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Morphological comparison of proventricular and gizzard in starling birds *Sturnus vulgaris* and pigeon *Columba livia*

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Abstract

The current study aimed to investigate the stomach of two species of starling *Sturnus vulgaris* and pigeons *Columba livia*. The experiment included 10 birds, it is distributed in two equal groups. The ages of birds were on average range 6-9 months (adult age). The observation has appeared the stomach in both the species, is divided into 2 chambers. The results showed the first stomach is called proventriculus. It's characterized as elongated in shape and expansion of the esophagus, located forward the gizzard to posterior at the esophagus in both species. Our study included some gross findings that differentiate into two kinds. However, the proventriculus in starling *S. vulgaris* was characterized as cylindrical-like and had gastric papillae, which it's appeared from an external surface of the proventriculus with a long isthmus. Whereas our results in pigeon *C. livia*, the glandular stomach was tubular in shape and no protrudes of gastric papillae during the outer wall of it with the short isthmus. Either gizzard was spherical in the shape of starling and fusiform-like in pigeons, but it was a thin muscular wall and clear at fatty tissue with pale color comparatively with pigeon because the starling birds were represented at omnivores depend on the nutrition added to the grains. In the pigeons, the gizzard had an amount of adipose tissue it's covered most of the external wall of it. The situation of gizzard in pigeon was situated posterior toward the proventriculus and had a thick muscular wall with dark-red in color according to nature of the diet, facilities of the grinding grain for indigestion, therefore the pigeons were considered from granivorous. Also, the study included anatomical statics measurements, length, weight, and volume in addition to weights of the birds. Where the study recorded no significant data mean between species of birds proventriculus and gizzard (table 1).

Keywords: Starling, pigeon, morphology, comparison

1. Introduction

The bird species are widespread around the world. Where they are more than 8000 styles of birds are lived between them. These birds are different in shape, location, and adaptation [1]. The starling birds *Sturnus vulgaris* are seasonal and come during winter. Whereas other birds such as pigeons *Columba livia* are presented along year [2, 3]. The stomach of the birds is divided into two chambers. The first stomach is proventriculus and the second chamber is called gizzard or ventriculus. Gizzard stomach is grinding function of grains by their muscles, so that it's facilities indigestive process [4]. The two chambers of stomach are different in size and shape depending on the nature of birds' diets as carnivores, piscivorous and granivorous birds. The glandular stomach (proventriculus) is characterized thin layer based on the food force (grains). Either ventriculus is called muscular part, which it's crushed the grains in, omnivores, insectivores, granivorous, and herbivores [5, 6]. The gizzard is varied among the birds depending on the diet. In vegetarian fowls are marked developed, and considerable masticator function for granivorous and insectivores [6, 7]. The birds are subdivided into 3 groups according to food nature. The first group has soft eating diet as kestrel and owl, second birds have hard eating food such as turkey and sparrow. Either the final group geese, hoopoe, and darter are intermediate between the first and second group of the birds, the gizzard function is used in storage and physical digestion in these birds [8].

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Morphology, the stomach of avian is different according to species, chick's proventriculus seems spindle in shape and it has gastric papillae which it's projected processes at in upper surface of it. The papillae are secreted the gastric juice which it's mixed from mucin, hydrochloride acid and gastric enzymes^[9, 10]. The study aimed to light the application of some morphological differences between proventriculus and gizzard of *S. vulgaris* and *C. livia*.

2. Materials and methods

2.1 Experimental design

Ten birds were used. The ages of birds included adults aged 6-9 months. It was divided into two equal groups, the first group included 5 starling birds and the other group had 5 pigeons. Then all the birds were sacrificed by dislocation in the neck region. The samples were put on dissected board for dissection. We are done mid-line incision through the abdomen region so that obtain on viscera. Proventriculus and gizzard were washed with tap water for the cleaning of blood, adhered particle, and food for the preparation of morphological techniques. The results included anatomical dimensions. The weights of birds were measured by sensitive electronic balance. So weight and lengths of proventriculus and gizzard. The lengths were measured by an electronic caliper. Either volume was measured by a volumetric cylinder. It contains normal saline and started to put samples inside it, then we read the scaling of a volumetric cylinder before and after putting of sample.

