

Histological Features of the Accessory Sex Gland of Indigenous Tom cat (*Felis catus*)**Dhyaa Ab. Abood, Mohamed S. Dawood and Lamees Ezaldeen Mohammed**

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Corresponding author; sabahali503@yahoo.com, dhyaahussen@gmail.com. Mobile:07733343033Doi: <https://doi.org/10.37940/AJVS.2019.12.2.1>**Abstract**

The study was aimed to investigate the histological characteristics of the Tomcats accessory sex glands. A total of six indigenous Tom cats were used in this study. The samples of the ampulla of ductus deferens, prostate and bulbourethral glands were collected and fixed in 10% buffered formalin saline, and processed with routine paraffin technique. The tissue sections were stained by Hematoxyline & Eosin, Masson's trichrom and PAS stains. Results showed that the mucosa of ampulla has composed of tunica mucosa, muscularis, and adventitia. The tunica mucosa lined by mucous secreting cells which showed negative reaction for PAS stain and non-secreting cells which have intense reaction for PAS stain. The tunica muscularis composed of circular oriented smooth muscle fibers. The tunica adventitia composed of dense irregular collagenous connective tissue. Prostate was large tubuloalveolar gland, surrounded the pelvic urethra; the gland consisted of very thick peri urethral tunica mucosa which lined with transitional epithelium. The prostatic lamina propria composed of collagen bundles, tubuloalveolar glands and manifested by many of like cavernous tissue wide veins. The prostate glandular epithelium was pseudo stratified columnar to low cuboidal which showed intense reaction for PAS stain. The muscularis of prostate composed of thick layer of skeletal muscle cells. The bulbourethral glands surrounded by a thick fibro-muscular capsule whose septa subdivided the gland into lobules. Each lobule composed of tubuloalveolar secretory units. The secretory units were lined by pseudo stratified to simple columnar epithelium supported by a thin layer of myoepithelial cells surrounds each alveolus. The cytoplasm of epithelial secretory units contained acidic secretory granules with Alcian blue (2.5pH) stains (fig.11, 12 & 13). It was concluded that tom cat's accessory glands has devoid of seminal vesicles and has well developed and functional prostate and bulbourethral glands.

Keywords: ductus deferens, Ampulla, histological, tom cat

الصفات النسيجية للغدد الجنسية اللاحقة في ذكر القط المحلي

الخلاصة

هدفت الدراسة الى بحث الخصائص النسيجية للغدد الجنسية اللاحقة في ذكر القط المحلي استعملت في الدراسة ستة حيوانات من القطط المحلية. العينات التي اخذت هي غدة الامبولة و غدة البروستات و الغدة البصلية الاحليلية , ثبتت العينات بوساطة محلول الفورمالين 10% ثم بعد ذلك عوملت العينات بتقنيات التقطيع النسيجي المعتاد و من ثم صبغت بصبغة الهيماتوكسولين ايوزين و صبغة الماسون ثلاثية الكروم و صبغة الباس ستين. النتائج النسيجية اظهرت ان غدة الامبولة تتكون من ثلاث غلالات وهي الغلالة المخاطية, الغلالة العضلية و الغلالة البرانية. الغلالة المصلية كانت مبطنة بخلايا افرازية اظهرت تفاعل سلبي و الخلايا الغير افرازية اظهرت تفاعل موجب لصبغة الباس ستين , الغلالة العضلية كانت مكونة من الياف عضلية دائرية ملساء والغلالة البرانية كانت مكونة من نسيج ضام كثيف غير منتظم. غدة البروستات كانت سنخية انبوبية كبيرة تحيط بالاحليل الحوضي و مبطنة بظهارة انتقالية , الصفيحة المخصصة للطبقة المخاطية كانت مكونة من حزم غروانية و غدد انبوبية سنخية مع نسيج متكهف و اوردت. بطانة غدة البروستات كانت من النوع العمودي الطبقي الكاذب والمكعب المنخفض التي اظهرت تفاعل قوي لصبغة الباس ستين. الطبقة العضلية لغدة البروستات كانت مكونة من طبقة سمكية من العضلات الهيكلية. الغدة البصلية الاحليلية كانت محاطة بغشاء عضلي ليفي مرسله حواجز الى داخل الغدة مقسمتا اياه الى فصوص سنخية انبوبية ذات خلايا افرازية و هذه الخلايا الافرازية كانت مبطنة بنسيج حشفي كاذب وعمودي بسيط و كانت مدعومة بطبقة نحيفة من الظهارة العضلية تحيط بكل سنخ. سايتوبلازم الخلايا الافرازية كانت تحوي حبيبات حامضية بالنسبة لصبغة الاليشينز

