

COMPARATIVE ANATOMICAL , HISTOLOGICAL AND HISTOCHEMICAL STUDY OF (LARYNX, TRACHEA AND SYRINX) BETWEEN MATURE AND IMMATURE MALES OF LOCAL DUCK (*Anas Platyrhnhos*)

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Key Words: Trachea, Syrinx, , Ossification.

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ABSTRACT

The present study aims to compare gross anatomical, histological and histochemical structures of the larynx, trachea and syrinx between mature(Drake) and immature (Duckling) male duck(*Anas platyrinchous*) . Twelve healthy local males ducks were divided into two groups. Six Drake at one year old and six Duckling at three months .For anatomical study the larynx, trachea and syrinx were measured by using vernia . For histological study specimens from larynx, trachea and syrinx were fixed in 10% formaldehyde after that the specimens embedded in paraffin. The next step tissues were sectioned using microtome and stained with routine stain and special stains .The anatomical results revealed that larynx, syrinx and trachea are identical in position in both Drake and Duckling , but differ in size . The histological results revealed that larynx of both Drake and Duckling lined by keratinized pseudostratified squamous epithelial tissue that appears thicker in Drake than Duckling . Trachea of Drake and Duckling lined with ciliated pseudostratified columnar epithelial with mucous glands , supported by ossified cartilages in Drake and hyaline cartilage in Duckling . Syrinx of both Drake and Duckling lining by the ciliated pseudostratified columnar epithelial with few goblet cells. Beneath it the lamina propria and sub mucosa that contained in loose connective tissue with blood vessels and amount of elastic and collagen fibers beneath it in Drake spongy bone trabeculae that contains bone lacuna fills with osteocytes , while in Duckling hyaline cartilage . The hyaline cartilage consists of lacuna which contains chondrocytes.

INTRODUCTION

The duck *Anas Platyrhynchos* lives in Europe, Asia, Northern America, Poland. They hardly sink in water and take flight adroitly. They feed on the water environments and bottom of shallows, their food almost insects, fish, land plants, seed, vegetables and aquatic⁽¹⁾.

The respiratory system plays a vital role in gases interchange, thermo-regulation of temperature of the body, and helps in producing the voice⁽²⁾⁽³⁾. There are many differences between the structures of respiratory system in mammals and birds, presence of both a larynx and syrinx. The trachea composed of complete cartilaginous besides ossification of tracheal rings and presence of air sacs⁽⁴⁾. Avian respiratory system consists of nasal cavity, larynx, trachea, primary bronchi, syrinx and lungs⁽⁵⁾. The larynx located as laryngeal amount at the floor of oropharynx, caudally to the tongue. The shape of the larynx in birds like heart shape covered with muscles and consists of four ossified cartilage, single cricoid and pricricoid and paired arytenoid cartilages. Glottis closes the opening of larynx to preventing food enter the air passage⁽⁶⁾.

In addition to that, histologically avian larynx is lined by two types of epithelium, near the pharynx stratified squamous tissue that changed to ciliated, pseudostratified columnar epithelium near the trachea. Lamina propria having elastic tissue, serous or mucous glands in addition to that hyaline and elastic tissues which give support to the wall of larynx⁽⁷⁾. The trachea is a longitudinal tube located at the end of the cricoid cartilage, that accompanied with the esophagus at the right side of the neck and supported in avian by a series of complete cartilaginous rings, histologically the trachea is lined by pseudostratified ciliated columnar epithelium with simple alveolar mucous gland that changed at the posterior portion of trachea by goblet cells. The lamina propria and submucosa consist of dense connective tissue and cartilage.⁽⁸⁾The syrinx in bird represents the voice box, and is analogous to the mammalian larynx except that it lacks the vocal cords. It is located at the ending part of the tracheal ring and initial part of the primary bronchi cartilages, there are shortened vertical bar (pessules) separated the bronchial opening⁽⁹⁾, moreover histologically, the syrinx is lined by different types of epithelium, stratified squamous or columnar or pseudostratified epithelium⁽¹⁰⁾.

When the primary bronchi enter the lung it passes through the lungs to its caudal border, where they open into the abdominal air sacs. The walls of primary bronchi contain incomplete C-shaped rings of cartilage⁽⁹⁾. The lungs of birds are lobulated, pink in color, soft and velvety to touch because they do not contain cartilage as in lungs of mammals which contains extra cartilage. In addition to that it is small in size therefore it fails to cover the external surface of the heart as in mammals. The ribs are deeply embedded in the dorsomedial portion of lungs, forming costal impression that separates the lung into segments. Each lung has a hilus on the ventral surface through which blood vessels and primary bronchi enter^(11, 12). The present study aims to a comparative anatomical, histological and histochemical between mature and immature ducks respiratory system due to lack of studies on these aspects.

MATERIALS AND METHODS

Twelve healthy ducks were collected. The birds were purchased at winter (From December to February) from Basrah Market. The weight of Drake ranged from 1,5 to 2kg and the Duckling weighting 1 kg. The birds were divided according to age into two groups (7 months and 12 months) each group there were six birds, all birds clinically healthy and devoid from any type of injuries. Some of ducks were anesthetized with chloroform dropped in cotton pad kept about the face for anatomical measurements and the other groups were euthanized by slaughtering through cutting off the major neck blood vessels and making an incision in the skin of neck and separation of trachea far off from the site of cutting to avoid damage of respiratory system through aspiration of blood for histological study, after that the samples isolated and washed with normal saline (0.9% NaCl) and fixing in 10% formalin for (24) hours. After that routine histological techniques preparing paraffin blocks cutting at 6- 10 μm , staining with hematoxylin and eosin (H&E) stain for general tissue structure, in addition to special stains (Mallory stain as indication for presence of collagen fibers, PAS stain as indication for presence of mucopolysaccharides, Verhoeff as indication for elastic fibers) to histochemical study^(13, 14).

RESULTS

Anatomical results showed that, the larynx is similar in structure and position in both Drake and Duckling. Fig(1), it is chordate or triangular in shape located at the floor of the pharynx caudal to the tongue forming the inlet to the trachea. A longitudinally opening called laryngeal opening or glottis located in the midline of the laryngeal mound surrounded by arytenoid cartilage from both sides cranio-caudally, with the absence of epiglottis. Every side of the laryngeal mound has a conical papillae coordinated transverse manner at the caudal border. Cartilage of larynx formed by the single cricoids, procricoid and paired arytenoid cartilages. There are no vocal cords in the larynx of duck and the production of voice takes place at the syrinx. The larynx supported at the root of tongue by two hyoid bones and by the muscles on both sides of the trachea that attached to the end of the larynx. Results of the morphometric measurements of the larynx revealed, there was significant difference in the length of larynx between Drake and Duckling ($20.75 \pm 3.93\text{mm}$, $15.50 \pm 3.74\text{mm}$) respectively (Table 1), larynx length of Drake longer than Duckling.

Anatomical results of trachea showed that, the trachea is similar in position in both Drake and Duckling. It begins at the caudal end of cricoid cartilage to the syrinx, then continuous together with the esophagus on the right side of the neck, then regains its median position upon entering the thoracic inlet. Fig (2). The trachea of Drake is supported by series of cartilaginous rings, these tend to become ossified and tightly stacked completely. While trachea of Duckling is supported by series of cartilaginous rings that appeared tightly stacked but not completely there were small detachment among them. There was significant difference in tracheal diameter between Drake and Duckling in the proximal part ($7.30 \pm 0.59\text{mm}$, $5.40 \pm 0.52\text{mm}$) and distal part ($8.26 \pm 0.59\text{mm}$, $7.13 \pm 0.52\text{mm}$) respectively (Table 2), diameter of trachea in Drake is larger than Duckling. As well as there was significant value in the length of trachea between Drake and Duckling ($188.33 \pm 7.63\text{mm}$, $171.00 \pm 3.60\text{mm}$) and number of tracheal rings ($129.66 \pm 2.51\text{mm}$, $137.66 \pm 2.51\text{mm}$) respectively (Table 3), the length of trachea in Drake is longer than Duckling, the number of tracheal rings in Duckling more than Drake.

