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Stomach of Balady Duck *(Anas platyrhnchos)* Histological, Histochemical and Electron Microscopical Studies

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Abstract

The stomach of balady duck (Anas platyrhnchos) was demarcated into upper part or the gastric (proventriculus) and the lower part or the muscular stomach (gizzard); connected together by isthmus. The pyloric region was a very small area between the gizzard and duodenum. The tunica mucosa of the proventricular wall showed longitudinal branched folds (plicae) separated from each other by sulci. The simple columnar epithelium lining the excretory ducts of the submucosal proventricular glands were positively reacted with PAS, alcian blue, PAS- alcian pH 2.5 combinations and Best's carmine; while, the secretory unites reacted negatively with these stains. The proventricular glands were lined with oxyntico-peptic cells. Ultrastructurally, the oxyntico-peptic cells were demarcated into light and dark alveolar cells. The mucosal folds of the middle gizzard were lined by simple columnar epithelial cells covered by an internal membrane; koilin. The propria submucosa was occupied by numerous simple branched tubular glands lined by simple cuboidal epithelium.

Keywords: balady duck (Anas platyrhnchos), stomach histology, proventriculus, gizzad, pyloric.

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CONTENTS

INTRODUCTION

Poultry had a significant contribution in the meat and egg production in Egypt where it was considered to represent a good source of animal protein supplies for the country **(Yakout and Kosba, 2009).** Additionally, poultry production industry particularly, chickens, ducks, turkeys, and gees had high economic value throughout the world **(Jordan and Pattison, 1996** and **Yakout and Kosba, 2009).** Ducks were raised all over the world for their eggs, meat products, and by products as well as, for hoppy. Recently, duck farming had increased due to its economic value, where the meat ducks industry had expanded to reach about 10-15% annually. Generally, there were more than 40 breeds of the domestic ducks **(Qureshi *et al.*, 2017).**

Ducks belong to aquatic bird family ***(Anatidae)***, genus ***(Anas)*.** Anatidea was known to be one of the three families in order of anesriformes (waterfowel) **(Al-Saffar and Abood, 2014).** Globally, ducks had been classified into wild and domesticated ducks **(*Anasboschasdomesticus*).** Almost all varieties of domesticated ducks ***(Anasboscasdomesticus)*** were descended from the mallard ***(Anasplatyrhynchos)***; apart from the Muscovy duck ***(Cairinamoschata)*** **(Rogers, 2001).**

Birds structurally differ from mammals in their various organs; among these is the digestive system **(Al-Helali *et al.*, 2010).** The digestive system is complex in most bird species and differs from other animals. It begins at the mouth and finish at the cloaca **(Zaher *et al.*, 2012).** The gastrointestinal tract (GIT) can provide suitable conditions for flight in birds, due to its length, which is less than that of mammals, lack of teeth, and light- weight beak **(Hamdi *et al.*, 2013).** The morphology and activities of the digestive system are changed during the bird's development **(Qureshi *et al.*, 2017).**

The bird's stomach showed distinct differentiation into two parts, the upper one, or the glandular stomach and the lower part or the gizzard. Both parts were characterized by a great morphological and functional variability, between and within species **(Starck, 1999).** However, Some of the avian stomach consists of three compartments; namely proventriculus, ventriculus and pyloric part **(Abumandour, 2014)** such as in cattle egret **(Hussein and Rezk, 2016)** and in quail **(Helal, 2016).** Furthermore, the stomach variations in the anatomical scheme were associated with the alimentary habit **(Batah *et al.*, 2012).**

Numerous studies on the anatomy and morphology of the stomach of several birds had been done. However; there were a paucity of work published on the stomach of ducks **(Ziswiler and Farner, 1972; McLelland, 1975, 1979; Nickel *et al.*, 1977; King**

and McLelland, 1984; Hassan and Moussa, 2012). In addition, native breeds of ducks such as Domiati ducks and Balady (Sudan) ducks were neglected in scientific researches for long time as most of researches were carried out on foreign breeds as **Evencio-neto *et al.* (1997) and EL-Gendy *et al.* (2016).** Who studied the Muscovy duck, **Patki and Lucy (2012)** investigated kuttanad duck and **Deka *et al.* (2014)** referred to pati and chara-chemballi ducks. However, there was a paucity of histological studies were published on the stomach of ducks.Therefore, the present study was conducted to elucidate more light on the histological features of the stomach of balady duck (*Anas platyrhynchos*).

