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HISTOMORPHOLOGICAL STUDIES ON THE PARAURETHRAL GLAND (FEMALE PROSTATE GLAND) OF BITCH

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ABSTRACT

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The present work was conducted on thirty two bitches classified as immature, mature and senile females. In the immature bitches the (paraurethral) prostate gland could be described as small dorsoventrally compressed compact organ has paraurethral localization just below the urinary bladder. The gland appeared as compound tubuloalveolar exocrine gland consisted of few stroma and ill developed parenchyma. In the mature females the paraurethral gland acquired larger size. The fibrous stroma became thicker formed of dense collagen bundles intermingled with small muscle fibers in the capsule, septa or even around the individual secretory alveoli and collecting ducts. The parenchyma showed well developed highly active secretory alveoli lined by high columnar secretory cells and the cytoplasm showed strong apical acidophilic affinity and contained well developed granular endoplasmic reticulum as well as numerous large round mitochondria. Both the secretory alveoli and the collecting ducts were surrounded by elongated curved cells with flattened slender-like darkly stained nuclei. The secretory cells were also characterized by the presence of a huge number of characteristic secretory granules. The senile paraurethral (female prostate) still large in size with lesser activity. The fibrous stroma showed progressive increase in thickness on the expense of the secretory alveoli which became greatly regressed and many of them were collapsed.

Key words: *Paraurethral gland, Bitch, Histomorphology.*

INTRODUCTION

The occurrence of a gland around the female urethra was firstly recorded in 1672 by De Graaf who described the presence of glandular tissue located around the woman's urethra which became known as the female prostate due to its great similarity to the male prostate (De Graaf, 1672). In 1880 Alexander Skene published a work describing the presence of gland intimately associated to the female urethra named Skene's gland (Skene, 1880). In 2002, the Skene's gland was officially renamed the female prostate by the Federative International Committee on Anatomical Terminology. The existence of a human female paraurethral gland similar to the male prostate was also reported in the decade of 1950 (Huffman, 1948; Huffman, 1951 and Mc Crea, 1952). In the same line the presence of prostatic gland in adult females was also described to various rodent species (Shehata, 1975; Shehata, 1980 and Flamini *et al.*, 2002). Moreover Gross and Didio (1987) comparing the prostate of male and female rodent (Preomys natalenses) noted the homology between these organs in both sexes. Furthermore, their comparative ultrastructural data indicated that the female prostate in these species is equivalent to the ventral male prostate and that the epithelial cells in the former exhibited a characteristic phenotype of functionally active cells.

Important prostatic markers such as acid alkaline phosphatase (PAP). And prostatic specific antigen (PSA) were identified in human female prostate (Tepper *et al.*, 1984; Warnet *et al.*, 1992; Zaviacic *et al.*, 1997a&b and Sloboda *et al.*, 1998). In addition, the ultrastructural analysis of the adult human female prostate showed that the alveolar epithelium contains secretory cells and less frequent basal cells, characteristics which indicate that the organ is functionally mature (Sloboda *et al.*, 1998 and Zaviacic *et al.*, 2000). In spite of several lines of evidences suggesting a physiological active state of human female prostate, this aspect as well as the detailed morphological characteristics remains unknown in other animals. Therefore, the main objective of this study is to identify and characterize the microscopic and ultrastructure of the female prostate of bitch at different ages, also to point out its functional activity by some histochemical techniques.

MATERIALS and METHODS

A total number of thirty two healthy female bitches were used in this study classified as immature puppies (1-6 months), mature (1-3 years) and senile bitches (more than 4 years). The whole urethra and its surrounding glandular tissue were carefully removed after strychnine anesthesia.

For light microscopy, the dissected organs were immediately fixed in Bouin's fluid and neutral buffered formalin then dehydrated in ethanol, cleared in xylene, embedded in soft paraffin and blocked in hard paraffin. Later on, we use the microtome to prepare 4- micrometrs-thick sections to be stained by Hars's Hematoxylin and eosin, Crossmon's trichrome, Gomori's reticulin, Periodic acid Schiff (PAS) and Alcian blue stains. The above mentioned methods were applied as outlined by Drury and Wallington (1980) and Bancroft and Steven (1996).