Anatomical study for the syrinx appeared that it was identical in position in both Drake and Duckling. It is located at the tracheal bifurcation, dorsal to the heart, ventral to the esophagus and between both sides of the left and right sternotrachealis muscle. Fig (2) . Syrinx of both Drake and Duckling fused with terminal tracheal cartilages and first cartilages of left primary bronchus thus called cartilaginous tracheobronchial type. Syrinx of Drake is composed of completely ossified cartilage, that consists of cranial part or (larger part) located on the left side of the body, its shape is oval and slanted called (Syringeal bulla). While Syrinx of Duckling is composed of non ossified cartilage, that consists of cranial part located on the left side, its shape oval straight called (Syringeal bulla). Internally the bulla is hollow and empty separated from the left and right bronchi by short vertical bar called (Pessulus). Fig (3) . The caudal part or (lower part) of both Drake and Duckling located on the right side, it is smaller than the cranial part.

Results of the morphometric measurements of the syrinx showed significant differences in the length between Drake and Duckling ($15.80 \pm 2.45\text{mm}$, $12.75 \pm 1.47\text{mm}$) and width ($32.16 \pm 1.96\text{mm}$, $20.95 \pm 2.23\text{mm}$) respectively (Table 4) . syrinx of Drake is larger than Duckling.

Histological results showed that, the larynx is lined by mucosa which consists of keratinized pseudostratified squamous epithelial tissue that appears thicker in Drake than Duckling. Fig (4), beneath it a thick connective tissue rich in collagen and elastic fibers (submucosa and lamina propria). The lamina propria is having numerous of mucous glands acini that arranged in groups in different sizes opened toward laryngeal cavity through the epithelium. Mucous glands are lined by pyramidal cells with basal nuclear nuclei. Beneath, the submucosa there are two vertical cartilage left and right hyaline arytenoid cartilages), they are short and differ in size (in Drake, while in Duckling it was longer than Drake and equal in size. Beneath arytenoid cartilage there is transverse cartilage (cricoid cartilage) which consists of one piece in Drake while in Duckling consists of two pieces between it loose connective tissue. Fig (5). The tunica muscularis in Drake is composed of internal circular and external longitudinal layer of smooth muscle. Between the two layers there are a nerve plexus, blood vessels associated with loose connective tissue. Our present study revealed the absence of tunica muscularis in Duckling. The outer most layer of larynx is adventitia which contains loose connective tissue, blood vessels, nerves and adipose tissue. Histochemical result

revealed positive reaction to Mallory stains ,in sub mucosa , lamina propria and perichondrium in both Drake and Duckling as a result to presence of collagen fibers that appears more abundant in submucosa than elastic fibers .Fig (6). Also positive reaction to PAS stain due to presence of mucopolysaccharides in mucous glands and laryngeal cartilage that appears more in Drake than Duckling. Fig (7) . While results of Verhoeff stains showed positive reaction in submucosa and lamina propria in both Drake and Duckling as a result to finding of elastic fibers in these regions Fig(8).

The present study showed that, trachea in both Drake and Duckling are represented by empty cartilaginous tube . Histologically it is composed of (mucosa, submucosa, cartilage and adventitia). Mucosa it is composed of ciliated pseudostratified columnar epithelium that consists of columnar cell, and mucous cells .The lamina propria - sub mucosa has loose connective tissue , collagen fiber with lymphocytes , supported by ossified cartilages in Drake while in Duckling it was supported by hyaline cartilage .The cartilage consists of two part (superior and inferior cartilages) they are not equal in the thickness and separated by loose connective tissue , beneath cartilage , tunica muscularis that composed of circular muscle covered by adventitia that composed of loose connective tissue with numerous blood vessels Fig (9,10).

Histochemical results for trachea showed positive reaction to Mallory stain as indication to presence of collagen fibers in cartilage , submucosa and in loose connective tissues between superior and inferior cartilage. Fig(11). On the other hand , the trachea being positive to Verhoeff stain as indication to presence of elastic fibers in perichondrium .Fig(12).

Histologically the present study showed that, the syrinx of Drake is lined by the ciliated pseudostratified columnar epithelial with few goblet cells ,the lamina propria and sub mucosa contained loose connective tissue with blood vessels and amount of elastic and collagen fibers . Beneath it spongy bone trabeculae that contains bone lacuna fills with osteocytes, in addition to bone marrow that fills spaces between bone trabeculae . Syrinx of Duckling is lined by the ciliated pseudostratified columnar epithelial , beneath it the lamina propria and submucosa consists of loose connective tissue with blood vessels and amount of elastic and collagen fibers . Beneath it hyaline cartilage . The hyaline cartilage consists of lacuna which contain chondrocytes and blood vessels. Fig(13). Histochemistry revealed bone trabeculae and submucosa of

Drake in addition to hyaline cartilage of Duckling seem positive to Mallory stains due to its contents of collagen fibers .Fig (14).

On the other hand, positive reaction to PAS stain as indication to presence of muco polysaccharides and carbohydrates Fig (15). While elastic fibers that seem in bone trabeculae of Drake and cartilage of Duckling less than collagen fibers positive to Verhoeff stain Fig(16).

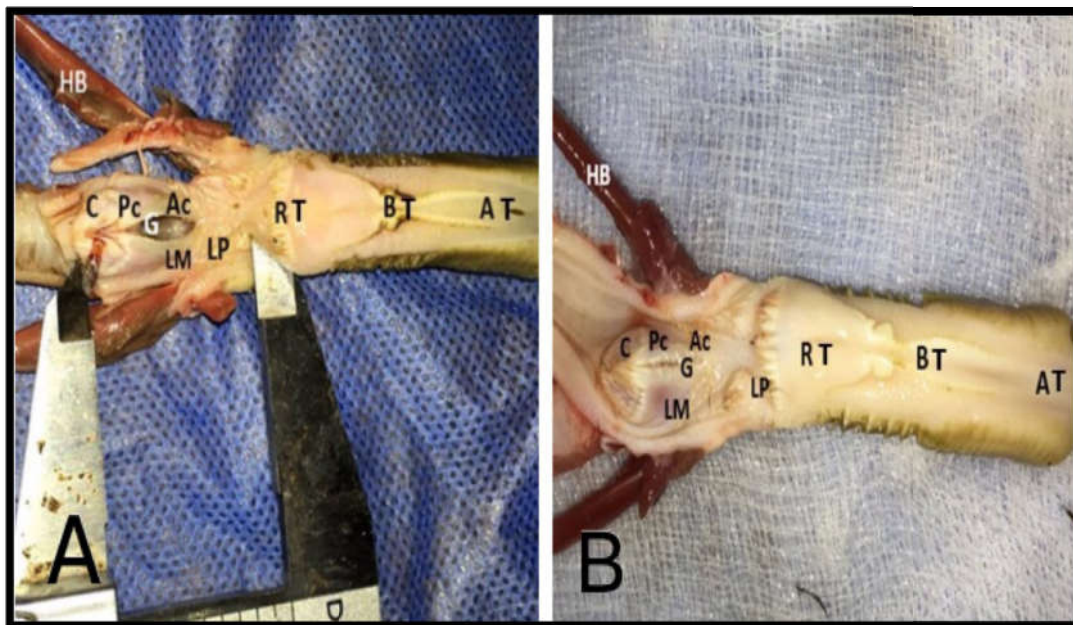


Fig 1; Topography showed the location of larynx in (A) Drake (B) Duckling , at the base of tongue, (AT) Apex of Tongue, (BT) Body of Tongue, (RT) Root of Tongue , (G)Glottis , (LM) Laryngeal Mound , (LP) Laryngeal Papillae ,(C) Cricoid cartilage , (Pc)Procricoid cartilage, (Ac) Arytenoid cartilage, (HB)Hyoid Bone .

