

COMPARATIVE MORPHOMETERIC STUDY OF SALT GLAND IN SOME DOMESTICATED AND WILD MARINE BIRDS

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ABSTRACT

The histological structure and statistical of the salt glands were investigated in some domesticated and wild marine birds. Both species have a well-developed bilateral salt glands lie under the skin in the supraorbital depression of the frontal bone. The salt glands consist of many concentric polygonal lobes arranged in rows and separated by richly vascularized interlobular connective tissue. Each lobe is made up of branched secretory tubules lining with single layer of radially arranged cuboidal cells from a central canal and meshed with connective tissue enriched of blood capillaries. The duct system of each lobe opens into the central canal that drain in a main duct leads to the anterior of the nasal cavity. The measurements of the epithelium heights in the domestic pekin duck were significantly lower than the other birds subjected in the present study.

INTRODUCTION

Salt glands are active adaptive organ for osmo-regulation to control the amount of fresh water needed by the birds (1),(2). Salt glands have been registred in several order of seabirds, meanwhile terrestrial birds have very small salt glands (3),(4). Salt glands are enable birds to excrete sodium chloride (5) , (6)and is considered more important than the kidney in the elimination of salt from the organism (7). The histological observations of the salt glands in birds were described by many investigators such (8),(9) and(10). The knowledge on the osmo-regulatory of the salt gland made it necessary to re-investigate its histological structure.

MATERIALS AND METHODS

Thirty adult marine birds (males and females) were used for this study. 18 birds were hunted from the marshes of the south of Iraq and brought alive to the laboratory of anatomy and histology, college of veterinary medicine, university of Baghdad as a wild species (un domesticated). These 18 birds include three pairs of *Aythya ferina* (Common pochard), three pairs of *Fulica atra* (Coot), and three pairs of *Anas cercca* (Common teal). 12 birds from a total of thirty birds include three pairs of *Ansar anser* (domestic Geese), three pairs of *Anas playhrnchos* (Pekin duck) were obtained from local farm as a domesticated species. These birds were decapitated to remove salt glands for the histological purpose and biometrical studies. Both lobes of salts glands were quickly removed and immediately immersed in 10% neutral formalin for 24 hr. all specimens then dehydrated with ascending grades ethanol alcohol for dehydration, then followed by clearing the samples in two changes of xylol and impregnation with two changes of paraffin wax, then embedded and blocked out. Sections of

five micrometer were stained with Haematoxylin&Eosin stain,(11).Biometric measurements were done by ocular micrometer method. (12).

RESULTS

The salt glands in domesticated and undomesticated marine bird have the same histological structures. all these species under the study have crescent like shape and a well-developed bilateral salt gland lie under the skin in the supraorbital depression in the frontal bone, Fig.(1) consists of two lobes (left and right) surrounded by a vascularized thin connective tissue. Each lobe divided into many of polygonal lobules by interlobular septa. Each lobule consisted from branched secretory tubules lining with one layer of cuboidal cells, radiated out form a central canal and meshed with connective tissue enriched by blood capillaries, Fig.(2), (3). The duct system of each lobule opens in central canal which drained in a main duct and leads to the interior of the nasal cavity. The cuboidal cells of salt gland possessed pale stained and rounded in shape centrally located nuclei surrounded with lightly acidophilic stained cytoplasm, Fig (4). The central canals were lined with stratified cuboidal cell in wild birds and stratified columnar in domestic geese Fig. (5), (6). The central canal drained the secretion from striated duct and the striated duct drained the secretion from secretory units. The striated duct lined with tall cuboidal epithelial cells, while the intercalated duct lined with lower cuboidal cells, Fig. (7).Each gland supplied by branches of blood vessels from where numerous arterial branches enter the gland. The arterial branches pass into the lobules via the interlobular connective tissue, Fig. (3). the measurement of the epithelial heights of tubule and the duct in the domestic geese was 0.097 ± 0.04 which significantly higher than that of the marine and pekin duck, Tab. (1). The histological and statistical finding of salt gland in pekin duck show that the secretory units lining with low cuboidal cells dark stained nuclei Fig.(8). The central canal was lined with stratified squamous epithelium of height 0.68 ± 0.04 which show the lower height between the others Tab.(1).

