



Original Research Article

SOI: <http://s-o-i.org/1.15/ijcrms-2016-2-7-4>

Gross and Microscopic Features of the Interdigital Sinus in the Barbados Black Belly Sheep in Trinidad

Reda Mohamed* and Andrew Adogwa

¹Department of Basic Veterinary Sciences, School of Veterinary Medicine, Faculty of Medical Sciences, University of the West Indies, Trinidad and Tobago & Anatomy and Embryology Department, Faculty of Veterinary Medicine, Beni Suf University, Egypt

²Department of Basic Veterinary Sciences, School of Veterinary Medicine, Faculty of Medical Sciences, University of the West Indies, Trinidad and Tobago

*Corresponding author: Reda.mohamed@sta.uwi.edu

Abstract

The aim of this study is to determine the anatomical and histological features of the interdigital sinus in the Barbados Black Belly sheep in Trinidad. About 20 feet were collected from the slaughter house and school of Veterinary Medicine in Trinidad. The anatomical study of the dissected interdigital sinus revealed that the shape of the sinus resembled a pipe consisting of body, flexure and excretory duct with external orifice and it was located between the digits in all feet. The wall of the interdigital sinus had three layers; epidermis, dermis and fibrous capsule. The epidermis consisted of a stratified squamous keratinized epithelium. The dermis contains hair follicles, sebaceous glands and secretory acini of the sinus lined by simple cuboidal epithelium. The gland was divided into lobules separated by interlobular connective tissue. The interdigital sinus was surrounded by the fibrous capsule containing several parallel bundles of collagen fibers, nerve fibers and blood vessels.

Keywords: Anatomy, Histology, Interdigital sinus, sheep.

Introduction

Blackberry sheep is one of the most commonly found breeds of sheep in Trinidad. Both male and female have no horns. It is bred largely for meat. Lameness in sheep which starts in the interdigital region has significant economic losses reflected as high costs of treatment and therapy and loss of body weight (Avdic *et al.*, 2013). The gland has bactericidal and fungicidal effects (Abbasi *et al.*, 2013). The interdigital sinus may cause foot rot by its infection with anaerobic bacteria such as fusobacterium necrophorum under poor hygienic conditions and mechanical injuries therefore may

need surgical interference (Avdic *et al.*, 2013; Wood, 2003). Much work has been done on the interdigital sinus in in Lori's sheep (Abbasi *et al.*, 2013), in Tuj sheep (Aslan *et al.*, 2010), in Egyptian native sheep (Awaad *et al.*, 2015), in Akkaraman sheep (Karahana *et al.*, 2007) and in Kivircik sheep (Suzer *et al.*, 2015). This study was done to provide information on the gross and microscopic anatomy as well as to provide a surgical approach to the interdigital sinus of the Barbados Black Belly sheep in Trinidad as there were no reports of any studies on the interdigital sinus of the Barbados Black Belly sheep.

Materials and Methods

The investigation was carried out on 20 limbs of male and female adult healthy Barbados Black Belly sheep in Trinidad. The limbs were obtained from the abattoir and school of Veterinary Medicine in Trinidad. They were dissected for gross examination. For histological examination, the specimens were put in 10% formaldehyde fixative solution at room temperature for 24 hr. The routine procedure of dehydration in ascending grades of alcohol, clearing in xylene then embedding in paraffin followed by serial sections of 5um using a microtome. The sections were stained with Haematoxylin and Eosin stain as well as Van Gieson stain. The sections were examined with the light microscope.

Results

I- Gross Anatomy

The interdigital sinus was found in all feet of the examined sheep in the interdigital area between the proximal and distal interphalangeal joints (Fig.5). It was present as a peculiar tubular invagination resembling the shape of the pipe. In both limbs, the interdigital sinus (Figs. 2, 3, 5, 6, 7, 8) consisted of a blind sac or body and a narrow long neck or excretory duct with external orifice. A prominent flexure between the body and the neck was easily notable. The blind sac was connected to the neighboring tissues by the connective tissue (Fig. 5). The external opening of the neck was observed dorsally at the level of the proximal interphalangeal joint (Figs 3& 6). The body of the interdigital sinus of the hind feet was smaller than that of the forefeet in the same animal (Figs. 7, 8). There was no sex variation observed.