For electron microscopic examination, small pieces 1mm X 1mm of the collected specimens were fixed in 3% glutraldhyde in 1M phosphate buffer (pH=7.3) for 24 hours then post fixed in 1M cold phosphate buffered 1% osmium tetroxide (pH=7.3) for 3 hours, rinsed in phosphate buffer then dehydrated (Hayat, 1986). Ultra thin sections were obtained and mounted on cupper grids then stained with uranyl acetate and lead citrate (Reynolds, 1965) to be examined by Joel 100 CX transmission electron microscope in the unit of electron microscopy, national institute of cancer, Cairo, Egypt.

RESULTS

In the immature bitches the prostate (paraurethral) gland could be described as small dorsoventrally compressed compact organ has paraurethral localization and exhibiting an intimate contact with the urethral wall just below the urinary bladder. The gland appeared as compound tubuloalveolar exocrine gland consisted of stroma and parenchyma.

The stroma appeared as a thick fibromuscular tissue represented by dense irregular fibromuscular capsule surrounding the gland and continued with the adventitia of the urethra. Thin fibromuscular septa arise from the dense capsule to divide the gland into different compartments housing the parenchymatous elements (Fig.1). The parenchymal tissue was represented by many branched alveoli and collecting ducts at different stages of development (Fig. 2). The developing alveoli appeared either compact (non canalized) or partially canalized. They were lined by cuboidal to low columnar cells with central spherical nuclei and slightly acidophilic cytoplasm. The collecting ducts appeared wider and lined by low cubiodal cells with clear cytoplasm (Fig.2). Ultrastructurally, the alveolar cells appeared slightly differentiated containing small spherical euchromatic nucleus and few organelles in electron lucent cytoplasm (Fig.3).

In the mature females the prostate gland acquired larger size and became more thicker and enlarged in all dimensions. The fibrous stroma became thicker formed of dense collagen bundles intermingled with small muscle fibers in the capsule, septa or even around the individual secretory alveoli and collecting ducts (Fig.4). The fibromuscular stroma were permeated by an extensive network of reticular fibers which could be easily recognized in the capsule, septa and around the individual parenchymal elements (Fig.5). The parenchyma of the gland in this stage became markedly enlarged and showed well developed and highly active secretory alveoli with wide irregular lumina and also large branched collecting ducts (Fig.6). The secretory alveoli were lined by high columnar secretory cells with basal oval to spherical vesicular nuclei and the cytoplasm showed strong apical acidophilic affinity. Small and short triangular basal cells with darkly stained nuclei were noticed between the columnar cells and their basement membrane (Fig.7). Both the secretory alveoli and the collecting ducts were surrounded by elongated curved cells with flattened slender-like darkly stained nuclei and scant fibriller cytoplasm, the myoepithelial cells,. Electron microscopically, the columnar cells lining the secretory alveoli showed large spherical euchromatic nuclei. The cytoplasm contained well developed granular endoplasmic reticulum with wide cisternae containing dark electron dense material. Numerous large round mitochondria with parallel cristae were also found and associated mainly with the endoplasmic reticulum. The secretory cells were also characterized by the presence of a huge number of characteristic secretory granules. The latter appeared as large oval electron dense membrane-bound granules containing two or more electron dense dots in a less electron dense matrix (Fig.8). Histochemically, the cytoplasm of the cells lining secretory alveoli and collecting ducts showed strong PAS reaction (Fig.9). In the same time these cells also showed moderate alcianophilic reaction (Fig.10).

The senile female prostate still large in size with lesser activity. The fibrous stroma showed progressive increase in thickness on the expense of the secretory alveoli (Fig.11). The secretory alveoli became greatly regressed and many of them were collapsed and lined by low cuboidal cells with clear cytoplasm while few of them still active and functioning (Fig. 12). Ultrastructurally, the secretory cells lost many of their cytoplasmic organelles which could be easily detected as disintegrated or exhausted organelles. The cytoplasm appeared electron-luscent free from secretory granules (Fig. 13). Histochemically, the epithelial cells lining the alveoli and ducts showed very weak PAS reaction although occasional secretory materials could be observed in some lumina (Fig. 14). No alcianophilic reaction noticed in the senile stage.