Aims of work:

This study aimed to investigate the morphological and histological structure and some histochemical activities of the stomach of adult balady duck.

This work also aimed to investigate the ultrastructural characteristics of the main cell types of the proventriculus and pyloric regions of the stomach of the same bird.

REVIEW OF LITERATURE

Oesophago-Proventricular Junction:

At esophageal - proventricular junction, there is a short zone showing the structure of both regions. The esophageal diameter increases until enter the proventriculus and become a portion of it. This distinct demarcation between the proventriculus and the esophagus is found in fowl **(Hodges, 1974),** domestic duck and pigeon **(Hassan and Moussa, 2012),** quail **(Helal, 2016)** and pati duck **(Deka *et al.*, 2017).**

In pigeon, esophageal - proventricular junction is found externally on the surface. This surface is smooth in the esophagus while that of proventriculus shows densely packed elevations which are the proventricular glands. On the other hand, this junction can be distinguished by color in ducks (the color of esophagus is whitish while that of proventriculus is light brown) and thickness (The wall of proventriculus is thicker than that of the esophagus) **(Hassan and Moussa, 2012).**

Close to the proventriculus, the stratified squamous epithelium becomes narrow and the lamina propria papillae are short in addition to cease of the mucosal glands. Moreover, the lining epithelium has been changed to simple columnar mucous

secreting epithelium; which lines the proventriculus folds. However, the mucous glands of the esophagus extend through the lamina propria of the proventriculus. At this point, strands of smooth muscle fibers; which are arranged longitudinally, pass through the anterior surface of the proventricular glands lobules. Moreover, lymphatic nodules at the junction are frequently heavily infiltrated with lymphatic cells **(Hodges, 1974)**.

Proventriculus:

The stomach is considered the most important part of the digestive system of birds **(Al-Helali *et al*., 2010).** It consists of two chambers that not differentiate externally. The glandular part; referred to as gastric proventriculus (glandular stomach), and the muscular part is called gastric ventriculus or gizzard (muscular stomach), in addition to the isthmus gastric **(king and McLelland, 1975; Nickel *et al*., 1977; McLelland, 1979; Ibrahim, 1992; Baily *et al*.,1997; Rocha and De Lima, 1998; Hassouna, 2001; Dyce *et al*., 2002; El-Shafey, 2006** and **El karmoty, 2014).**

The aforementioned trait similarly is present in most avian species, such as; domestic fowl **(Akester, 1986)**, partridge **(Rossi *et al*., 2005),** Japanese quail **(Ahmed *et al*., 2011** and **Helal, 2016)**, falcon **(Abumandour, 2013)** and pigeons **(Al- Saffar and Al-Samawy, 2016).** Conversely, the stomach in some birds consists of

three compartments namely; proventriculus, ventriculus and pyloric part **(Hodges, 1974)**, in domestic fowl **(Mclelland, 1979)**, chicken and pigeon **(Abumandour, 2014)** falcon **(Hussein and Rezk, 2016)**, cattle egret **(Helal, 2016)** and in quail**.** Each part varies morphologically and functionally between and within species **(Starck, 1999** and **Al-Saffar and Al-Samawy, 2015).** Additionally, the shape and size of the stomach depend mainly on the type of diet consumed by the birds **(Al- Saffar and Al-Samawy, 2015).**

The proventriculus differs in size according to the species, where it is small in the graminivorous, it is large in the carnivorous **(Duke, 1997).** However, the proventriculus is spindle in shape and originates from the esophagus in domestic duck and pigeon**(Ibrahim, 1992; Nagy, *et al.*, 1992; El-Shafey, 2006** and **Hassan and Moussa, 2012)**, dove and quail **(Ibrahim, 1992)**, goose **(Hassona, 2001),** fowl **(Dyce *et al.*, 2002),** chicken **(El-Shafey, 2006)** and in common quail **(Zaher *et al.*, 2012).**

Generally, the wall of proventriculus (glandular stomach) is thick and consists of four layers of typical tubular organs in mallard duck **(Al-Saffar and Al-Samawy, 2015).** These were a mucous membrane (tunica mucosa gastris), submucosa (tela submucosa gastris), a muscular layer (tunica muscularis gastris) and serosa (tunica serosa gastris) in ostrich **(Cooper and Mahrose, 2004)**, guinea fowl **(Selvan *et al.*, 2008)**, quail **(Attia, 2008)**, japanese