Fig. 1



Fig. 2

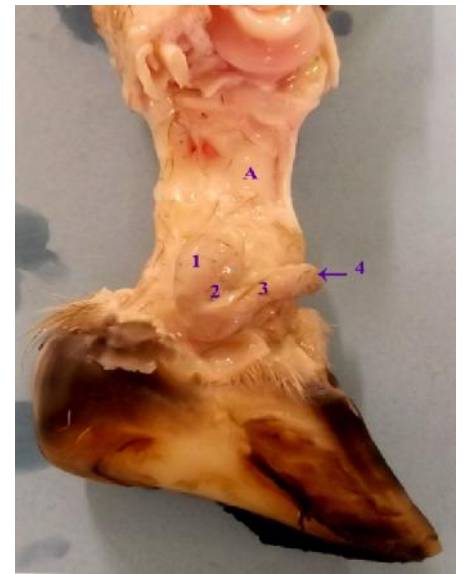


Fig. 3

Fig.1: Dorsal view of the interdigital region of the Forelimb of the Barbados Black Belly sheep showing the external orifice of the interdigital sinus (arrow)

Fig.2: Dorsal view of the interdigital region at the Forelimb of the Barbados Black Belly sheep showing the parts of the interdigital sinus in situ. A. proximal phalanx, 1. body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice.

Fig.3: lateral view of the interdigital region at the forelimb of the Barbados Black Belly sheep showing the parts of the interdigital sinus in situ. A. proximal phalanx, 1. body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice.

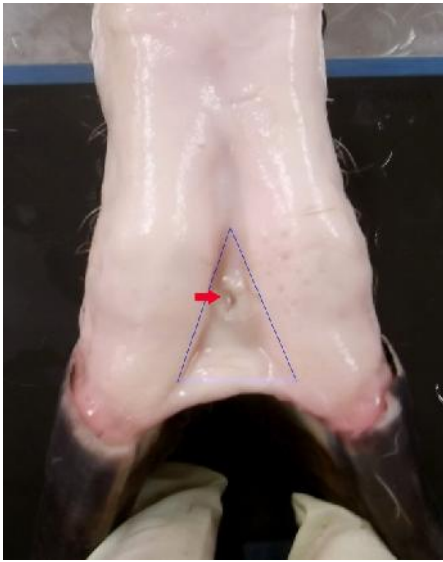


Fig. 4



Fig. 5

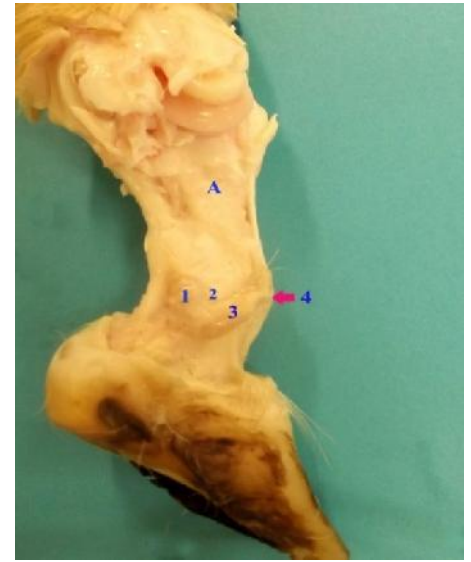


Fig. 6

Fig.4: Dorsal view of the interdigital region in at the hind limb of the Barbados Black Belly sheep showing the external orifice of the interdigital sinus (arrow)

Fig.5: Dorsal view of the interdigital region at the hind limb of the Barbados Black Belly sheep showing the parts of the interdigital sinus in situ. A. proximal phalanx, 1. body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice.