Introduction

In mammals the male reproductive system has supported by a group of accessory sex glands which comprised of the seminal vesicles, ampulla of ductus deference, prostate, bulbourethral and coagulating glands. Nonetheless, not every mammalian order has all of the glands. The prostate glands are present in all domestic animals involve Cats as compact and globular organ which surrounds the pelvic urethra. The bulbourethral glands are paired structures positioned at the caudal part of pelvic urethra between the urethra and bulbospongiosus muscles, in front of penile root (1, 2, and 3). In rabbit the bulbourethral glands have cubical shaped and extend along the dorsal urethra, surrounded by a fibrous capsule and bulboglandularis muscle and connected to the prostate gland by connective tissue (4). In human the bulbourethral gland is small size, tubular organ has ovoid- pea sized and located dorsolateral between both fasciae of the pelvic diaphragm (5). The indigenous tom cat male genital system has described previously by (6), but the study want involve the accessory glands. It is important to provide a data on the histological characteristics of the accessory sex glands which considered significance in breeding, in order to make a pathological diagnosis and provide clinical treatment of diseases. The aim of the study was aimed to describe histological and histochemical features of accessory sex glands and ductus deference glands in the indigenous cat.

Materials and Methods

Ethical approval

The design of the present study was approved by the Animal Care and Use Committee at the College of Veterinary Medicine, University of Baghdad. Baghdad, Iraq.

Experimental animals

Six adult tom cats were obtained from the Department of Surgery and Obstetrics in the Faculty of Veterinary Medicine, University of Baghdad after which death due to unsatisfactory accidents were used for this study. The study was carried out at department of Anatomy & Histology, College of Veterinary Medicine -University of Baghdad. The samples of the ampulla of ductus deferens, prostate and bulbourethral glands were removed immediately from the body and fixed in 10% buffered formalin saline. Samples were processed with upgrading concentration of ethanol (70, 80, 90 & 100%), cleared with xylen and embedded in paraffin bath at (58C) and sectioned at 5-6 μ m with rotary microtome. The tissue sections were stained with Hematoxylin & Eosin stain, Mason's trichrom stain and combine Alcian blue & PAS stain (7,8,9 and 10). The tissue sections were examined by light microscopy and microphotography has done by using Future Win Joe microscopic camera, the images have analyzed and scored by using Fiji image analyzer system (11).

Statistical analysis Statistical analysis has been done by using The SPSS statistic version (24) to analyze the data. The results were displayed in Means and Standard Error.

Results and Discussion

The results of the wall of ampulla composed of three tunicae; (i) mucosa, (ii) muscularis, and (iii) adventitia. This result was coincided with (12, 13 and 14). The tunica mucosa was lined by non-ciliated simple cuboidal epithelium and this epithelium has composed of mucous secreting cells, non-secreting cells and in some regions was showed cellular bulging (fig.1&2), the epithelium height in tomcat was ($18.3 \pm 1.1 \mu\text{m}$). The mucous secreting cells were showed negative reaction for PAS stain, while the non-secreting cells showed intense reaction for PAS stain (fig.3). The current result was in contrast with (12, 15 and 16) who recorded that the tunica mucosa was lined by pseudo stratified columnar epithelium. Meanwhile (14) in bull and jackass recorded tall columnar pseudo stratified epithelium in bull, and high simple cuboidal epithelium in jackass. The tunica muscularis was thick layer, measured about ($198.5 \pm 6.07 \mu\text{m}$) and composed of circular oriented smooth muscle fibers (fig.3). The tunica adventitia composed of dense irregular collagenous connective tissue (fig.4), the thickness of tunica adventitia was ($109.9 \pm 2.1 \mu\text{m}$). This results were disagree with (12) in buck, (15) in sheep and goat, and (16) in camel who mentioned for two layers in tunica muscularis (Inner circular and outer longitudinal smooth muscles), the tunica adventitia was loose connective tissue. On the other hand (15) has observed autonomic ganglion in adventitia of goat. Meanwhile (14) in bull and jackass noticed three layers in tunica muscularis (Inner longitudinal, middle and outer layers), also the epithelium height of ampulla in tomcat was lower than that recorded in the bull ($64 \pm 10 \mu\text{m}$) and in