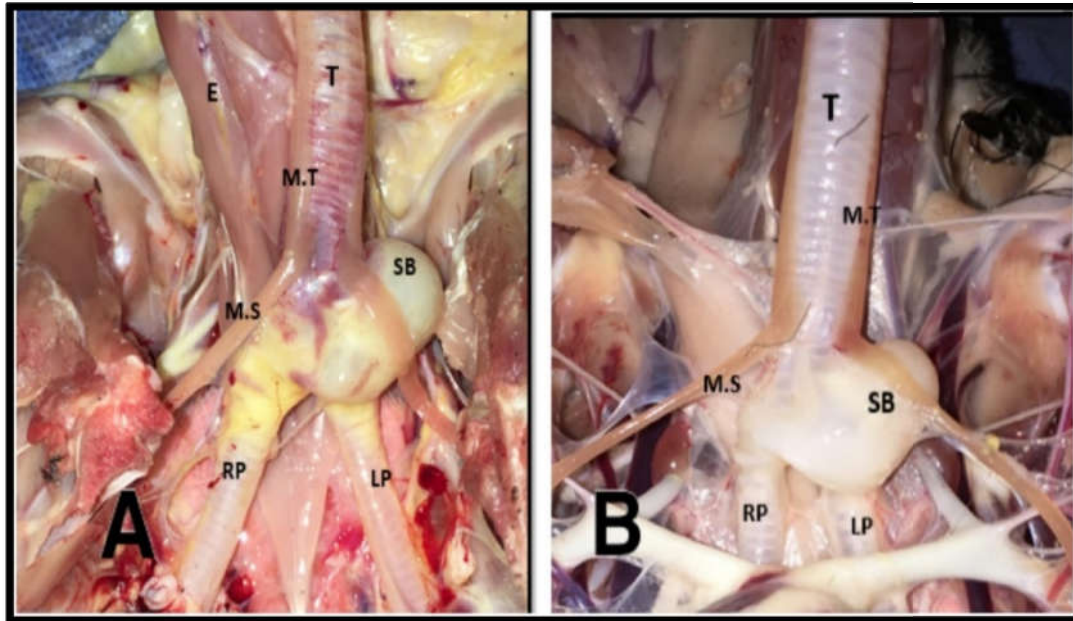


Fig 2; Topography showed trachea in (A) Drake (B) Duckling ; (T) Trachea , (SB) Syringeal Bulla, (M.S) Sternotrachealis muscle,(M.T) Tracheolateralis muscle , (E) Esophagus, (RP) Right Primary Bronchi , (LP) Left Primary Bronchi in situ.

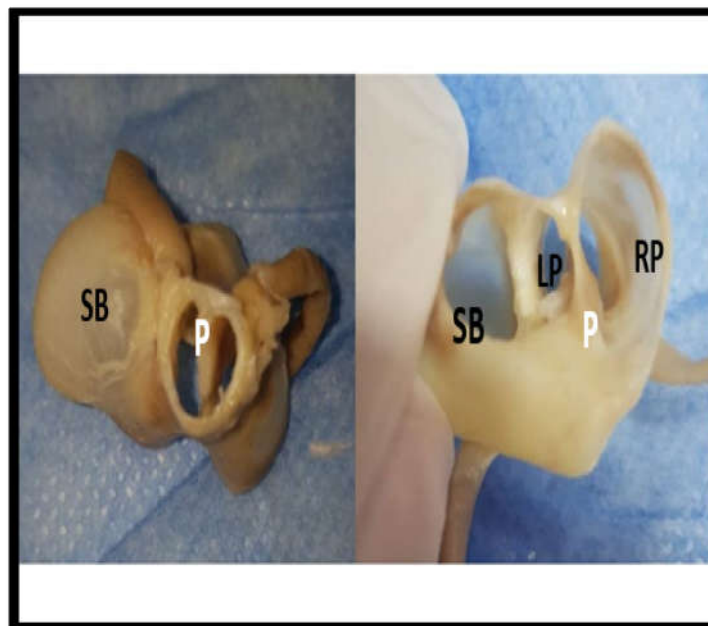


Fig 3; Topography showed syrinx and the relationship of pessulus with the opening of trachea and the opening of right primary bronchi and left primary bronchi, (P) Pessulus , (SB) Syringeal Bulla, (RP) Right Primary Bronchi, (LP)Left Primary Bronchi.

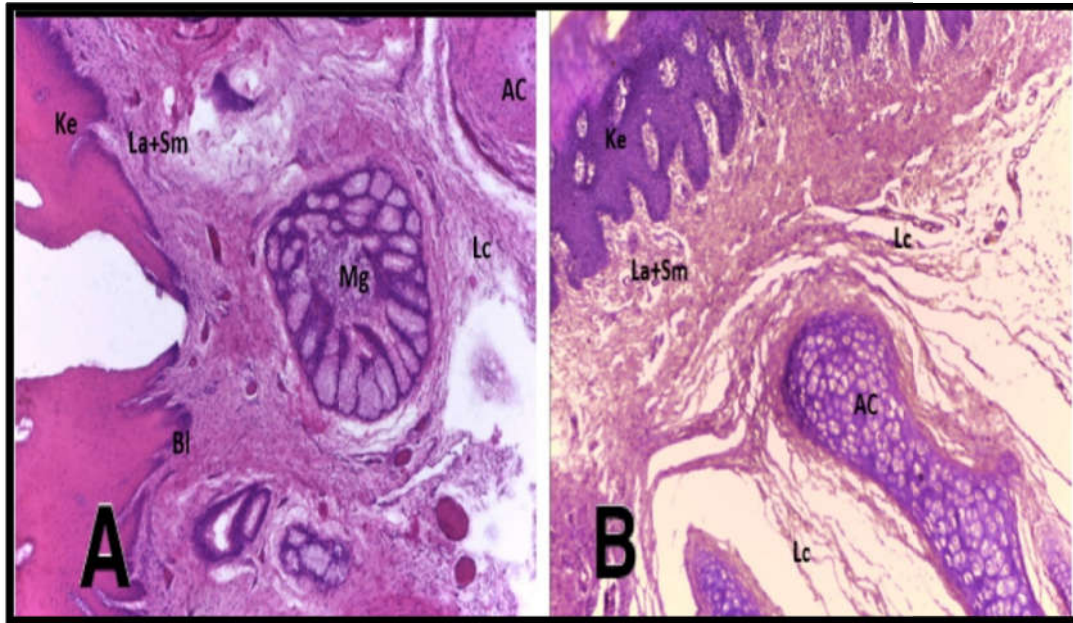


Fig 4; Cross section of the larynx in (A)Drake (B) Duckling ; (Ke) Keratinase stratified squamous epithelium ,(La+ Sm)Lamina propria and Sub mucosa ,(Bl) Basement membrane,, (Lc) Loose connective tissue, (Ac) Arytenoid cartilage (H&E Stain 10X).