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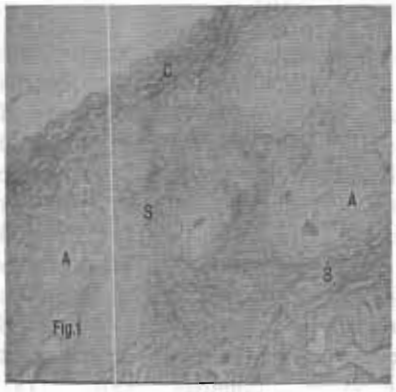
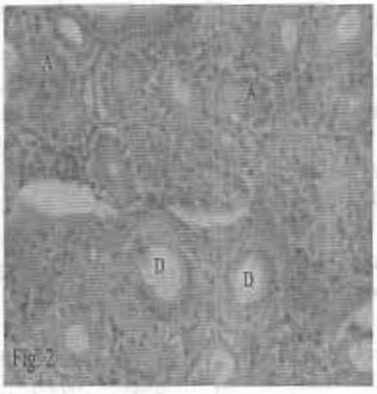
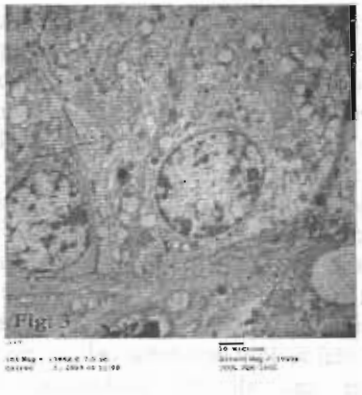
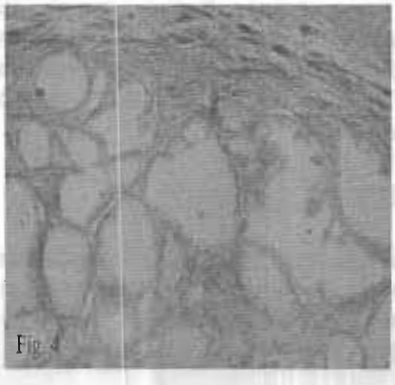
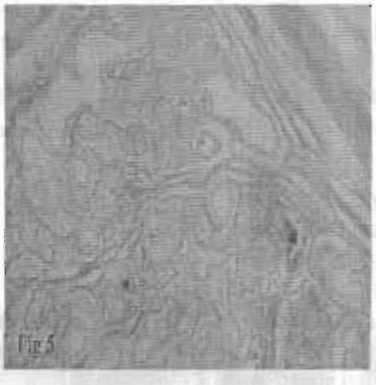
Fig. (14):- A photomicrograph of prostate gland of senile bitch showing very weak PAS reaction in both alveoli and ducts. Note, occasional secretory materials in the lumen of some alveoli (arrow). PAS technique, X400.

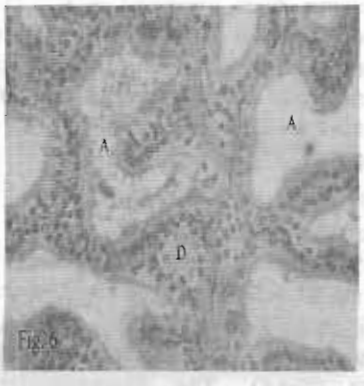


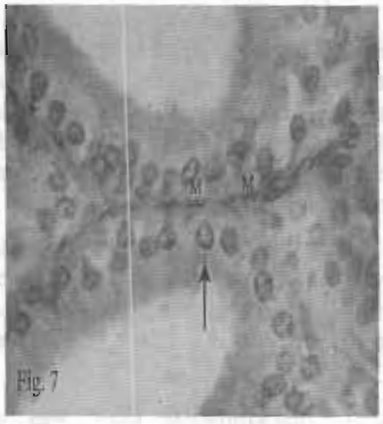












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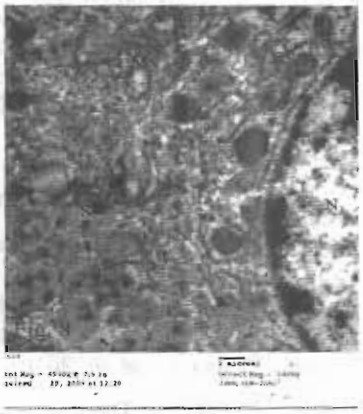
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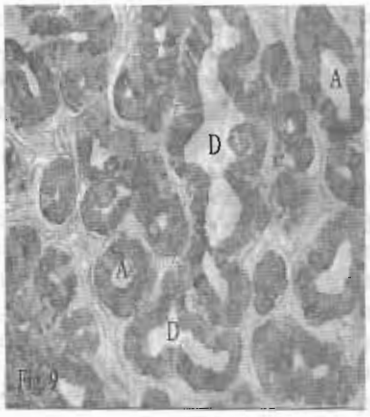