jackass ($21 \pm 4 \mu\text{m}$).

In tomcat the prostate was a large gland and composed of tubuloalveolar secretory units that surrounded the pelvic urethra (fig.5). The gland has consisted of the very thick periurethral tunica mucosa and lined with transitional epithelium. The lamina propria was composed of slightly dense irregular collagen fibers, tubuloalveolar glands and many of wide veins (fig.6, 7 & 8). The prostate muscularis was composed of thick layer of skeletal muscle cells (fig. 9 & 10). The secretory units of the prostate was of vary small size and variable shape. The glandular epithelium was pseudo stratified columnar and few of low cuboidal in some of the larger saccular cavities (fig.10), the secretory units showed intense reaction for PAS stain (fig.11). This result was not coincided with (17) in boar who recorded that the prostate was lobulated tubule-alveolar type and has only the disseminated part because its glandular tissue distributed through the sub mucosal layer of pelvic urethra, the capsular septa were composed of collagen, reticular fibers and smooth muscles, the serous secretory end pieces and ducts were lined with cuboidal epithelium, while (18) mentioned that the prostate of rabbit was constituted by stroma and glandular acini. On the other hand, (19) in bull reported lobulated with marked the disseminate part. Also in bull the prostate was fibro-muscular gland and composed of tubule-lobulated structure, their alveoli were lined with simple cuboidal epithelium which reacted positively with PAS and alcian blue stains, in tomcat the main excretory ducts of prostate were opening in the pelvic urethra that lined with transional epithelium as well

as mentioned by (20).

The current results showed that the bulbourethral gland was small glands on the urethra surrounded by a thick fibro-muscular capsule whose septa subdivided the gland into lobules. Each lobule composed of tubuloalveolar secretory units. The secretory units were lined by pseudo stratified to simple columnar epithelium supported by a thin layer of myoepithelial cells surrounds each alveolus. The epithelium height was ($28.9 \pm 2.3 \mu\text{m}$). The cytoplasm of epithelial secretory units contained acidic secretory granules with Alcian blue (2.5pH) stains (fig.11, 12 & 13). This result in contrast with results of (15, 21 and 22) who mentioned that the bulbourethral glands in Gaddi goat, sheep and bull were compound tubule-alveolar and mixed gland. However, (23) in camel, mentioned that the bulbourethral glands were compound tubuloalveolar glands has three types of secretory units which designated (A, B and C). Type A is lined with high columnar cells and the cytoplasm contains lots of secretory granules, which are PAS-positive, Alcian Blue-positive. Type B is lined with pyramidal or cuboidal cells and the cytoplasm shows PAS-positive, Alcian Blue-positive. In bull recorded that the bulbourethral gland was compound tubule-alveolar glands composed of mix mucous and serous secretory units, the mucous were lined with tall columnar epithelium, and the serous were lined with cuboidal epithelium. But (24) in bull, declared that the bulbourethral gland appeared intense PAS positive reaction in the basement membrane lining epithelium. On the other hand, (17) in boar, mentioned that the bulbourethral gland were compound tubulo-alveolar glands. The gland was

predominantly mucous glands were lined with columnar epithelium.

Conclusion

From the current results concluded that tom cat's accessory glands has devoid of seminal vesicles and has well developed and functional prostate and bulbourethral glands.