Fig.6: Lateral view of the interdigital region at the hind limb of the Barbados Black Belly sheep showing the parts of the interdigital sinus in situ. A&p1. proximal phalanx, P2. Middle phalanx. 1. body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice



Fig. 7

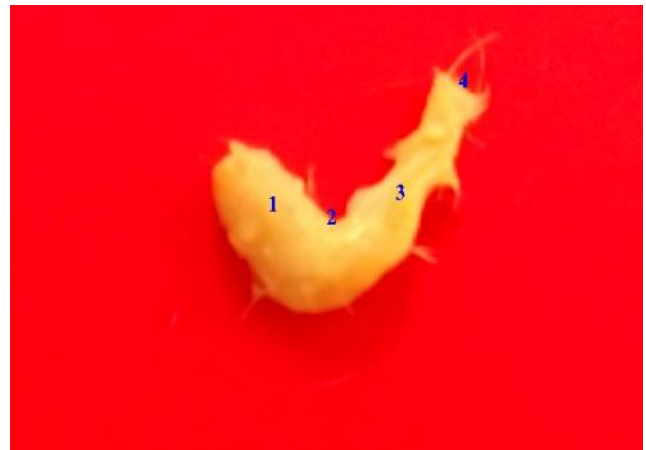


Fig. 8

Fig. 7: View of the interdigital Sinus of the forelimb of the Barbados Black Belly sheep showing its parts 1. Body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice.

Fig 8: View of the interdigital sinus of the hind limb of the Barbados Black Belly sheep showing its parts 1. Body of the sinus, 2. Flexure, 3. Excretory duct, 4. External orifice.

II- Microscopic Studies

The wall of the interdigital sinus was composed of three layers; the epidermis, the dermis and the fibrous capsule. The epidermis consisted of stratified squamous epithelium with a keratin layer (Fig. 9) facing the lumen of the interdigital sinus. The dermis was composed of loose

connective tissue containing hair follicles, sebaceous glands, nerve plexuses and glandular structure. The hair follicles (Figs.10, 12) were of different sizes and were surrounded by connective tissue. The sebaceous glands (Figs. 10, 12) were lobular with clusters of acini.

The glandular structure of the sinus was composed of secretory units (Figs. 9, 11, 12) arranged in lobules separated by the loose connective tissue (Fig. 12) which also support these acini. Each secretory unit was composed of a single layer of cuboidal cells (Fig. 11) resting on a basement membrane and surrounded externally by myoepithelial cells (Fig. 11). Acidophilic

homogenous secretory material was present within the lumen of the secretory acini. The fibrous capsule was the outermost layer of the interdigital sinus and it was composed of dense connective tissue, containing several parallel bundles of collagen fibers (Figs. 9, 12), adipose tissue, nerve fibers and blood vessels.

