

Original Research Article

Histological Investigation of the Proventriculus in the Local Fringillidae (Carduelis Carduelis)

Yahia Y. Al-Seady^{1*}

¹Department of Applied Biological Science, College of Biotechnology, Al-Nahrain University, Jadriya, Baghdad, Iraq

***Corresponding Author:** Yahia Y. Al-Seady

Department of Applied Biological Science, College of Biotechnology, Al-Nahrain University, Jadriya, Baghdad, Iraq

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Abstract: In the our study, focus and designed, to investigation for features histological structure of proventriculus (glandular stomach) of the local Fringillidae family. The samples of the (glandular stomach) proventriculus, were collected after the dissecting, and processed by doing the steps of histological sectioning. The microscopic inspection revealed, the histological structure of glandular stomach wall consists of (four) main layers that was :tunica mucosa, tunica submucosa, tunica muscularis, tunica serosa. The tunica mucosa composed of deep folds that lined with asimple columnar epithelium, with glandular crypts. In the tunica submucosa present the (tubular gland) that surrounded by thick connective tissue, with present large number of blood vessels. Tunica muscular was consist of smooth muscle layers are arranged as (inner circular, outer longitudinal) layers. Findings of this study was give the scientific information for the normal histological structure of the glandular stomach of the local Fringillidae family.

Keywords: Bird, Glandular, Stomach, Fringillidae, Tunica mucosa.

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INTRODUCTION

Digestive systems of the bird was adapts according to the type of there food, species and the origins. Birds digestive system have special stomach (ventricular and proventriculus) glandular and non-glandular part [1]. Glandular part (proventriculus) was lined with layer of glandular tunica mucous that secretions the digestive enzyme like (pepsin, hydrochloric acid). The secretions enzymes was facilitate the food movement into the part of stomach, and broken down the smallest particles to give arise for absorpction when reach to the small intestines [2]. Proventriculus (glandular stomach) was the primary part of the serration of the digestive enzymes [3]. The glandular stomach (proventriculus) was consist of four distinct layers, each layers possesses specific histological structures that correspond to their function. The tunica mucosa was lined by simple columnar epithelium, thickness of these layer was increased with ages. The tunica mucosa and the tunica submucosa was thicken in over times [4].

Proventriculus (glandular stomach) was classified to different stomach types that depended on the type that ingested, and the proventriculus histologically consist of four histological layers (tunica). The histological study of the birds digestive system is differ from each birds the depended on their food type (behavior, food consumed) [5]. The glandular part (proventriculus) microscopically was have large and long papillae that have many small folds. Individual glands, was organized to many lobules that was take a lumen adjacent to the surface. The lumen was formed with the common duct, this duct was opened through the surface at the tips of small papillae. Surface of luminal fold was lined with the epithelium simple columnar, each of these fold was contain core of (lamina properia) [6].

MATERIALS AND METHODS

In this research ten birds were used, to examine the histological layers structure of the glandular stomach (proventriculus). The sample that take from the glandular stomach tissues (1cm³) washed with distal water, and then fixation by using (formalin10%) for 48 hours. When the fixation was complete starting with dehydration

technique with graded concentrations of the methy alcohol (70,80,90,100), after the dehydrations the samples, were embedded in the paraffin. After omplet bloking of sample start with sectioning of these sample (5–7 μm) in thickness that cutting by using the microtome, and the histological section was stained by (H&E) stain for study the general histological structure of the glandular stomach [7]. The tissue histological structure was examined by using the light microscopy that equipped with the microscope camera (Scope Image 9.0, China). All Histometrical of glandular stomach wall was measurements (epithelial height, mucous thickness, thickness of the four histological layers): mucosa, submucosa, muscularis, serosa [8].

RESULTS AND DISSECTIONS

The tunica mucosa measured approximately $198.24 \pm 0.32 \mu\text{m}$ in thickness. It consisted of highly folded mucosal folds lined by simple columnar epithelium, which measured about $21.62 \pm 0.85 \mu\text{m}$. The plicae were separated by sulci. The lining epithelium thickness was measured at approximately $8.96 \pm 0.12 \mu\text{m}$. The properia was occupied the entire core of the mucosal folds and was composed of loose connective tissue that containing the collagen bundles, connective tissue fibers, blood vessels, and lymphocytes. Simple tubular glands it was lined by simple cuboidal epithelium were located at the base of the mucosal folds. The muscularis mucosa of the glandular stomach was absent (Figure 1; Table 1). Glandular vestibule was consist of (papillae and ducts), the papillae was directed in to the mucosal surface (inner surface). These papillae was comprised with the four basic histological layers that associated with the tubular or elongated structures: (tunica mucosa, tunica submucosa, tunica muscularis, tunica serosa) (Figure 2). Histological layers were mentioned in the glandular vestibule, of the different birds, that including the domestic pigeons [9], the Japanese quail [10], and the coots [11]. Our study was shown that the lining epithelium of the glandular stomach mucosa was contains large number of the goblet cells, this finding was in unexpected to the finding that reported by eman [12]. Research of groin region of the Gallinule chorus, revealed that the fibers was located