Acknowledgments

The authors would like to acknowledge the sincere collaboration of all technical staff in the Department of Surgery and Obstetrics, Department of Anatomy and Histology at College of Veterinary Medicine, University of Baghdad. The authors did not receive any funds for this study.

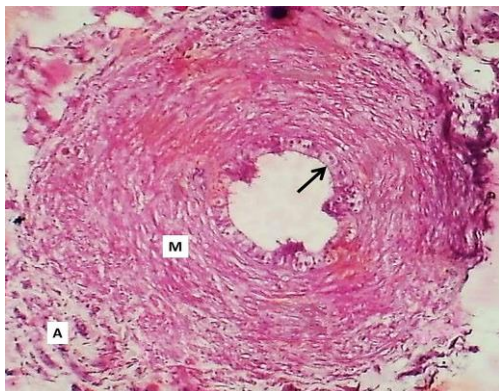


Figure 1: Section of Ampulla of ductus deference (Adult Tom cat) show: Epithelialis mucosa (Arrow), Tunica muscularis (M) & Tunica adventitia (A). H&E stain. 100X

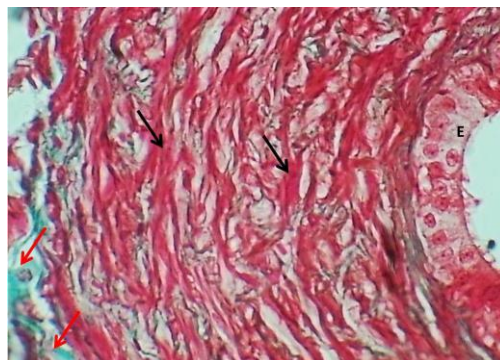


Figure 4: Section of tunica mucosa and muscularis of ductus deference (Adult tom cat) show: epithelium (E), Smooth muscle of tunica muscularis (Black arrows) & collagen bundles of tunica adventitia (Red arrows). Masson's trichrom stain. 400X.

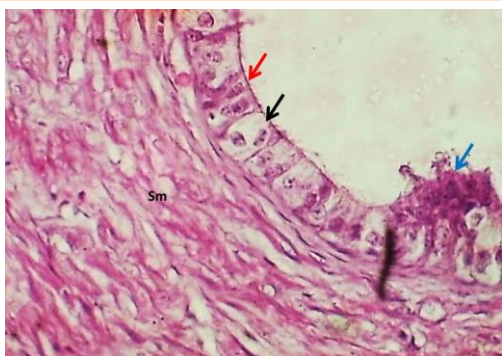


Figure 2: Magnified Section of tunica mucosa and muscularis ampulla ductus deference (Adult Tom cat) show: mucous secreting cells (Black arrow), non-secreting cells (Red arrow), epithelial bulging (Blue arrow) and smooth muscle of tunica muscularis (Sm). H&E stain. 400X.

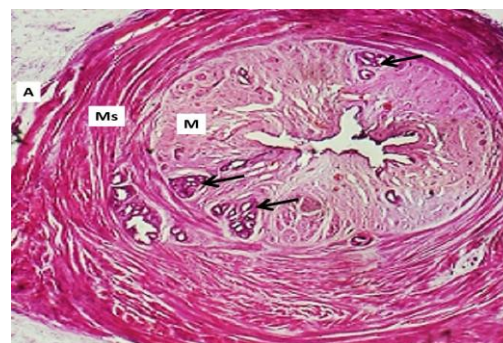


Figure 5: Section of prostate (Adult Tom cat) show: tunica mucosa (M), glandular lamina propria (Arrows), fibromuscular layers (Ms) & tunica adventitia (A). H&E stain. 40X.

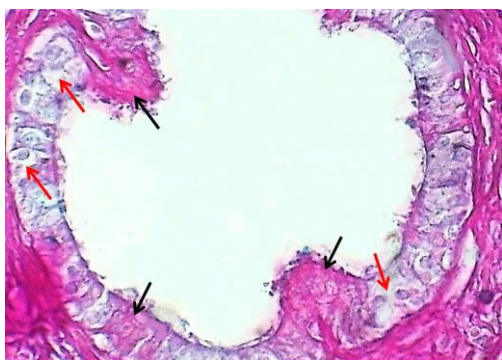


Figure 3: Section of ampulla ductus deference (Adult Tom cat) show: positive reaction for PAS stain (Black arrows) & negative reaction of PAS (Red arrows). PAS stain. 400X.