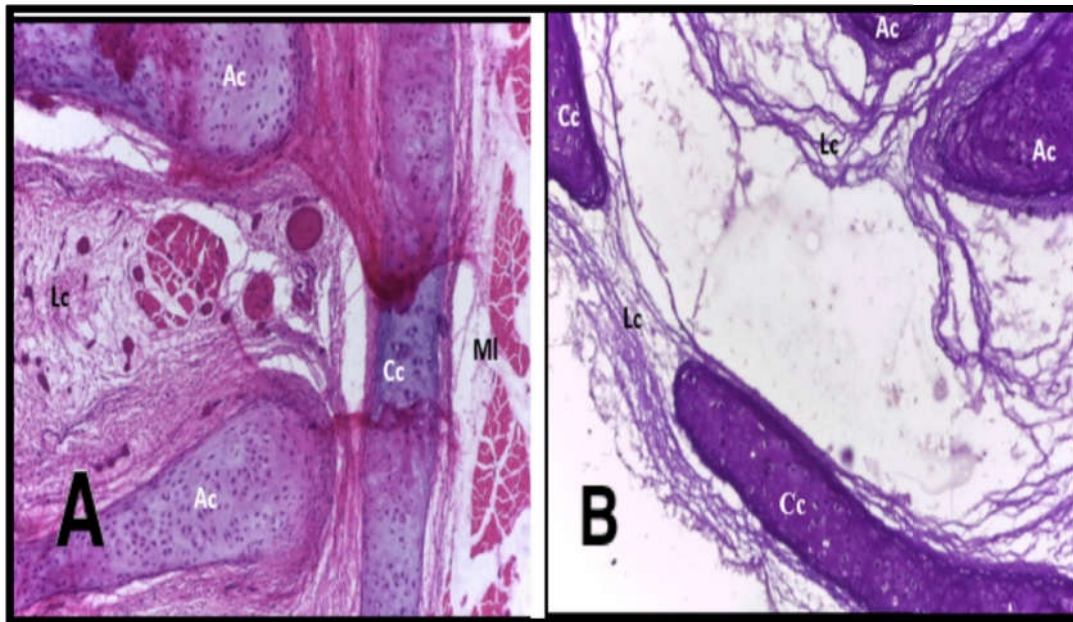


Fig 5; Cross section of the larynx in (A) Drake (B) Duckling ; (Lc) Loose connective tissue, (Ac) Arytenoid cartilage ,(Cc) Cricoid cartilage, (MI) Muscular layer (H&E Stain 10X).

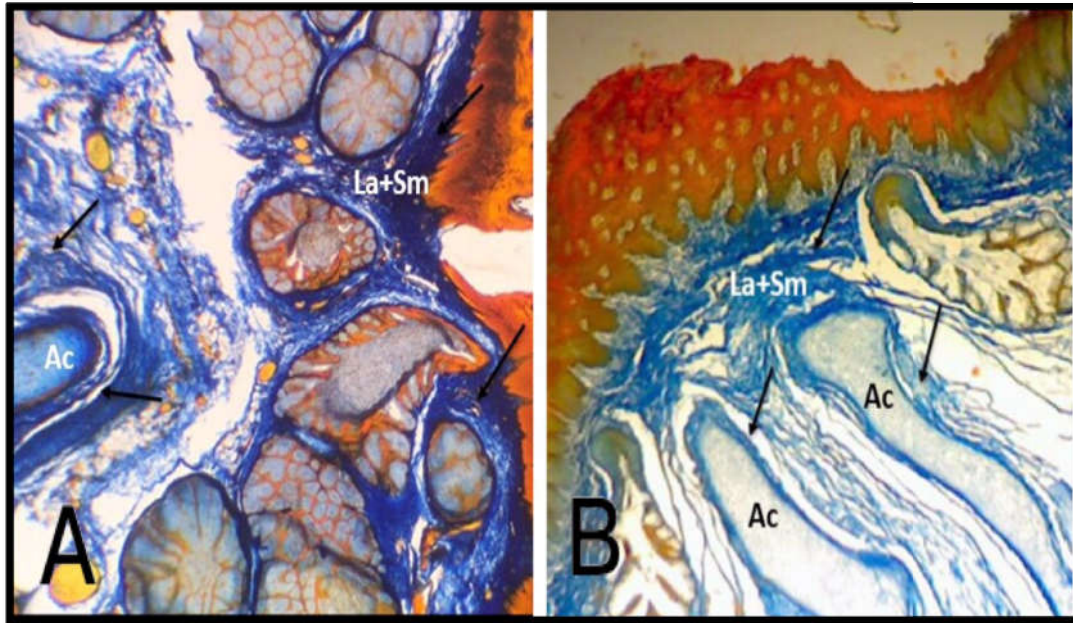


Fig 6; Cross section of the larynx in (A) Drake (B) Duckling : showed collagen fibers in the (La+ Sm) Lamina propria and Submucosa and perichondrium of (Ac) Arytenoid cartilage (Mallory Stain 4X) .

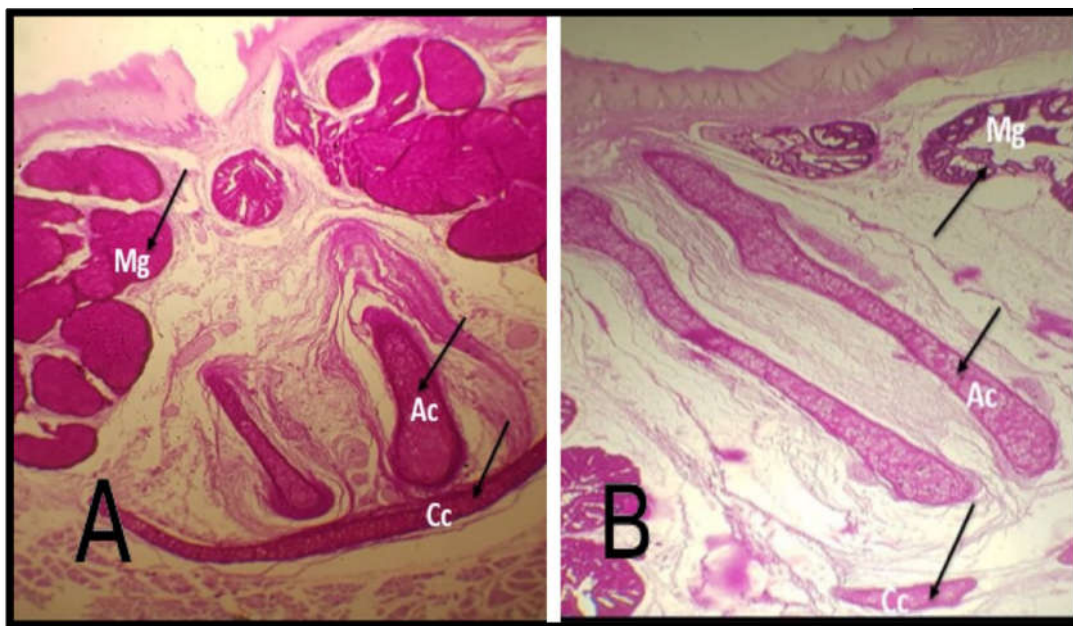


Fig 7; Cross section in the larynx of (A) Drake (B) Duckling , revealed (Mg) mucous glands , (Ac) Arytenoid cartilage and (Cc) Cricoid cartilage positive to PAS stain (PAS Stain 4X).