intermingle with the mucosal folds, making the simple duct through that lubricant, can escape [13]. Kadaknath chickens stomach, the lymphoid tissue at the gastric tunica mucosa was appears diffuse or nodular. The tunica submucosal layer was contains the large number of glands that composed of the cuboidal epithelium cells, this gland was project at straight outward [14]. Other finding in the red partridge (*Rhynchotus rufescens*) revealed that the glands was surrounding with the fibrous sheath. This finding was corroborate with the our findings [13]. Histological results of the tunica submucosashow that this layer was a thickest layer of glandular stomach wall, it was measured about ($618.94 \pm 4.37 \mu\text{m}$), and sub mucosa that fill completely by the proventriculus glands. The connective tissue septa were separated between the adjacent proventriculus gland, and present of large number of the blood vessels. The proventriculus gland (tubuloalveolar glands) was appeared as elliptical in shape, that occupied the tunica submucosal layer of proventriculus. These glands were arranged in a single row and featured a central lumen. The tubular glands that lined by the simple columnar, epithelium and composed of numerous secretory units. Each secretory unit opened into ducts that converged into a main duct connected to the gland lumen. The tunica muscularis consisted of smooth muscle are arranged in to (inner circular layer and outer longitudinal layer), with the outer one is being thicker. The tunica muscularis measured about $86.81 \pm 1.46 \mu\text{m}$. histologically tunica serosa, composed of mesothelial cells, loos connective tissue, and adipose tissue. In the partridge, the muscular tissue included an internal muscle layer and an external fat layer (Figures 3 and 4; Table 1). In the domestic duck, the muscular tissue of the glandular stomach consists of inner longitudinal muscle fibers and outer circular muscle fibers, present at both the proximal and distal parts of musculature. Additionally, an internal region contains an extra muscle layer. The serosa is formed by loos connective tissue that includes numerous blood vessels, neurons, and adipocytes, and is covered by a layer of mesothelium cells containing some scattered cells. The our findings was consistent with the finding that reported by Hussein *et al.*, [14, 15], regarding the proventriculus of the Iraqi falcon (*Falco peregrines*).

Table 1: This table show the thickness of mucosa, submucosa and muscularis, mucosal fold and lining epithelium in the Local Fringillidae (*Carduelis carduelis*)

Mucosa M $\pm$ SE μm	Submucosa M $\pm$ SE μm	Muscularis M $\pm$ SE μm	Mucosal fold M $\pm$ SE μm	lining epithelium M $\pm$ SE μm
198.24 $\pm$ 0.32	618.94 $\pm$ 4.37	86.81 $\pm$ 1.46	21.62 $\pm$ 0.85	8.96 $\pm$ 0.12



Figure 1: Microphotograph cross section of proventriculus in Local Fringillidae (*Carduelis carduelis*) show: tunica mucosa (black arrow), tunica submucosa (yellow arrow), tunica muscularis (blue arrow), tunica serosa (red arrow). H&E stain. 200x