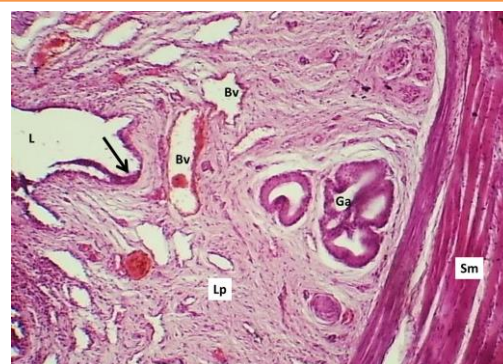


Figure 6: Section of prostate (Adult Tom cat) show: epithelium (Arrow), glandular lamina propria (Lp), Glandular alveolus (Gg), skeletal muscle (Sm) & blood vessels (Bv) & Lumen (L). H&E stain. 40X.

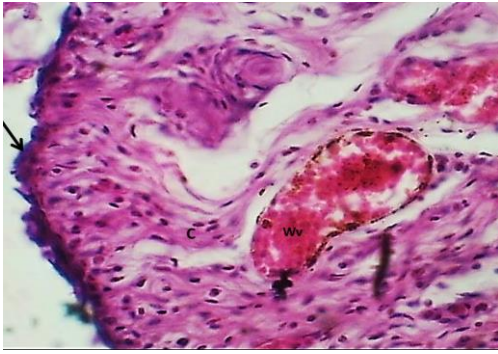
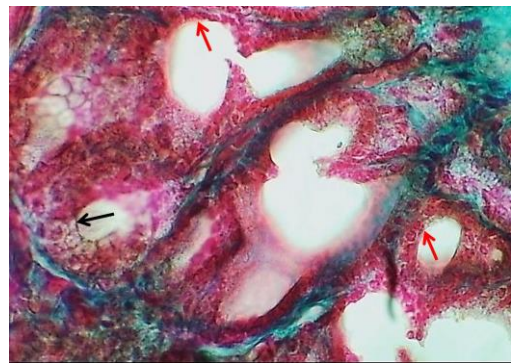


Figure 7: magnified section of mucosa of prostate (Adult Tom cat) show: epithelial mucosa (Arrow), collagen fibers (C) & wide vein (Wv). H&E stain. 400X.



Figures 10: Section of prostate glandular tissue (Adult Tom cat): pseudo stratified epithelium (Black arrow) & simple cuboidal epithelium (Red arrow). Masson's trichrom stain. 400X



Figure 8: Section of prostate (Adult Tom cat) show: lumen (L), glandular alveolus (Ga), circular bundles of skeletal muscle (Arrows), wide veins (Wv) & collagen bundles (Cb). H&E stain. 40X.

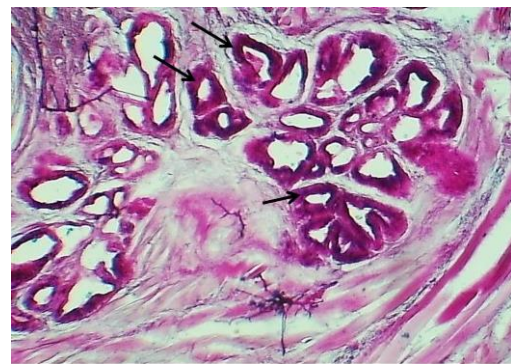


Figure 11: Magnified section of mucosa of prostate (Adult Tom cat) show: strong PAS reaction (Black arrow). PAS stain. 100X.