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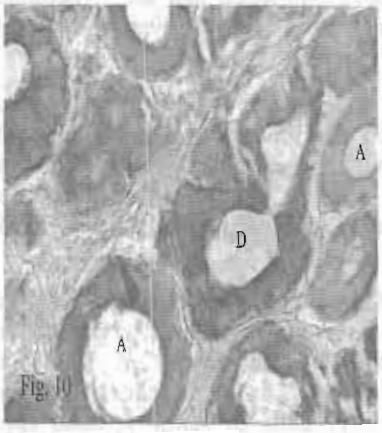

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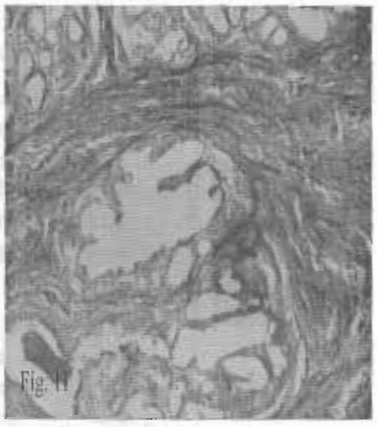
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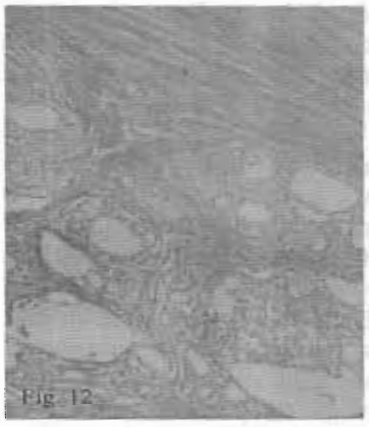
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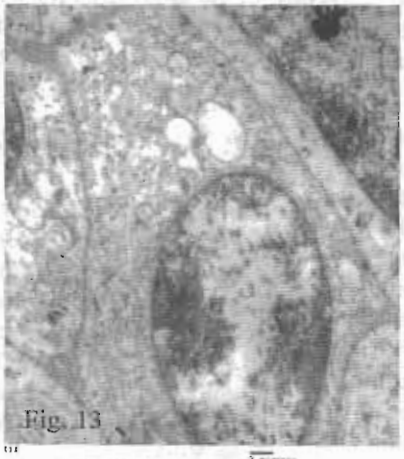
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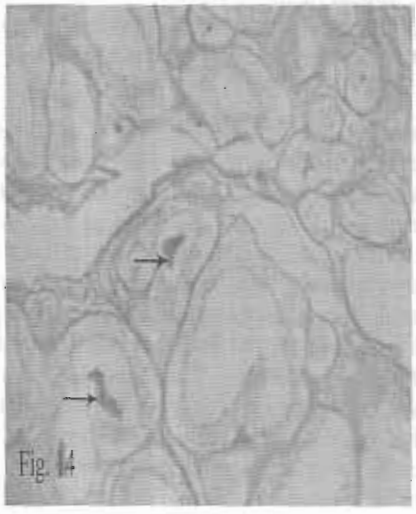
Fig. 14

DISCUSSION

During this investigation, the morphological characteristics of the paraurethral or female prostate gland of bitch were carefully studied with both histological (either light or electron microscopy) and histochemical utilities.

Among most histologists, there is a general agreement that the development and maintenance of prostatic tissue was controlled and regulated by androgens. Cunha *et al.* (1986); Banerjee *et al.* (2000) and Taplin and Ho (2001) stated that the development, differentiation and activity of prostate depends on androgen. Moreover, Thomson (2001) reported that the maintenance of prostate morphology and secretory activity is dependent on high androgen levels. In this respect Warnet *et al.* (1992) recorded the presence of specific androgen receptors on the cell membrane of prostatic alveolar epithelium of the women. In fact, the source of androgen in females is mainly attributed to the adrenal cortex as mentioned by Anderson *et al.* (2006). On the other hand, Fochi *et al.* (2008) in gerbil affirmed that the activity of female prostate is mainly dependent on the estrogen level during estrous cycle since the androgen level remain constant during the cycle. Oliveira *et al.* (2011) stated that the female prostate gland, like the prostate in males, is targeted by testosterone action, which promotes morpho-functional development. Furthermore, estrogens are required to maintain the male and female prostate and this gland presents both estrogen receptors (ER-α and ER-β).