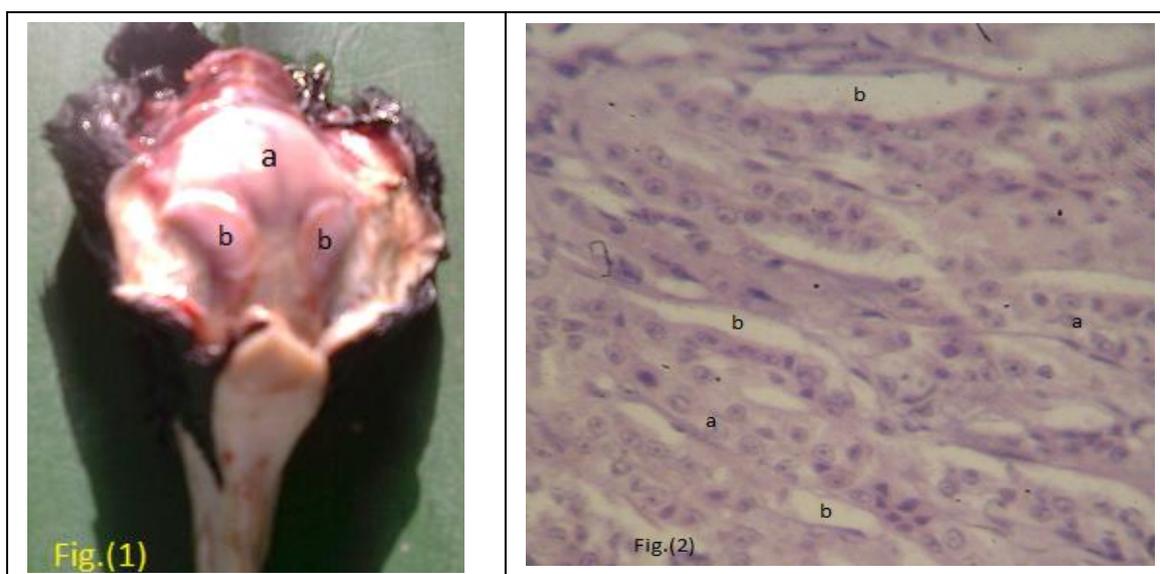


Fig.(1) Anatomical specimen for salt gland (water birds) show : (a) Frontal bone (b) Left and right lobes of salt gland in the supraorbital depression.

Fig.(2) Histological section of salt gland (domestic Geese) showing branched secretory tubules : (a) Simple cuboidal cell. (b) Lumen. (H&E) stain 400x.

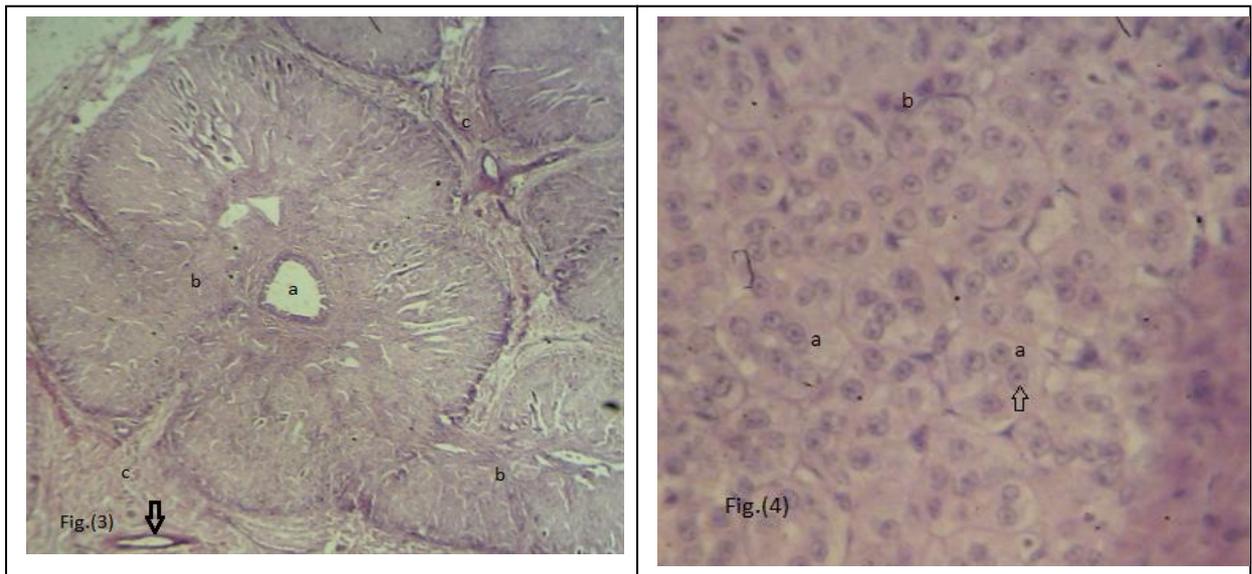


Fig.(3) Histological section of salt gland (domestic geese) showing: (a): Central canal. (b): polygonal lobule. (c): interlobular connective tissue (Arrow head shows blood vessels) (H&E) stain 200x.

