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Histomorphological study of trachea in starling birds (*Sturnus vulgaris*)

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Abstract
The current study was included 10 birds of *Sturnus valguris*, divided into two groups, each group has 5 birds for using of the study. Ages of that birds were average between (6-9 months), and they were weight (123-131 g). The present study was had two sides, the first side was represented morphological results and second side was histological target. The trachea was musculo-membranous cartilaginous tube, located between the larynx and runs away toward left and right lungs, inside the thoracic cavity and continuously dorsally with esophagus. The study expressed the trachea in *S.valguris* decreased in diameter towards posterior progressively, where the study showed tracheal ring, characterized complete ring, the trachea was characterized flexible, non-folded rings and series of cartilage rings, this ring numbers were range average between (70 to 100) in different numbers between types. Second target included the histological results, where it's showed tracheal rings were complete and observed mucosa of trachea was composed pseudostratified columnar ciliated epithelium which lined internal surfaces of trachea with distribution of goblet cells, either the second layer represented lamina propria was a loose connective tissue which rich a blood vessels. Either others layers represented by submucosa, muscularis and adventitia.

Keywords: Trachea, starlings, morphology, histology

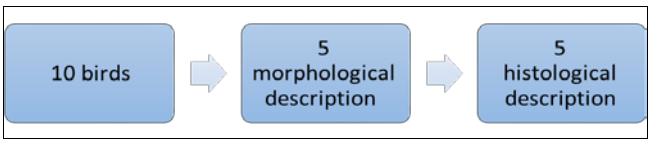
1. Introduction
Respiratory system begins at the nares, passages in the head that lead to pump gas to the larynx. Trachea extends from the larynx to left and right lungs. Trachea is different in some birds may tortuous or coiled, as in the trumpet bird [1, 2]. The trachea branches into two extra pulmonary primary bronchi, each of that goes to a lung and its associated air sacs [3]. Birds considered as one of the most important nutritional sources. They constitute a high rate of human consumption specially poultry meat which is characterized by depression of cholesterol percent. The trachea in birds appears as cylindrical tube-like flexible cartilaginous structure, with an empty interior arranged in loops or coils. So that the length of the trachea is much longer than the length of the neck and variable dimension in different bird species [4, 5, 6]. It passes from the right side of the neck ventral to the esophagus and ventro-lateral to the cervical vertebrae as it extends caudally, therefore, most of the trachea lies on the right side of the neck and can easily be palpate in the live bird. As it approaches the thoracic inlet returns to the midline-ventral position. The trachea bifurcate into two parts, left and right. Primary bronchi, which enters the hilus of the lung on the septal surface [7, 8]. The trachea based on a series of tracheal rings, which tends to ossify in large species. The form of these rings is rather constant in birds generally. Each is complete and not C-shaped as in mammals. This shape is like a signets ring, the broad part forming the left and right halves alternately of successive rings. Each broad part overlaps externally the narrow parts of the two adjacent rings [9]. The trachea follows the larynx and is made up of the tracheal cartilage ring [10, 11]. In birds; the number of cartilage rings in the trachea varies due to the length of the neck. The trachea usually made up of 108-126 cartilages in dove penguins [12, 13]. Histologically, the tracheal wall is composed of pseudostratified ciliated columnar epithelium and goblet cells, the propria-submucosa under the basal cells of ciliated respiratory epithelium is consist from the loose connective tissue with mucous and serous tracheal glands.

The hyaline cartilage may be complete (O-shaped) or non-complete (U or C shaped) rings which are supported the tracheal wall. Periphery longitudinal oriented striated muscle which is located and surrounded externally tunica adventitia [14, 15, 16]. In Bursa roller pigeon (Columba livia) and Turkey the epithelium lining of the trachea is mucous type that is secreted by simple alveolar mucus glands intraepithelial or goblet cells [17, 18]. In birds, the anterior portion of epithelium lined trachea contains numerous, simple alveolar mucous glands while in the posterior portion of epithelium the goblet cells are lieu mucous glands which form 'intraepithelial glands [18]. Whereas [19], mention that goose have plentiful goblet cells constituted the 'intraepithelial glands' which is contain mucin with a predominance of sulphate ester salt.

1.2 Aim of the study

The study was designed to describe the morphological and histological results of trachea during starling birds *Sturnus vulgaris*

2. Materials and Methods



We brought 10 birds of starlings from Al-Amiriyah market in baghdad & kept them at home for short period, before starting to dissect them for the purpose of studying histology & morphology of trachea, the weights of birds were approximately the same, we use a surgical set, formalin 37%, blades, normal saline 0.9%w/v, containers, blades, blue paper, cylinder tube. *we diluted the formalin to 10% so the tissue doesn't damage. Starting to dissect the bird by killing the animal through sloughing it gently and we placed the bird on his back, pull the legs to the side and the back. Cut the skin between the legs and abdomen on each side, Hold the legs from near the hip and then lift it to the top so inseparable, Raise the skin over the thigh and chest.