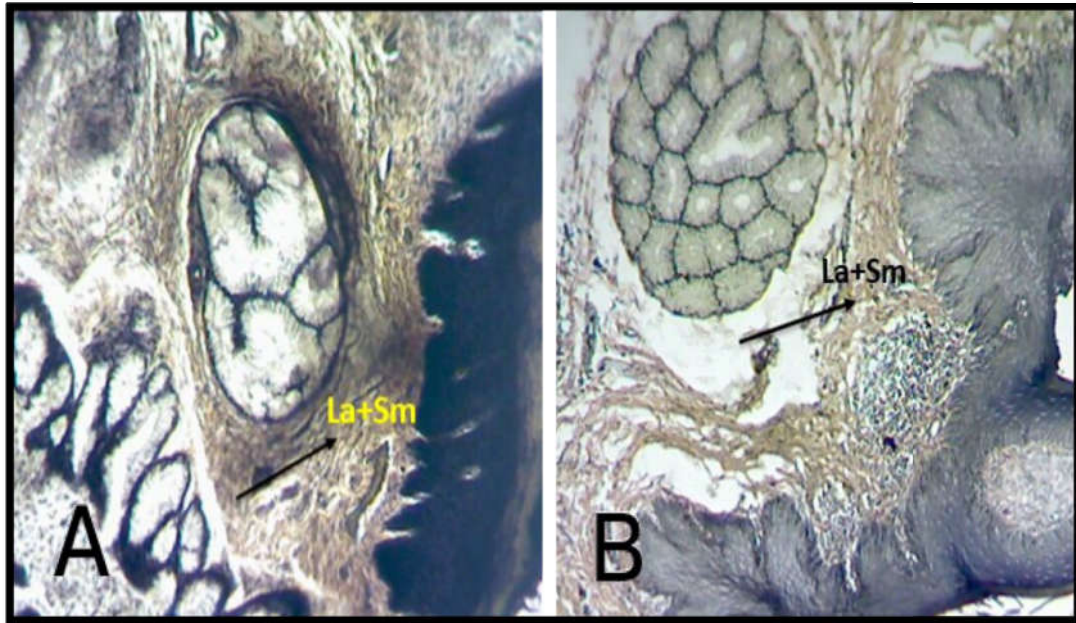


Fig 8; Cross section of the larynx in (A) Drake (B) Duckling : showed elastic fibers in the (La+Sm) Lamina propria and Submucosa (Verhoeff Stain 10X).

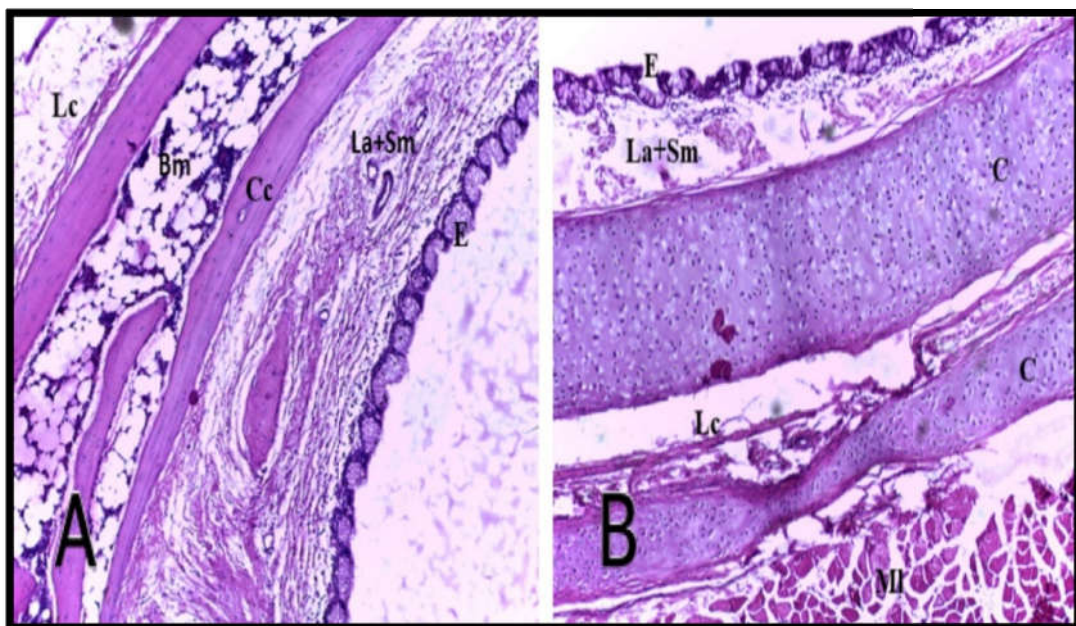


Fig 9; Cross section of trachea in (A) Drake (B) Duckling ; (E) Pseudostratified ciliated columnar Epithelial with mucous glands , (La+Sm)Lamina propria and Submucosa, (C)Hyaline Cartilage ,(Cc) Calcified cartilage, (Bm) White Bone marrow, (Lc) Loose connective tissue, (MI) Muscular layer.(H&E Stain 10X).

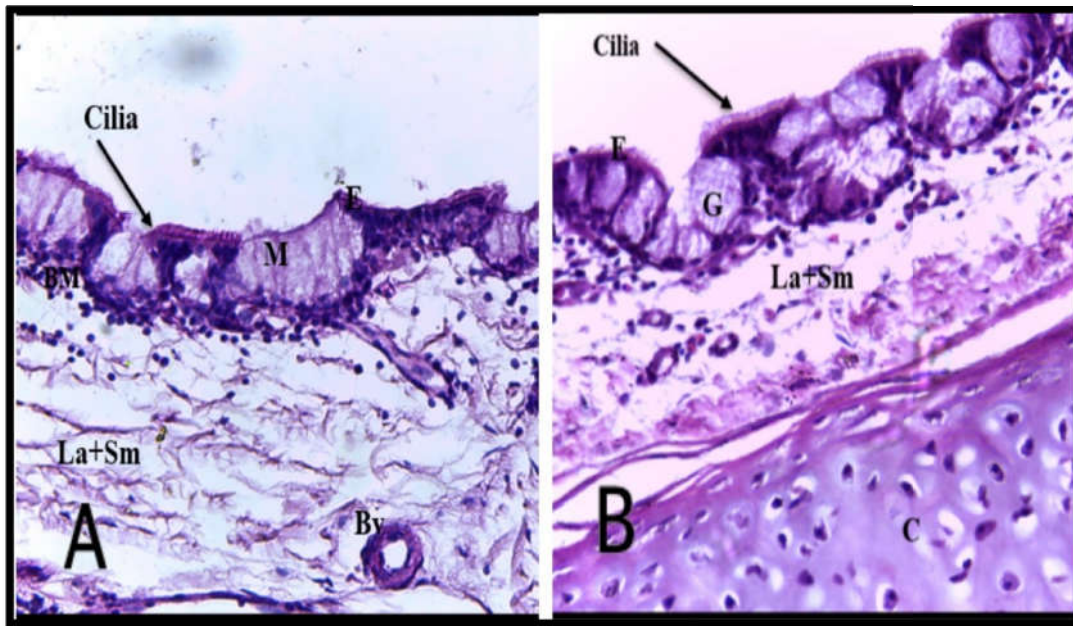


Fig 10; Cross section of trachea in (A) Drake (B) Duckling ; (E) Pseudostratified ciliated columnar Epithelial, (La+ Sm)Lamina propria and Submucosa, (C)Hyaline cartilage ,(M) Mucous glands,(G) Goblet cells (BM) Basement Membrane (H&E Stain 40X).