In the present study, the female prostate still immature and non functioning until the age of puberty as it appeared more fibrous less cellular and its alveoli still non secretory and illuminized. Results similar to those mentioned by DeCampos *et al.* (2006).

In mature or adult bitches, the prostate gland started to develop and became larger in size showing well developed secretory alveoli as mentioned by Shehata (1980); Warnet *et al.* (1992); Sloboda *et al.* (1998) and Flamini *et al.* (2002). The secretory cells of the present study became tall columnar with apical acidophilia and their cytoplasm reacted positively to PAS and alcian blue which indicate high secretory activity (Thomson, 2001). The double staining reaction of the secretory cells to PAS and alcian blue resembled that of male prostate and confirm the fact that the female prostate is absolutely similar to the male one in its function (Banerjee *et al.*, 2000; Tapoga *et al.*, 2001 and Corradi *et al.*, 2004).

The secretory activity of the alveolar cells were also confirmed by the electron microscopical findings as it revealed well developed RER, numerous mitochondria and huge number of secretory granules. Similar findings were also reported by Flamini *et al.* (2002) and Tapoga *et al.* (2001).

The secretory alveoli of the present study showed small triangular basal cells, as also recorded by Zaviacic *et al.* (2000). The latter mentioned that the spatial organization as well as the ultrastructural characteristics of basal cells suggests that these cells are responsible for the renewal of the prostatic epithelium. This probably occur due to their proliferation and differentiation through a transient stage of intermediate type.

The epithelium of the collecting duct in mature bitch showed PAS and Alcian blue positive reaction which confirm their role in secretion in both male and female prostate (Flamin *et al.*, 2002 and Soliman *et al.*, 2010).

The presence of myoepithelial cells was also recorded in the prostate of both male and female animals (Tapoga *et al.*, 2001 and Soliman *et al.*, 2010). The authors mentioned that the myoepithelial cells when contracted help in evacuation of the alveoli and duct system.

In both human and rodents the female prostate are found to produce acid phosphatase, prostatic specific antigen (PSA), while alkaline milky secretion- rich in zinc absolutely similar to that produced by male prostate (Warnet *et al.*, 1992; Zaviacic *et al.*, 1997a &b and Tapoga *et al.*, 2001).

In the senile female the gland in this study still enlarged with a marked decrease in its parenchymal structure as stated by Sloboda *et al.* (1998) and Zaviacic *et al.* (2000). As mentioned by the same author the secretory cells of senile females appear clear with very few organelles indicating lower secretory activity as a result of decreased androgen levels. In our study the very weak PAS reaction of the secretory alveoli and disintegration of most organelles indicates the lowered secretory activity of the gland.

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دراسة التركيب النسيجى لغدة البروستاتا فى اناث الكلاب

خالد محمد مظهر

أجريت هذه الدراسة على عدد اثنين و ثلاثين من اناث الكلاب السليمة حيث قسمت الى اناث غير بالغة ، اناث بالغة واناث مسنة. ظهرت غدة البروستاتا فى الاناث غير البالغة على شكل جسم صغير حول الاحليل اسفل المثانة البولية وتكونت هذه الغدة من دعامة ليفية ونسيج حشوى غير ناضج. أصبحت هذه الغدة فى الأناث البالغة كبيرة الحجم وكثيفة النسيج الدعامى والذى تميز الى حافظة وحواجز ليفية مكونة من نسيج غروى متداخل مع الياف عضلية ملساء. أما النسيج الحشوى فقد تميز الى عنبات مفرزة وأنيبيبات مجمعة، واحتوت العنبات المفرزة على خلايا عمادية نشطة ومفرزة. ظل حجم الغدة فى الاناث المسنة كما هو فى المرحلة السابقة مع زيادة واضحة فى الدعامة الليفية على حساب النسيج الحشوى المفرز حيث أظهر الأخير تغيرات اضمحلالية وانكماشية واضحة.