Complete raise the skin from the director and even the beak, Cut the abdomen gently in a cross-sectional area at the end of the sternum, in order to gain access to internal organs (trachea), Cut the ribs on the right side and the left until it reaches the shoulder, Raise the chest at this stage, lift the trachea carefully, and then put each of trachea in containers that contain diluted formalin 10%, then send the samples to get dissected histologically in the histology lab.

Stains have been used on samples is Hematoxillin and Eosin (H&E) stain and periodic acid schafit (PAS) stain. The staining procedure for H&E follows a basic protocol [20].

3. Results and Discussion

3.1 Morphological results

The current study was included two sides, the first side was represented morphological results and second side was histological target. The trachea is an organ of the respiratory system. Define, its musculo- membranous cartilaginous tube, located between the larynx and runs away toward left and right lungs inside the thoracic cavity (figure 1). So the trachea is continuously dorsally with esophagus. The study expressed the trachea in starling birds decreased in diameter towards posterior progressively (figure 1). These results corresponding with [1, 23]. Whom said the craniocaudal width of the rings progressively increase throughout the cranial third of the trachea and then progressively decrease throughout the caudal third of the trachea. These results was accepted with said [21], in Iraqi pigeons, the trachea was long tube extended from larynx until bifurcate into left and right primary bronchio which enter inside the lungs. where the study showed tracheal ring of starlings, characterized complete ring, the trachea was characterized flexible, non-folded rings and series of cartilage rings, this ring numbers were range average between (70 to 100) in different numbers between types of the birds (figure 2).these results accepted with [9]. The present study showed the division of trachea before enter into the left and right lungs is called primary bronchi (figure 3). This result accepted with [22], whom stated the trachea bifurcates into two primary bronchi dorsal to the base of the heart. These enter the ventral surface of the lungs after short course. In penguins, a median septum divides the trachea into left and right tubes, making it very easy to intubate a primary bronchus by mistake.

3.2 Histological results

Histologically, the current study was included histological structures, where the study showed tracheal rings of starlings were complete (figure 4). Also the study observed mucosa of trachea was composed from epithelia called pseudostratified columnar ciliated epithelium which lined internal surfaces of trachea with goblet cells, either the second layer represented lamina propria was a loose connective tissue which rich a blood vessels (figure 5). These study accepted with [14,23], said the tracheal wall is composed of pseudostratified ciliated columnar epithelium and goblet cells, the propria-submucosa under the basal cells of ciliated respiratory epithelium is consist from the loose connective tissue with mucous and serous tracheal glands. The hyaline cartilage may be complete (O-shaped) or non-complete (U or C shaped) rings which are supported the tracheal wall. Periphery longitudinal oriented striated muscle which is located and surrounded externally tunica adventitia. These results accepted with [21], whom stated the trachea is included from four tunicus, mucosa, submucosa, muscularis and adventitia, where epithelia lined by psudostratified columnar epithelium ciliated. So the study showed all layers of trachea. Mucosa, submucosa, muscularis as well as adventitia is last layer. The mucosa consist of epithelia with goblet cells, and lumina properia is loose connective tissue and mucosa muscularis. Either submucosa was beneath mucosa dense connective tissue, third tunica is called muscularis is smooth muscle fibers (Figure 6). These results parallel with [14, 17, 18] in Bursa roller pigeon (*Columba livia*) and Turkey the epithelium lining of the trachea is mucous type that is secreted by simple alveolar mucus glands intraepithelial or goblet cells. In birds, the anterior portion of epithelium lined trachea contains numerous, simple alveolar mucous glands while in the posterior portion of epithelium the goblet cells are lieu mucous glands which form 'intraepithelial glands [18]. Whereas [19], mention that goose have plentiful goblet cells constituted the 'intraepithelial glands' which is contain mucin with a predominance of sulphate ester salt.

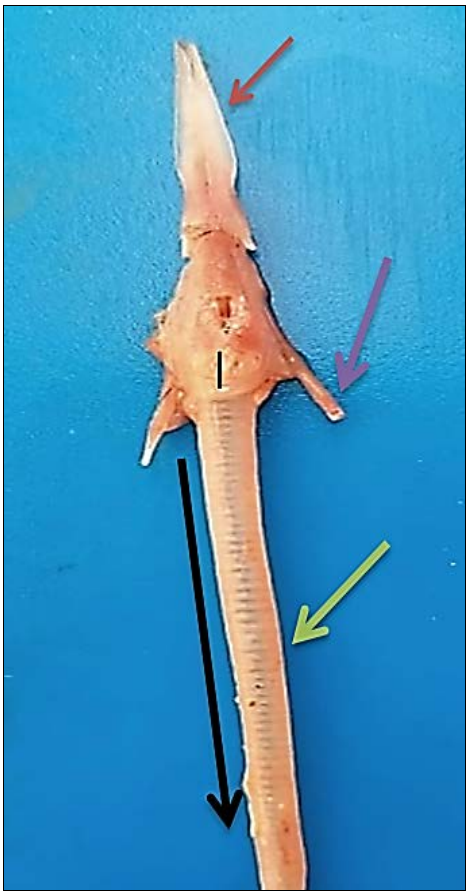


Fig 1: Morphological picture of starling's birds showed tongue (red arrow), hyoid bone (purple arrow) and trachea and larynx (l) (green arrow) progressive in diameter (black arrow).