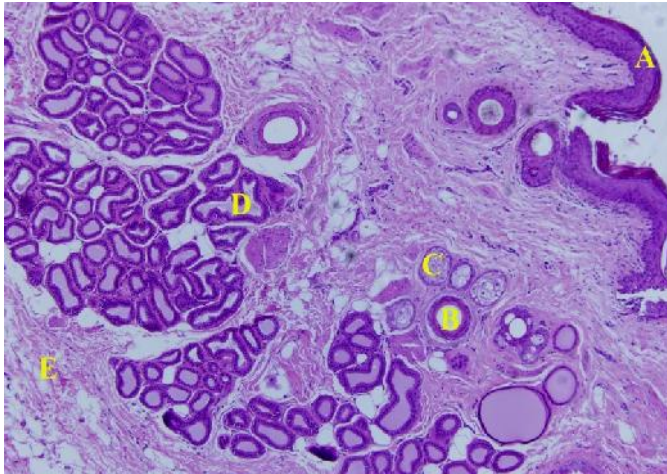


Fig. 9

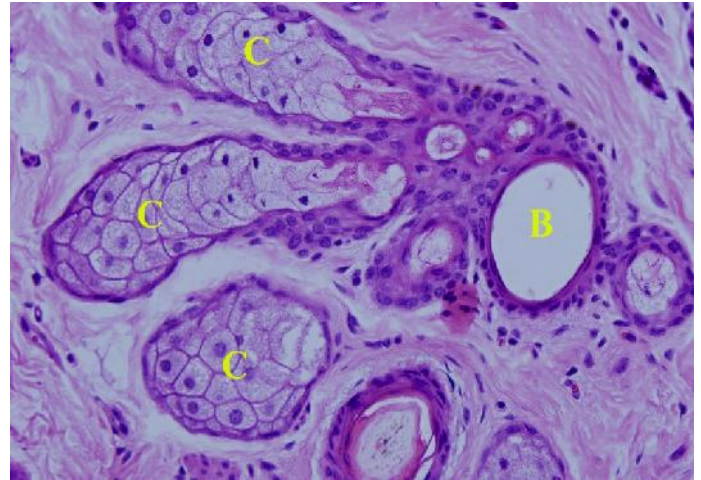


Fig. 10

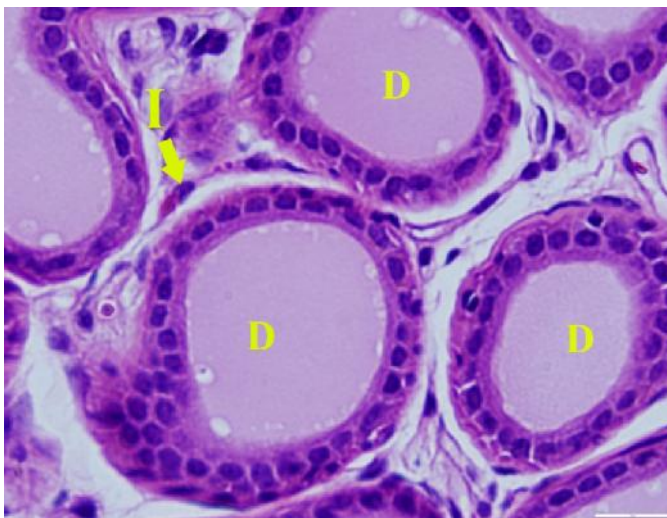


Fig.11



Fig. 12

Fig.9, A Photomicrograph of the fibrous capsule of the interdigital sinus wall (epidermis, dermis and fibrous capsule) of the Black Belly sheep showing Stratified squamous keratinized (A), hair follicle (B), Sebaceous gland (C), Secretory acini (D), Fibrous capsule (E) H & E stain X100

Fig.10, A Photomicrograph of the dermis of the interdigital sinus of the Black Belly sheep showing hair follicles (B), sebaceous glands (C). H & E stain X400

Fig.11, A Photomicrograph of the dermis of the interdigital sinus of the Black Belly sheep showing the secretory acini lined with cuboidal cells (D) and Myoepithelial cells surrounding the acini (I). H & E stain X1000

Fig.12, A Photomicrograph of the interdigital sinus showing secretory acini separated by dense collagen bundles (F). Van Gieson stain X100. Note, hair follicle (B), Sebaceous gland (C) and Fibrous capsule (E)

Discussion

Observations of the present study confirmed those of Lori's sheep (Abbasi *et al.*, 2013), Tuj sheep (Aslan *et al.*, 2010), Japanese serow (Atoji *et al.*, 1988) and Akkaraman sheep (Avdic *et al.*, 2013), Egyptian sheep (Awaad *et al.*, 2015), Kivircik sheep (Demiraslan *et al.*, 2014), where the interdigital sinuses are found in all feet. However it was reported that the interdigital gland is found only in the hind feet of the roebuck (Janicki *et al.*, 2003). On the other hand, the interdigital sinuses are reported to be rudiment (Atoji *et al.*, 1988) or absent (Awaad *et al.*, 2015; Calislar, 1971) in goat.