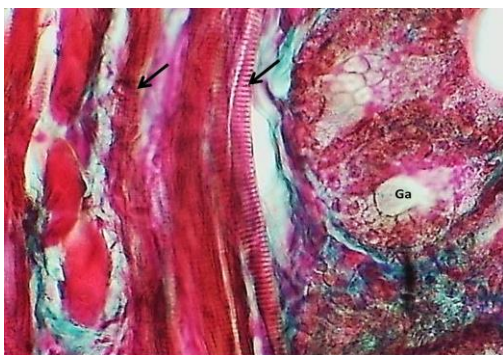


Figure 9: Section of prostate (Adult Tom cat) show: Glandular alveolus (Ga) & skeletal muscle (Arrows). Masson's trichrom stain. 400X.

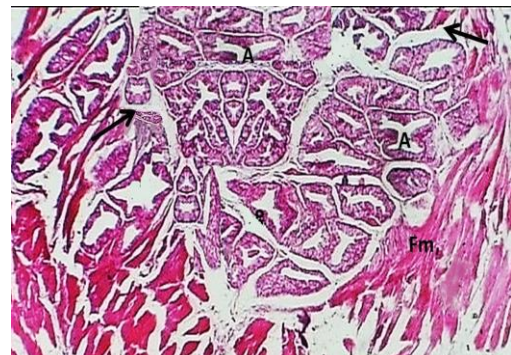


Figure 12: Section of mucosa of bulbourethral gland (Adult Tom cat) show: Alveoli (A), septa (Arrows) fibro-muscular capsule (Fm). PAS stain. 40X

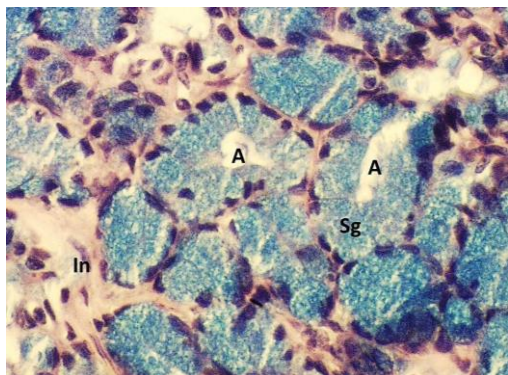


Figure14: Magnified section of lobule of bulbourethral gland (Adult Tom cat) show: inter alveolar connective tissue (In), acidic secretory granules (Sg) of alveoli (A) with Alcian blue stain. 400X.



Figure13: Magnified section of lobule of bulbourethral gland (Adult Tom cat) show: Epithelium (E), Alveoli (A), myoepithelial cells (arrow) & Septum (Ms). PAS stain. 400X.

References

1. **Barone R, Simoens P.** Anatomie comparée des mammifères domestiques-tome 4: Splanchnologie II/appareil uro-génital, foetus et ses annexes, péritoine et topographie abdominale. Paris: Edition VIGOT.-896 p. 2001.
2. **Dimitrov R, Russenov A.** Ultrasonographic features of feline bulbourethral glands. *Trakia Journal of Science.* 2006; 4(1):18-21.
3. **König HE, Liebich HG,** editors. *Veterinary anatomy of domestic mammals: textbook and colour atlas.* Schattauer Verlag; 2013 Dec 27.
4. **Vásquez B, del Sol M.** Complejo prostático en el conejo (*Oryctolagus cuniculus*). *Revista chilena de anatomía.* 2002 ;20(2):175-80.
5. **Chughtai B, Sawas A, O'MALLEY RL, Naik RR, Ali Khan S, Pentiyala S.** A neglected gland: a review of Cowper's gland. *International journal of andrology.* 2005 Apr; 28 (2):74-7.
6. **Dawood S, Al-Aaraji AS, Mohammed LE, Abood DA.** Morphological and Morphometrical Features of Testes and Penis in Indigenous Tom Cat. *Indian Journal of Natural Sciences,* 2019; 9 (53): 17272-17277.
7. **Luna LG.** *Manual of histologic staining methods of the Armed Forces Institute of Pathology,* ed. 3. New York, 1968.
8. **Suvarna KS, Layton C, Bancroft JD,** editors. *Bancroft's theory and practice of histological techniques E-Book.* Elsevier Health Sciences; 2018 Feb 27
9. **Jarad AS, Al-Kaisei BI.** Effect in of L-Arginine on Some Biochemical and pathological parameter in diabetes mellitus induced by Alloxan-monohydrate in Rats. *Al-Anbar Journal of Veterinary Sciences.* 2013;6(1):89-100..
10. **Mohammed SD.** Histological Features of Penis in Indigenous Tom Cat. *Indian Journal of Natural Sciences,* 2018;8(47): 13720-13729, 2018.
11. **Schindelin J, Rueden CT, Hiner MC, Eliceiri KW.** The ImageJ ecosystem: An