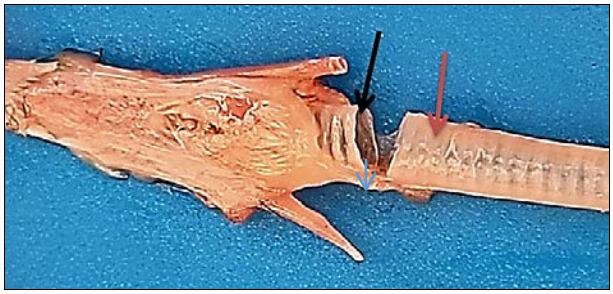


Fig 2: Morphological picture of starling's birds showed tracheal rings (black arrow), trachea (red arrow).

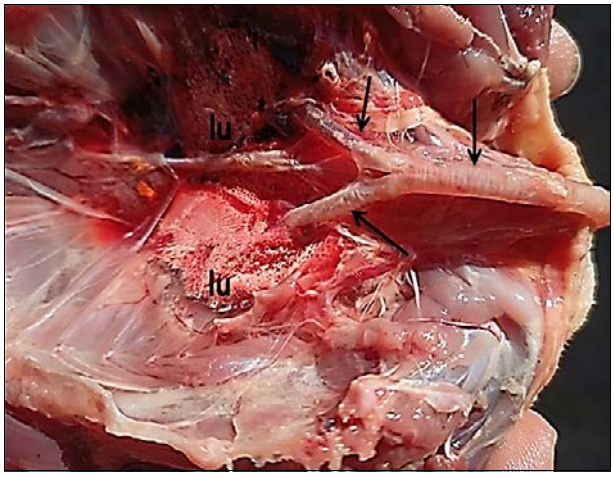


Fig 3: Morphological picture of starling's birds showed trachea (black arrow), bifurcate of trachea (primary bronchi) (black arrow) and lung (lu).

Fig 4: Cross histological picture of tracheal ring in starling birds showed epithelia (red arrow), hyaline cartilage (blue arrow), trachealis muscles (black arrow).

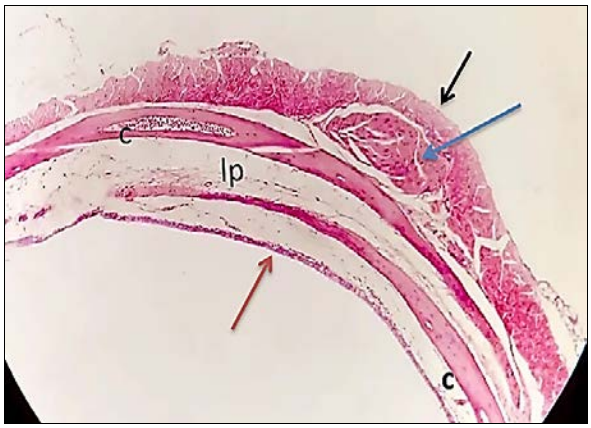


Fig 5: Cross histological picture of tracheal ring in starling birds showed epithelia (red arrow), lamina propria (lp) hyaline cartilage (c) and trachea muscles (black arrow). PAS stain 100x

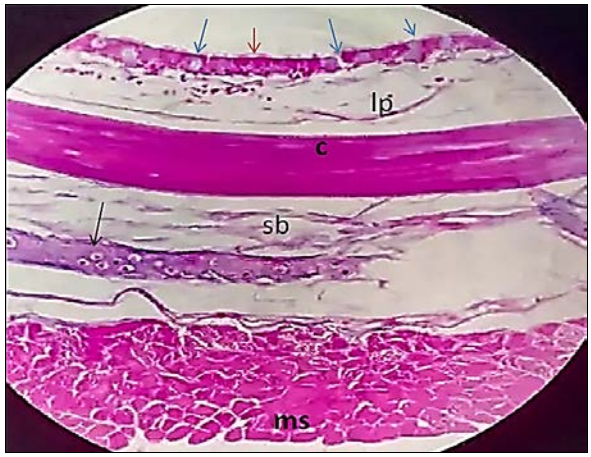


Fig 6: Cross histological picture of trachea's starling showed pseudostratified columnar ciliated epithelia (red arrow), goblet cells (blue arrow), lamina propria (lp) hyaline cartilage (c), submucosa (sb), chondrocytes (black arrow) and trachea muscles (ms). H and E stain 400x

4. Conclusions

1. The trachea in starling is lined by pseudostratified columnar ciliated epithelium with goblet cells.
2. In starling's birds had well developed trachea and complete rings.
3. Starling's trachea is decrease progressively toward the posterior.

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