Fig.(4) Histological section of salt gland (domestic geese) showing (a): simple cuboidal cells. (Arrow head shows nucleus. (H&E) stain 1000x.

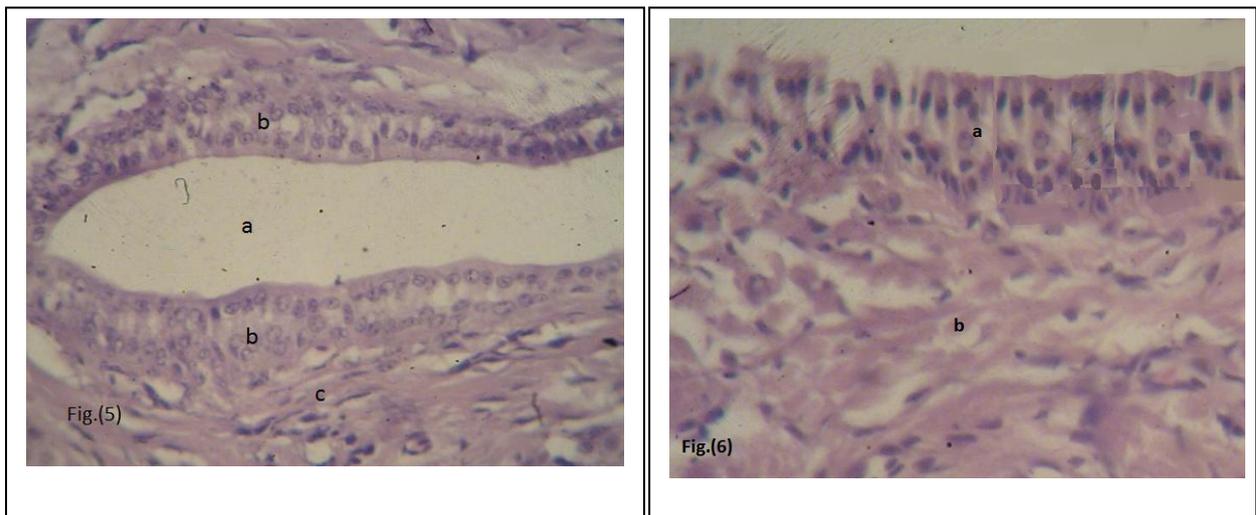


Fig.(5) Histological section of central canal of salt gland (wild birds) showing: (a) Lumen. (b) Stratified cuboidal epithelium. (c) Subepithelial connective tissue. (H&E) stain 400x.

Fig.(6) Histological section of central canal of salt gland (domestic geese) showing: (a) Stratified columnar epithelium. (b) Subepithelial connective tissue. (H&E) stain 400x. (H&E) stain 1000x.

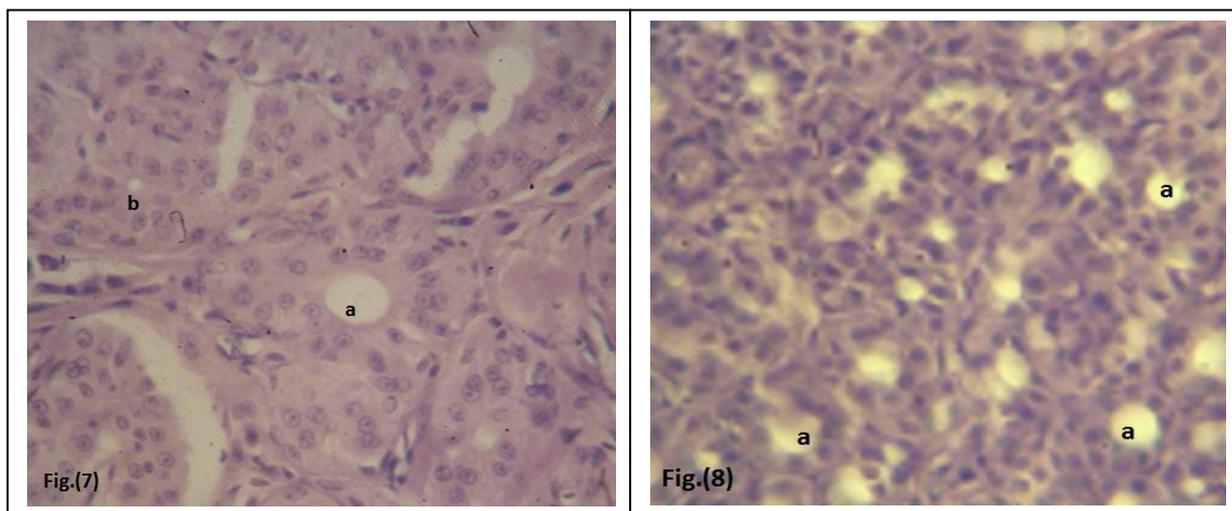


Fig.(7). Histological section of salt gland (domestic geese) showing: (a) striated duct. (b) Intercalated duct. (H&E) stain 400x.

