMENT

The authors are grateful to Ahmadu Bello University, Zaria, Nigeria for its support in facilitating this study.

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