In agreement with Abbasi *et al.* (2013) in Lori's sheep, Aslan *et al.* (2010) in Tuj sheep, Atoji *et al.* (1988) in Japanese serow, Awaad *et al.* (2015) in Egyptian sheep, Demiraslan *et al.*, 2014) in Kivircik sheep, Karahan *et al.* (2007) in Akkaraman sheep the present study revealed that the interdigital sinuses were found between digits and their excretory ducts opened to the proximal-dorsal section of the interdigital region. In Lori's sheep the gland extends between the distal section of the proximal phalanx and the proximal section of the middle phalanx (Abbasi *et al.*, 2013). While, in the roebuck (Janicki *et al.*, 2003) reported that the gland extends between the half of the proximal phalanx and distal phalanx.

It was observed in our study as well in Tuj sheep (Aslan *et al.*, 2010), in Egyptian sheep (Awaad *et al.*, 2015), in roebuck (Janicki *et al.*, 2003), in Akkaraman sheep (Karahana *et al.*, 2007) and in Kivircik sheep (Suzer *et al.*, 2015) that the interdigital sinuses are like a pipe.

The current investigation confirming those of Egyptian sheep (Awaad *et al.*, 2015) and in ovine sheep (Karahana *et al.*, 2007) found that the interdigital gland had divisions of body, neck and external orifice. While, in Lori's sheep (Abbasi *et al.*, 2013) mentioned that the interdigital glands comprise of secretory and excretory portions. However, the interdigital gland is divided into the carpus, collum and fundus in Dubska Pramenka (Avdic *et al.*, 2013). In Kivircik sheep the interdigital gland is divided into orifice, excretory duct, flexure and corpus (Demiraslan *et al.*, 2014).

In the roebuck described the gland comprises as a body, a neck and flexure (Janicki *et al.*, 2003). In Kivircik sheep mentioned that the interdigital sinus comprises of a blind proximal end, wide body and long-narrow neck (Suzer *et al.*, 2015).

Our findings were in an accordance with those reported in Lori's sheep (Abbasi *et al.*, 2013), in Japanese serow (Atoji *et al.*, 1988), in Egyptian sheep (Awaad *et al.*, 2015) and in Kivircik sheep (Demiraslan *et al.*, 2014) who said that the interdigital sinuses in the forefeet are larger than those in the hind feet.

The results of this study are identical with those reported in Egyptian sheep (Awaad *et al.*, 2015; Misk and Misk, 2013) where there are no sex differences in the interdigital sinuses. While, in Lori's sheep (Abbasi *et al.*, 2013) there is a sex-related difference in respect to the gland size as males show higher values in all dimensions except for the lumen diameter than females.

Observations of the present study confirmed those of Lori's sheep (Abbasi *et al.*, 2013), in Tuj sheep (Aslan *et al.*, 2010), in Egyptian sheep (Awaad *et al.*, 2015), in Akkaraman sheep (Karahana *et al.*, 2007) and in Kivircik sheep (Suzer *et al.*, 2015) that the interdigital sinus has three layers; epidermis, dermis and fibrous capsule. On the other hand, in roebuck (Janicki *et al.*, 2003) the interdigital gland was devoid of connective tissue capsule.

It was observed in our study as well in Lori's sheep (Abbasi *et al.*, 2013), in Tuj sheep (Aslan *et al.*, 2010), in Egyptian sheep (Awaad *et al.*, 2015), in Akkaraman sheep (Karahana *et al.*, 2007), in Kivircik sheep (Suzer *et al.*, 2015) that the epidermis consists of a stratified squamous keratinized epithelium. The dermis contains sebaceous glands and hair follicles. The fibrous capsule contains vessels and adipose tissue.