Fig.(8). Histological section of salt gland (Pekin duct) showing: (a) Secretory units. (H&E) stain 400x.

Table (1) The Measurements of epithelial heights for Salt Glands in Birds (represented mean& standard error).

Birds	Secretory Unit/ mμ	Intercalated Duct / mμ	Striated Duct/ mμ	Central Canal/ mμ
Common teal	0.62 ± 0.04	0.38 ± 0.02	0.61 ± 0.04	0.92 ± 0.05
Common pochard	0.65 ± 0.04	0.39 ± 0.02	0.68 ± 0.04	0.76 ± 0.04
Fowl (Coot)	0.61 ± 0.04	0.49 ± 0.03	0.60 ± 0.05	0.89 ± 0.06
Geese	0.97 ± 0.04	0.64 ± 0.03	0.86 ± 0.01	1.42 ± 0.06
Pekin Duck	0.53 ± 0.02	0.38 ± 0.04	0.48 ± 0.02	0.68 ± 0.04

DISCUSSION

The salt glands are well developed and quit functional in birds that live in marine habited. But are also present, with limited functions, in some birds inhabit fresh water ponds possess significantly inactive salt gland. The saline tolerance in these birds is determined by the efficiency of the secretion of sodium ions by the salt (8). The results of the present investigation show statistically without doubt that the data of the secretory tubules in the salt gland of the domestic pekin duck (*Anas playhrnchos*) is 0.53±0.02 and the histological structure of gland is atrophic because pekin duck has very good tolerate to the changes in concentration of the salt in drinking water and feed (13). Measurements of secretory tubules in the marine bird in this study show that the data in *Athya ferina* is 0.65±0.04, *Anas crecca* is 0.62±0.04 and *Fulica atra* is 0.61±0.04. The histological structure of salt gland in these species in present study has well-developed secretory tubules and considered as actively functional. This agree with the results of (8) who study the slat gland in greater flamingo

phoenicopterus rubber roseus (9) and Jarrar in his investigation on the structure and histochemistry of the Kentish plover, *Charaderius alexandeaent surmriues* (10). The histological finding and the data obtained from measurements of the salt gland in geese showed significantly higher than all the birds used in the present study. The salt gland of domestic geese is considered very developed gland even it rising in fresh water. These unexpected results was explained by (Schmidt -Nielsen and Fange) who study the effect of high concentration of salt drinking water on the salt gland of domestic fowl which have no changes in the histological structure and the size of gland also no possess hypertonic excretion (13). All the results above about the changes in the gland of the domestic geese agree with results of (13) , who explained the development of the size of salt secreting gland in birds depends on gene expression and have great role (14).

دراسة مقارنة للقياسات الشكلية للغدة الملحية في بعض الطيور البحرية الداجنة وغير الداجنة

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الخلاصة

تم دراسة التركيب النسيجي للغدة الملحية ودراستها احصائيا في بعض الطيور البحرية الداجنة وغير الداجنة . تمتلك هذه السلالات من الطيور غدة ملحية متطورة ذات تركيب مزدوج تقع تحت الجلد في عند منخفض فوق العيني في العظم الجبهي. تتألف الغدة الملحية من فصوص متعددة الاضلاع تنتظم في صفوف محاطة بنسيج ضام تكثر به الاوعية الدموية . يتكون كل فص من نبيبات افريزية متفرعة من قناة مركزية محاطة بشبكة من نسيج ضام الغني بالشعيرات الدموية ويطن كل فص بطبقة مفردة من الخلايا المكعبة. تصب النبيبات الافرازية والقنوات المركزية افرازاتها في قناة رئيسية تؤدي الى مقدمة التجوييف الانفي للطائر. اظهرت القياسات الشكلية ان سمك الظهارة للغدة الملحية في طيور البط الداجنة كانت اقل من مثيلتها التي تمتلكها بقية الطيور الخاضعة للدراسة الحالية.

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