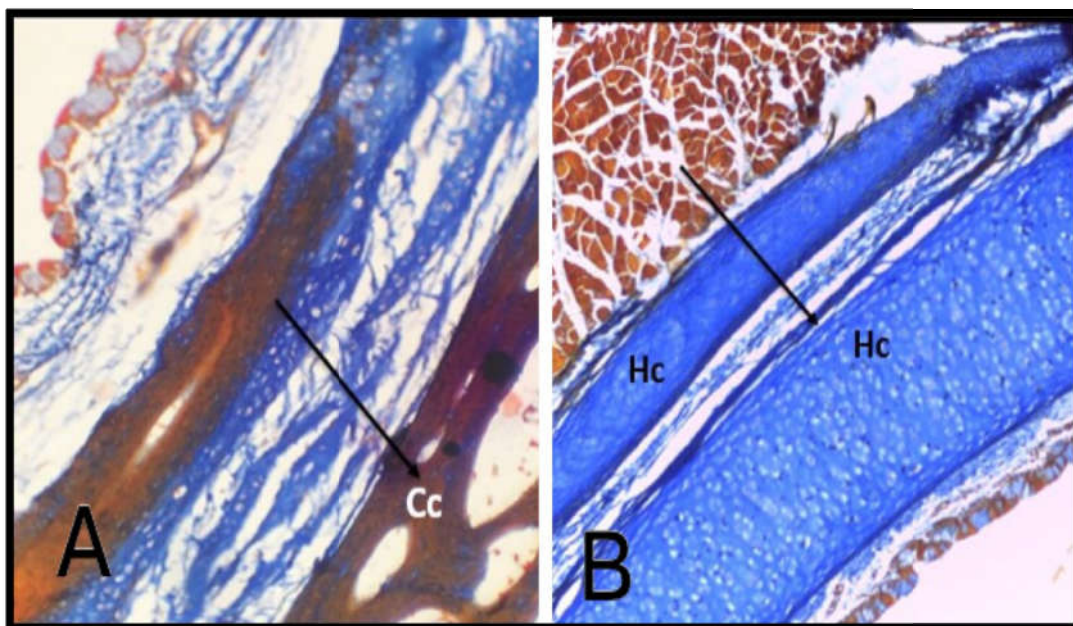


Fig 11; Cross section of trachea in (A) Drake (B) Duckling ; showed that (Cc) Calcified cartilage in Drake ,(Hc) hyaline cartilage, and perichondrium in Duckling positive to Mallory stain (Mallory Stain 10X).

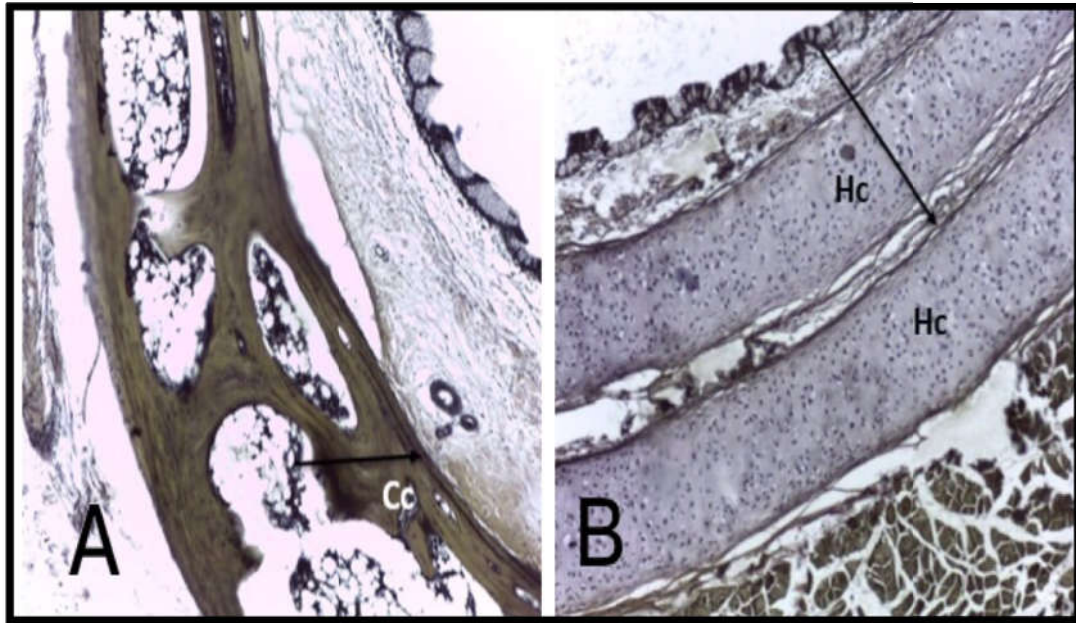


Fig 12; Cross section of trachea in (A) Drake (B) Duckling ; showed that elastic fibers in the perichondrium and between cartilages, (Cc) Calcified cartilage , (Hc) Hyaline cartilage (Verhoeff Stain 10X).



Fig 13; Longitudinal section of the syrinx in (A) Drake (B) Duckling : showed general structure, (E) Pseudostratified ciliated columnar Epithelial ,(La+Sm) Lamina propria and Submucosa, (Bt+o)Bone trabeculae and osteocytes , (Bm) Bone marrow, (Lc) Loss connective tissue (C) hyaline cartilage (H&E Stain 10X) .

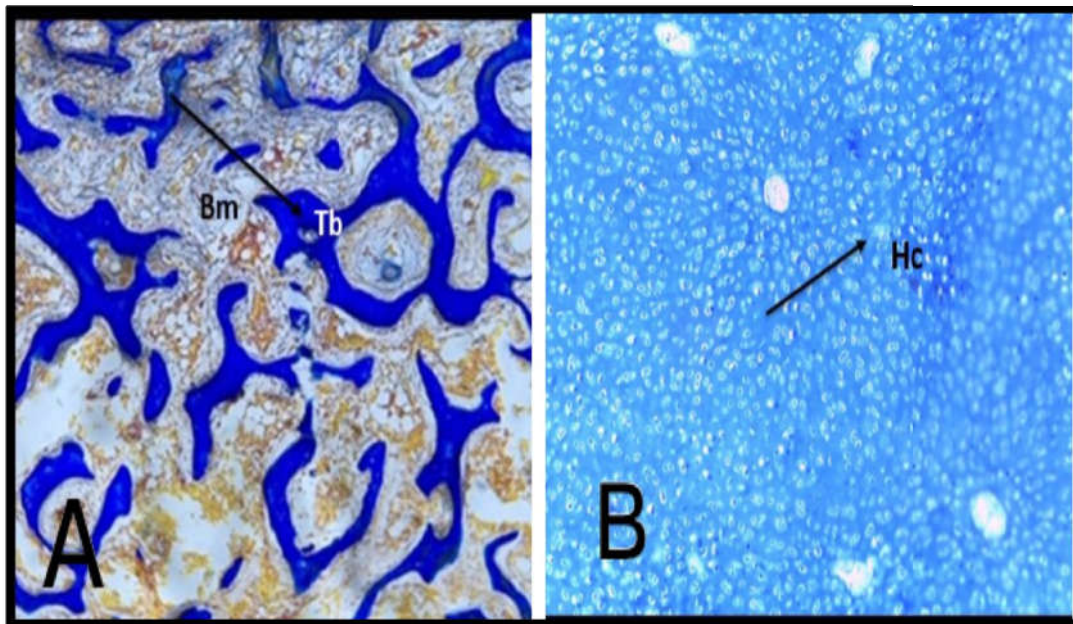


Fig 14; Longitudinal section of syring in (A) Drake (B) Duckling , showed collagen fibers in the (Tb) Trabeculae of bone of Drake, (Bm) Bone marrow and (Hc) Hyaline cartilage of Duckling positive to Mallory stain (Mallory Stain 10X).