Observations of the present study confirmed those in Lori's sheep (Abbasi *et al.*, 2013) and in Egyptian sheep (Awaad *et al.*, 2015) that myoepithelial cells surround the secretory acini and that these cells may help in gland discharge by their contraction.

This is the first report of the gross and microscopic features of the interdigital sinus in Barbados Black Belly sheep in Trinidad. The study showed that the interdigital sinuses were present in forelimb and hind limb are reported in other breed and the histological features were also similar to those reported in other sheep and it was made of lobules separated by interlobular connective tissue and that the lobules contained the secretory material. The surgical approach to drain or remove the interdigital sinus in the triangular area between the two digits.

Acknowledgements

I am very grateful to the technical staff and lab assistances in the Department of Anatomy and Histology for their assistance.

References

Abbasi, M., Gharzi, Mohammadzadeh, A., and S Karimi, S. 2013 . Morphology and histology of the interdigital gland in an Iranian native breed of sheep. *J. Anim. Vet. Adv.* 8: 1157-61.

Aslan, K., Kurtul, I., Nazli, M. and ATE , S. 2010. Morphologic features of the interdigital sinus of the Tuj sheep. *Kafkas Univ Vet Fak Derg* 16: 623- 6.

Atoji, Y., Suzuki, Y. and Sugimura, M. Lectin histochemistry of the interdigital gland in the Japanese serow (*Capricornis crispus*) in winter. 1988. *J. Anat.* 161: 159-70.

Avdic, R., Katica, A., Mlaco, N., Softic, A., Tandir, F. and Cengic, B. 2013. Morphological characteristics of interdigital diverticulum

(sinus cutaneous interdigitalis of Dubska pramenka). *Biotechnol. Anim. Husb.* 29: 441-8.

Awaad, A., Tawfik, M. , Moawad, U., Adel Razek, A. and Abdellllah, B. 2015. Morphohistological and surgical anatomy of the sinus interdigitalis in Egyptian native breeds of sheep. *Beni-Suef University Journal of Basic and Applied sciences* 4: 157- 166.

Calislar, T.1971. Sinus interdigitalis'in morfolojik zellikleri. *Ank. Univ. Vet. Fak. Derg.* 1971: 38-40.

Demiraslan, Y., Akbulut, Y., Deprem, T., Karadagsari, E and Aslan, K. 2014. Morphological and morphometrical characteristics of the interdigital gland in Kivircik sheep. *Turk. J. Vet. Anim. Sci.* 38: 485-9.

Janicki, Z., Hraste, A., Slavica, A., Konjevic, D., Marinovic, Z and Stubiean, D. 2003. Morphohistological characteristics of the interdigital gland in the roebuck (*Capreolus capreolus* L.). *Vet. Arh.*73: 27-37.

Karahan, S., Yildiz, D. and Bolat, D. 2007. Scanning electron microscopic features of the ovine interdigital sinus. *Acta Vet Hung.* 55: 417-24.

Misk, T. and Misk, A. 2013. Surgical excision of interdigital pouch and cyst in sheep. *Int J Veterinary Med. Res. Reports:* 1-8.

Suzer, B., Akkoc, C., Arican, L. and Yildiz, H. 2015. Morphological and immune histochemical features of interdigital sinus in Kivircik sheep. *Kafkas Univ. Vet. Fak. Derg.* X (X) xxx-xxx.

Wood, W.2003. Volatile components in metatarsal glands of sika deer. *J Chem Ecol.* 29: 2729- 33.

Access this Article in Online	
	Website: www.icrims.com
	Subject: Veterinary Sciences
Quick Response Code	

How to cite this article:

Reda Mohamed and Andrew Adogwa. (2016). Gross and Microscopic Features of the Interdigital Sinus in the Barbados Black Belly Sheep in Trinidad. *Int. J. Curr. Res. Med. Sci.* 2(7): 22-27.