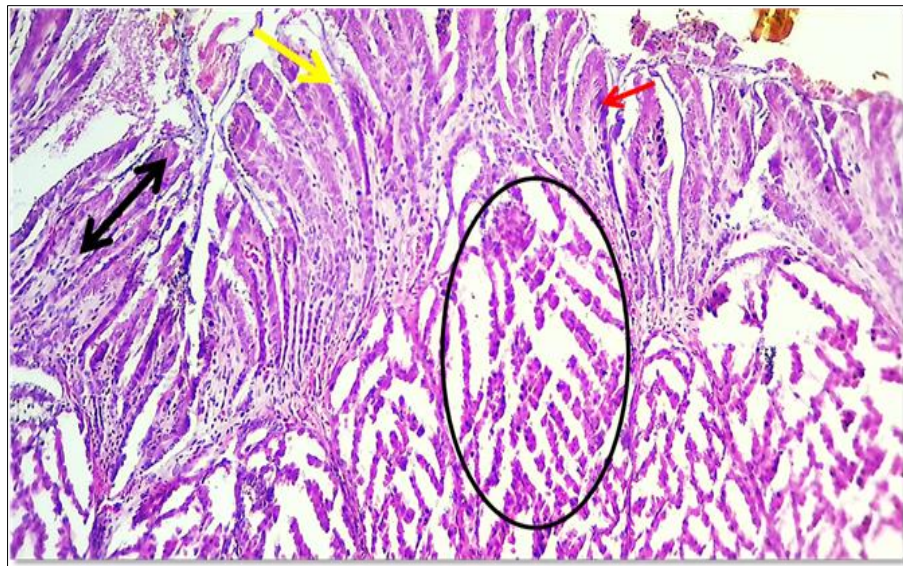


Figure 2: Microphotograph of proventriculus cross section in Local Fringillidae (*Carduelis carduelis*) show: mucosal fold (black double head arrow), plica of mucosa (yellow arrow), proventriculus gland (black circle). H&E stain. X100

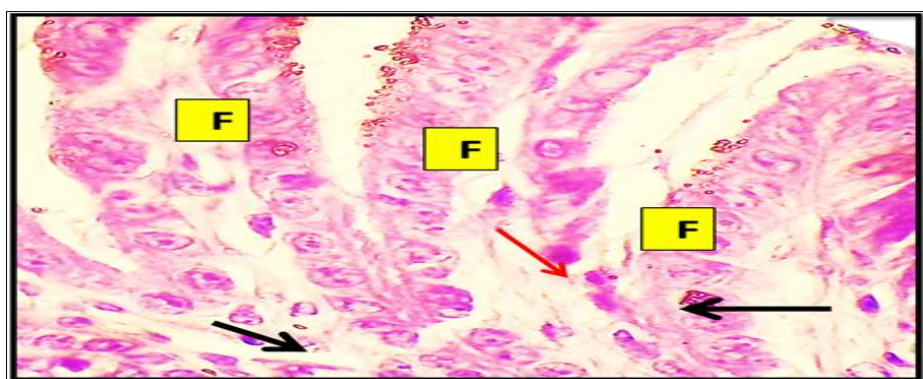


Figure 3: Microphotograph of proventriculus cross section in Local Fringillidae (*Carduelis carduelis*) show: simple columnar epithelium (red arrow), mucosal fold (F), lamina propria (black arrow).H&E stain 400x

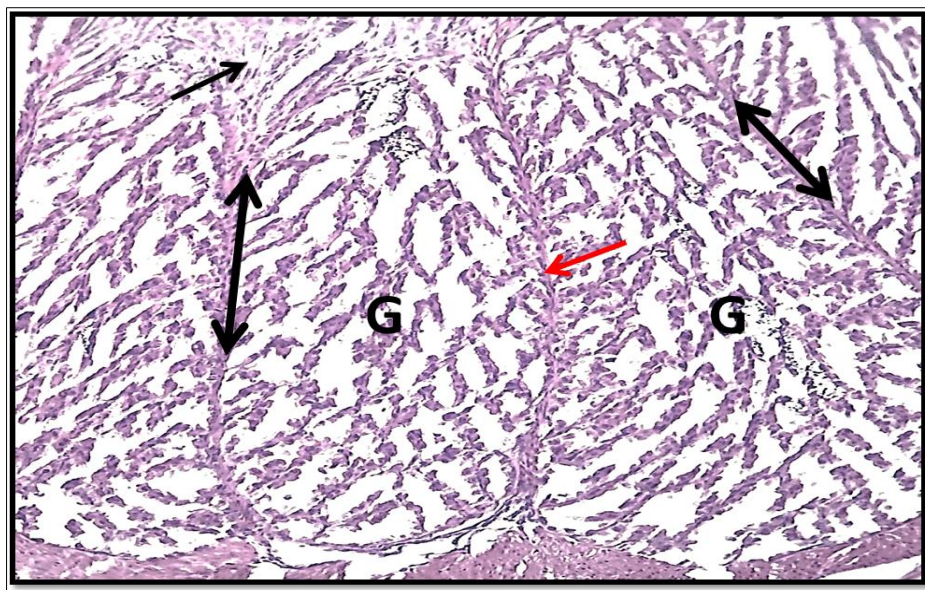


Figure 4: Microphotograph of proventriculus cross section in Local Fringillidae (*Carduelis carduelis*) show: mucosa (black arrow), muscularis (red arrow), proventriculus gland (G), collagen septa (black double head arrow). H&E stain 200x

CONCLUSION

The proventriculus of the local Fringillidae (*Carduelis carduelis*) has four principal layers: mucosa, submucosa, muscularis, and serosa. They provide baseline data on the normal histological structure of the glandular stomach in this species.

Conflict of Interest: Authors declare, there is no conflict of interest

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