3. Results and discussion

The current study included the stomach of starling birds *S. vulgaris* and pigeon *C. livia*. Generally, the present observations appeared the stomach in both the species, divided into 2 chambers (figure 1, 2, 3). This result is accepted with^[9] Japanese quail.^[11] In domestic fowl *Gallus gallus*.^[12] Partridge *Rhynchotus rufescens*. Whom said the stomach in some birds, consisted of three chambers, proventricular, ventriculus, and pyloric part. The current study

showed the first stomach is called proventriculus. It's characterized elongated in shape and expansion of the esophagus, so it's located forward the gizzard to the posterior at the esophagus in both species (figure 1, 2, 3). These findings were corresponding with stated^[13] in Ostrich^[14] In common quail *Coturnix* and^[15] in chicken. This part of the stomach was called the fore glandular stomach. These results were accepted with^[16] in pigeon *C. livia domestica*. Our study observed some gross differences between the two species. However, the proventriculus in starling *S. vulgaris* was characterized a cylindrical-like and had gastric papillae which it's appeared from external surface of proventriculus with a long isthmus (figure 1a). These results were paralleled with said by^[17]. While our results in pigeon *C. livia*, the glandular stomach was tubular in shape and no protrudes of gastric papillae during outer wall of it with short isthmus (figure 1b, 3a). Either gizzard was spherical in shape during starling and fusiform-like in pigeons, but it was a thin muscular wall and clear at fatty tissue with pale color comparatively with pigeon, because the starling birds were represented at omnivores depend on the nutrition adding to the grains. In the pigeons, the gizzard had amount of adipose tissue it's covered most the external wall of it (figure 1b, 3a). These results were accepted with^[18, 19] in Striated Scope Owl *Otus Scors brucei* and goose, turkey, sparrow, kestrel, hoopoe, owl respectively. Whom said the gizzard was fusiform in shape. The study accepted with them about the gizzard surrounded by amount from fatty tissue. Generally, the gizzard in pigeon was situated posterior toward proventriculus and had thick muscular wall with dark-red in color according to nature of diet, facilities of the grinding grain for indigestion. Therefore the pigeons were considered at granivorous. These results accepted with said by^[16]. The study included anatomical measurements, length, weight, and volume in addition to the weights of the birds. Where the study recorded no significant data mean between species of birds proventriculus and gizzard (table 1). These results are accepted with^[17] in starling birds.

Table 1: Shows anatomical dimensions of proventriculus and gizzard during two species.

Species	Starling bird <i>Sturnus vulgaris</i>		<i>Columba livia</i> pigeon	
Weight	123.32g		347.56g	
Organs	proventriculus	gizzard	proventriculus	gizzard
Length	3.43±01cm	4.54±02cm	4.33±01cm	cm 5.21±01
Weight	2.45±03g	3.54±03g	3.65±00g	4.00±03g
Volume	2.28±23 cm ³	cm ³ 2.33±30	3.54±32 cm ³	3.65±25 cm ³