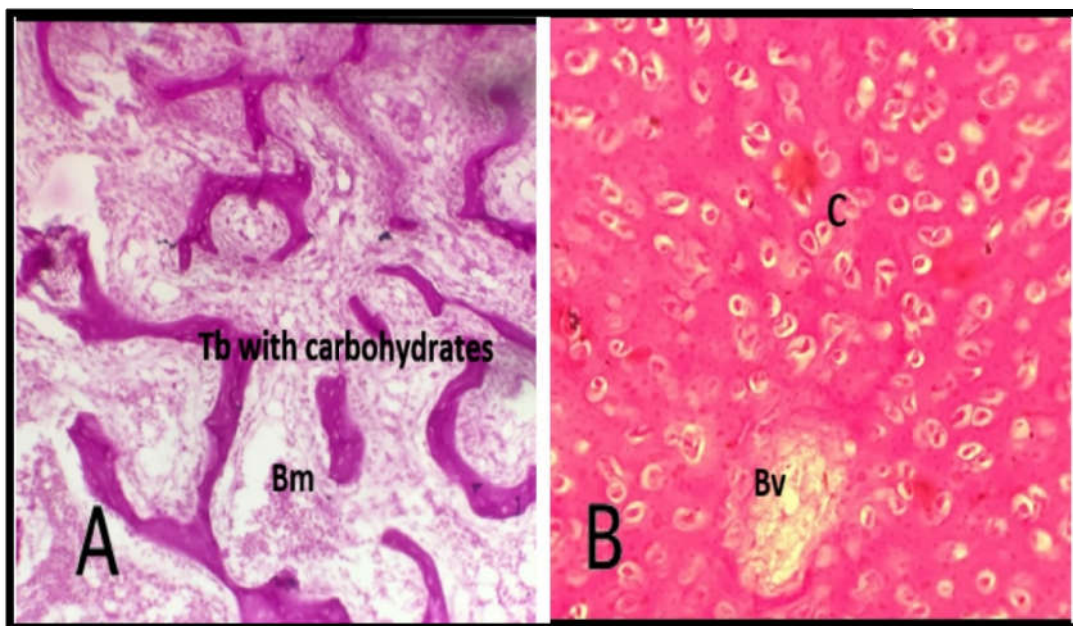


Fig 15; Longitudinal section of syring in (A)Drake (B) Duckling , showed the (Tb) Trabeculae of bone of Drake containing carbohydrates , (Bm) Bone marrow, (Bv) Blood vessels and (C) the hyaline cartilage of Duckling positive to PAS stain (PAS Stain 40X).

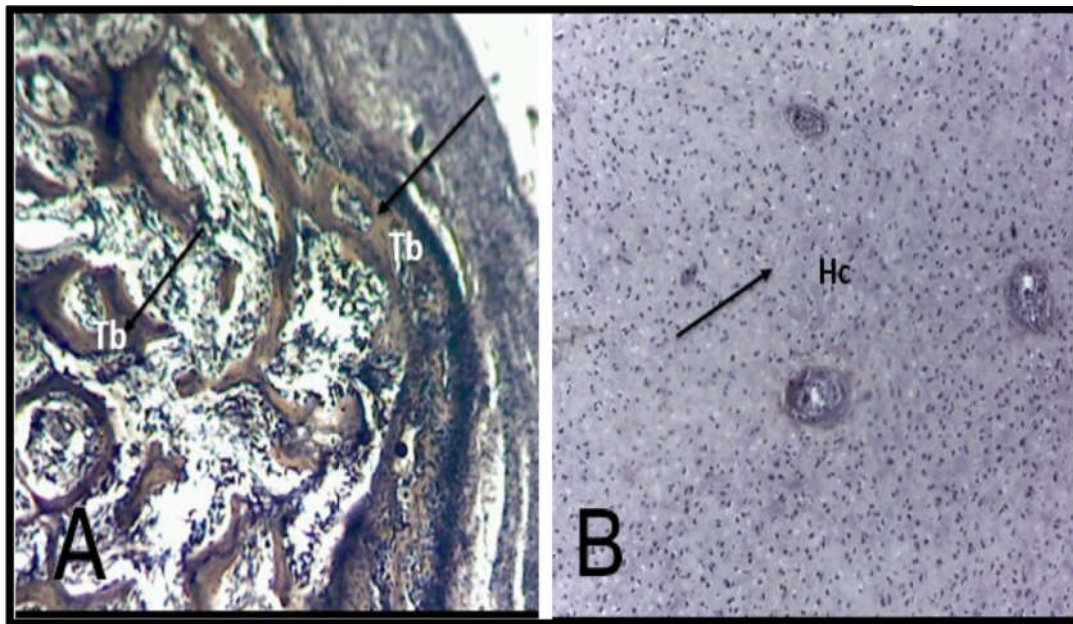


Fig 16; Longitudinal section of syrinx in (A) Drake (B) Duckling , showed elastic fibers in the(Tb) Trabeculae of bone of Drake and (Hc) Hyaline cartilage of Duckling (Verhoeff Stain 10X).

Table(1). Anatomical morphometric measurements of larynx, showed significant differences in length of larynx between Drake and Duckling By mean SD (P<0.05).

Parameters(mm)	Drake	Duckling
Length of larynx	20.75±3.93 ^a	15.50±3.74 ^b
Width of larynx	12.16±1.80 ^a	10.33±1.08 ^a

Table(2). Anatomical morphometric measurements of tracheal diameter, showed significant differences in tracheal diameter between Drake and Duckling By mean SD (P<0.05).

Parameters(mm)	Drake	Duckling
Proximal part	7.30±0.59 ^a	5.40±0.52 ^b
Distal part	8.26±0.59 ^a	7.13±0.52 ^b

Table(3). Anatomical morphometric measurements of trachea ,showed significant differences in length and number of tracheal rings between Drake and Duckling By mean SD (P<0.05).

Parameters(mm)	Drake	Duckling
Length of trachea	188.33±7.63 ^a	171.00±3.60 ^b
Tracheal rings	129.66±2.51 ^a	137.66±2.51 ^b

Table (4). Anatomical morphometric measurements of syrinx , showed significant differences in the width and length of syrinx between Drake and Duckling By mean SD (P<0.05).

Parameters(mm)	Drake	Duckling
Length of syrinx	15.80±2.45 ^a	12.75±1.47 ^b
Width of syrinx	32.16±1.96 ^a	20.95±2.23 ^b

DISCUSSION

The anatomical result of present study of both Drake and Duckling, showed that the larynx chordate or triangular in shape located on the floor of the pharynx caudal to the tongue forming the inlet to the trachea . This finding matched with ⁽¹⁾ in mallard. ^(5,15,16) in turkey, chicken and long-legged buzzard they showed the laryngeal mound elongated heart-shaped located in the caudal part of the oropharyngeal cavity, Whereas ⁽¹⁷⁾ showed the laryngeal mound triangular and roughly shape in the West African guinea fowl. More over our present study differs from ⁽¹⁸⁾ in ostriches showed that the larynx projects from the pharynx and do not have laryngeal mound. In addition to that the present study showed that the laryngeal cartilage is formed by single cricoid , procricoid and paired arytenoid cartilages , there are no vocal cords in the larynx of duck and the voice production occurs in the syrinx. These results agreed with ^(6,17,19,20,21,22) found that the thyroid and epiglottis cartilage are absent and appeared out that mostly in all birds. But in disagreement with ⁽²⁰⁾ , that showed the larynx of ostriches do not have procricoid cartilage therefore the arytenoid cartilage was attached to each other and having shaping irregular triangular form.

The current study revealed that the trachea of both Drake and Duckling begins at the caudal end of cricoid cartilage to the syrinx , then continuous together

with the esophagus on the right side of the neck, then regains its median position upon entering the thoracic inlet, as well as our present study showed two types of tracheal muscles, the first one is the tracheolateralis muscle that originates from the syrinx then passes along the lateral trachea to inserted at cricoid cartilage, the second one sternotrachealis muscle that originates from the sternum and inserted laterally at the caudal end of the trachea. This finding is in agreement with results of (18,21,23,24) that pointed anatomical structures of the trachea in most birds, and agreed with, (22) and (25), they reported the trachea in goose. These result disagreed with (26) who pointed that in spoonbills and swan birds the trachea is long, coils and it ends extends in midline, passes to right side of neck, and then returns to midline to enter thoracic cavity.