- open platform for biomedical image analysis. Molecular reproduction and development. 2015 Jul 1; 82(7-8):518-29.
12. **Nissar S, Suri S, Sarma K.** Histology of the Ampulla of Vas Deferens of Buck erwali Goat in Different Age Groups. Indian Vet. J., 2012;89(11), 144-145.
 13. **Shalini S, Sudhakar LS, Bhardwaj RL.** Gross and histological studies on the bulbourethral gland of Gaddi goat and sheep. Indian Journal of Veterinary Anatomy. 2009;21(1):25-8.
 14. **Alkafafy M, Attia H, Rashed R, Kandiel M.** Some Comparative Immunohistochemical Studies on the Ductus Deferens in the Donkey (*Equus asinus*) and Water Buffalo Bull (*Bubalus bubalis*). Journal of Veterinary Anatomy. 2010 Apr 1;3(1):55-69.
 15. **Shalini S, Sudhakar LS, Bhardwaj RL.** Anatomical studies of the prostate gland of Gaddi goat and sheep. Indian Journal of Animal Sciences. 2009;79(3):294-6.
 16. **Mahmud MA, Josephat O, Abdullahi SS, Aminu UM, Abdurrahman B, Akawu SH, Abubakar D, Shehu S.** Species Variation on Gross Morphology and Gross Morphometry of Accessory Sex Glands in One-Humped Camel Bull (*Camelus dromedarius*), Uda Ram and Red Sokoto Buck. World Vet. J., 2016; 6(2): 53-58.
 17. **Nissar S, Suri S.** Histomorphology of the Accessory Genital Glands of Boar. PARIPEX-Indian Journal of Research. 2016; 5(4): 393-394.
 18. **Vasquez B, Sol M.** Mesoscopic and Histology of Vesicular gland of rabbit (*Oryctolagus cuniculus*) . Int J. Morphol., 2003; 21 (4): 225-230.
 19. **Adhikary GN, Begum MI, Islam MN, Islam KM, Rauf SM.** Morpho-Histometric Evaluations Of Pre-Pubertal, Pubertal And Post Pubertal Prostate Glands Of Indigenous Bulls (*Bos Indicus*) Of Bangladesh. International Journal of Biological & Pharmaceutical Research. 2015; 6 (8) : 586-592.
 20. **A Aly M, MS Ammar S, A Mohamed H, AA Mahdy E.** Some Morphological Studies on Prostata (Prostate Gland) of Buffalo Bull (*Bos Bubalis L.*). Zagazig Veterinary Journal. 2014 Jun 1;42(2):170-80.
 21. **Sudhakar LS.** Histomorphology of the accessory genital glands of yak-A preliminary study. The Indian Journal of Animal Sciences. 2005 Aug 1;75(8).
 22. **Suri S, Sudhakar LS, Bhardwaj RL.** Seasonal variation in the histomorphology and histochemistry of the bulbourethral gland of Gaddi goat and gaddi Sheep. Indian Journal of Veterinary Anatomy. 2012 Jun;24(1):1-4.
 23. **Luo Y, Li H, Lv Y, Xu S, Liu Y, Zhang N, Wang D, Shao B, Wang J.** Anatomical and histochemical features of the bulbourethral glands in bactrian camel (*Camelus bactrianus*). Journal of Camel Practice and Research. 2016;23(1):121-5.
 24. **Bhosle NS, Shingatgire RK, Kapadnis PJ.** Histochemical study of bulbourethral glands in uncastrated and castrated cattle. Indian Journal of Animal Research. 2008;42(4):305-7.