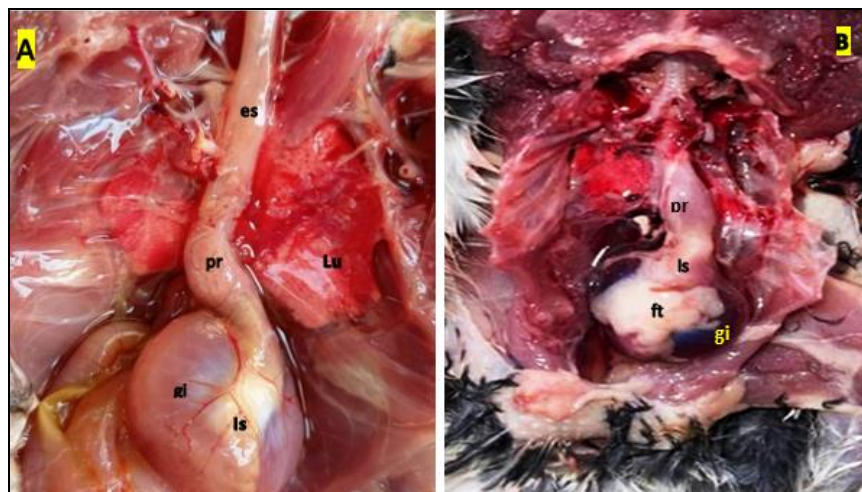


Fig 1: Microphotograph of ventral view showed A. esophagus (es), proventriculus (pr) gizzards (gi), isthmus (Is) and lungs (LU) in *S. vulgaris*, B. proventriculus (pr), gizzards (gi), isthmus (Is) and fatty tissue (Ft) in *C. livia*



Fig 2: Macrophotograph of viscera showed A. proventriculus (pr), gizzards (gi), fatty tissue (ft), duodenum (d), pancreas (p), jejunum (j), ileum (i) and anus (a) in *C. livia* B. esophagus (es) proventriculus (pr), gizzards (gi), fatty tissue (ft), duodenum(d), pancreas (p), jejunum (j), ileum (i) and anus (a) in *S. vulgaris*

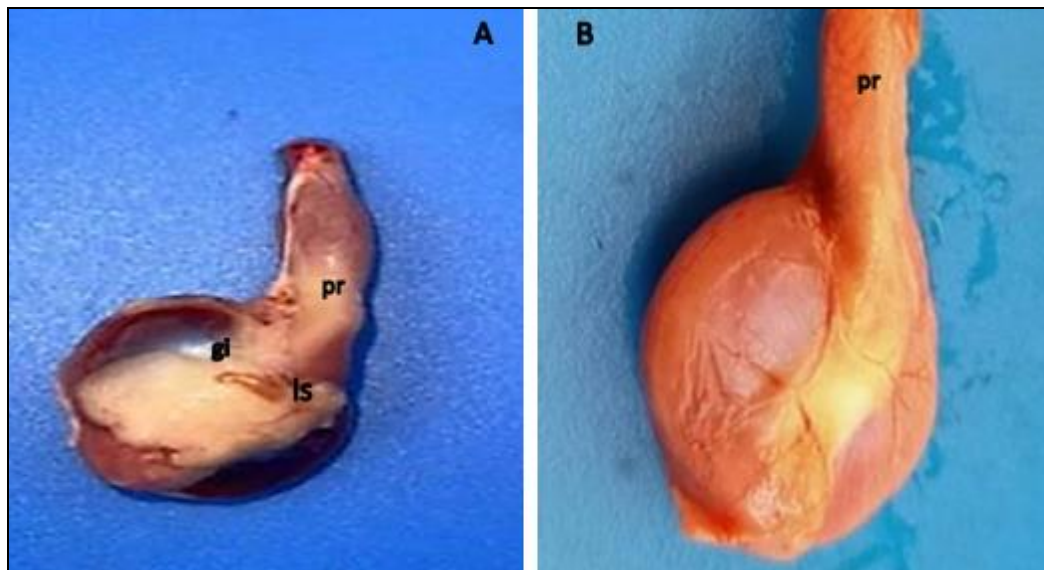


Fig 3: Microphotograph of shown A. proventriculus (pr), gizzard (gi) and fatty tissue (ft)and isthmus (Is) in *C. livia* B. proventriculus (pr), gizzard (gi) *S.* and isthmus (Is)in *S. vulgaris*.

5. Conclusions

The stomach in *S. vulgaris* and *C. livia* included two chambers, fore stomach (proventriculus) and muscular stomach (gizzard). In both species, the proventriculus was elongated-like continue with esophagus posteriorly. In starling's proventriculus had appearance of projected processes of gastric papillae in external wall. While in pigeon's proventriculus has no appear. Pigeon's gizzard was covered by fatty tissue on the most external surfaces of it.

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