In the present study there were significant differences in the tracheal diameter between Drake and Duckling (7.30 ± 0.59 mm, 5.40 ± 0.52 mm) in addition to significant differences in the length of trachea (188.33 ± 7.63 mm, 171.00 ± 3.60 mm) and the number of tracheal rings (129.66 ± 2.51 mm, 137.66 ± 2.51 mm) respectively. This result is un coincided with (27), who pointed the average length of the trachea in European starling in (cervical and thoracic regions) approximately (4.5cm) and the diameter of cartilage (3 mm) also in the same time the number of tracheal rings ranging about (54 rings), and un coincided with (28) who pointed that the average tracheal length in white-eared bulbul in (cervical and thoracic regions) is (3cm), the diameter of cartilages ($2-2.21$ mm) and the number of cartilages rings is (51 rings). While (29) found that the tracheal length was (4.05 ± 0.08 cm) and the number of rings (110-116) in Japanese quail. Whereas (22,25,26) reported that length of trachea in turkeys, in West African guinea fowl and in Ostriches were (26.36 ± 0.38 cm), (26 ± 1.23 cm), and (78cm) respectively, while (27) the number of tracheal rings in goose 137-140 rings. Whereas (28) showed the number of tracheal rings of pigeon 83-91. These differences in tracheal length and width maybe related to differences in size and species of birds.

The anatomical results of syrinx of Drake and Duckling found that the syrinx located at the tracheal bifurcation, dorsal to the heart base, ventral to esophagus and between both sides of left and right sternotrachealis muscles. It is fused with terminal tracheal cartilages and first cartilages of left primary brochus thus called cartilaginous tracheobronchial type. This finding is similar with (30,31) in most birds, (1) in mallard, (5) in pisttacines, (25) in goose (33), (9) in turkey (34) in sea gulls (27) in European starling, (28) in white-eared bulbul. These result disagreed with (34) that observed the syrinx was

hidden by the heart in Pigeon, and disagree with ⁽²⁰⁾ finding that the type of trachea in Furnarioidea and Budgerigars a tracheal syrinx.

The results of histological study for larynx in both Drake and Duckling revealed it is lined by mucosa which consists of keratinized pseudostratified squamous epithelial tissue that appears thicker in Drake than Duckling, beneath it a thick connective tissue rich in collagen and elastic fibers (submucosa and lamina propria). The lamina propria had numerous of mucous glands acini that arranged in groups in different sizes opened toward laryngeal cavity through the epithelium. This result disagreed with ⁽³⁴⁾ reported that the laryngeal mound in west African guinea was covered by non-keratinized stratified squamous epithelium that arises from oral cavity epithelium which directly communicates with food to abolish friction. Near the glottis the epithelium converted gradually to ciliated, pseudostratified columnar epithelium with a copious various sizes of mucous glands. Also our results disagreed with ⁽³⁵⁾ in ostrich that find the epithelium that lined the larynx is non keratinized stratified squamous, the lamina propria contains fibroblast and bands of the collagen fibers with numerous of mucous glands, in addition to that our results in duck disagreed with ⁽²⁶⁾ in spoonbills and swan birds ⁽²⁷⁾ in European starling ⁽²⁸⁾ in white-eared bulbul, they explained that the larynx was lined by pseudostratified columnar epithelia mixing with goblet cell, and mucous gland. In addition to that, the lamina propria of larynx in both Drake and Duckling is having numerous of mucous glands acini that arranged in groups in different sizes opened toward laryngeal cavity through the epithelium. Beneath the sub mucosa there are two vertical cartilage (left and right hyaline arytenoid cartilages) under that there is transverse cartilage (cricoid cartilage), this finding disagreed with ⁽²⁷⁾ in European starling and ⁽²⁸⁾ in white-eared bulbul, they pointed that lamina propria or sub mucosa contains collagen fiber and elastic fiber with laryngeal salivary glands as a simple tubule-alveolar gland extending from the cranial area ending at the glottis in the lateral side of laryngeal mound. The arytenoid cartilage is hyaline in nature seeing obviously beneath sub-mucosa mixing with lymphatic tissues which found at the lamina sub-mucosa.

Histochemical result revealed positive reaction to PAS stain due to the presence of mucopolysaccharides in mucous glands and laryngeal cartilage. While results of Mallory stains showed positive reaction in sub mucosa, lamina propria, perichondrium in both Drake and Duckling as a result to presence of collagen fibers

that appears more in submucosa than elastic. This results matched with ⁽²⁷⁾ in European starling who pointed positive reaction by PAS demonstrated the presence of mucous gland and the hyaline cartilage by Mallory stain showed that the collagen and elastic fiber seemed blue in color.

The current study showed the that trachea histologically is composed of mucosa, submucosa, cartilage and adventitia. Mucosa of Drake and Duckling composed from pseudostratified ciliated columnar epithelium mixed with mucous glands and goblet cells . The lamina propria - sub mucosa of Drake and Duckling has loose connective tissue , collagen fiber with lymphocytes , supported by ossified cartilages in Drake while in Duckling trachea is composed of hyaline cartilage. This result is in agreement with ⁽³⁶⁾ who explained that the trachea of laying hens at one year is lined with ciliated, pseudostratified columnar epithelium and the tracheal calcification of the lower part in this age are increasing than the upper part, while at six month the trachea appeared as unfilled hyaline cartilaginous tube without any calcification . The result also agreed with, ⁽⁸⁾ in coot birds and guinea fowl , ⁽²³⁾ in chicken , ⁽²⁷⁾ in European starling ⁽²⁸⁾ in white-eared bulbul .⁽²⁹⁾ Japanese , ⁽³⁷⁾ in black francolin , ⁽³⁸⁾ in turkey and ⁽³⁹⁾ in Quail.

The epithelial thickness increase toward distal part of the trachea in both Drake and Duckling , so the present findings disagreed with ⁽⁶⁾ who reported that in turkey and bursa roller pigeon there is decreasing in epithelial thickness toward distal part. This may be due to that the mucus glands are replaced by numerous of goblet cells. The lamina propria - sub mucosa has loose connective tissue , collagen fiber with lymphocytes , supported by ossified cartilages in Drake while Duckling trachea is composed of hyaline cartilage, this finding matched with ⁽²⁷⁾ in European starling and ⁽³³⁾ in turkey , they pointed that the lamina propria-submucosa consists of loose connective tissue. The adventitia made up fibro-elastic connective tissue with the blood vessel

Histochemical results for trachea in both Drake and Duckling showed positive reaction to Mallory stain as indication to presence of collagen fibers in cartilage , submucosa and in loose connective tissues between superior and inferior cartilage . These results agreed with ⁽²⁷⁾ in European starling ⁽⁶⁾ in indigenous turkeys⁽³⁷⁾ in black francolin, they pointed that the hyaline cartilage, collagen fiber and elastic fiber appeared blue colored with Mallory stain.

The results of the study showed that syrinx of Drake and Duckling histologically is lined by the pseudostratified ciliated columnar epithelial with little goblet cells, the lamina propria and submucosa contained loose connective tissue with blood vessels and amount of elastic and collagen fibers, beneath the lamina propria there is spongy bone trabeculae that contains bone lacuna fills with osteocytes, in addition to bone marrow that fills spaces between bone trabeculae. This result matched with ⁽⁴⁰⁾ who explain that syrinx of male duck lined by ciliated pseudostratified epithelium with goblet cells. This result also matched with ^(20,33) in turkeys and Japanned Quail ⁽²⁷⁾, ⁽²⁸⁾ in white-eared bulbul and European starling, they described that histological structure of syrinx is lined by ciliated pseudostratified epithelium with goblet cells. But these results did not matched with ⁽²¹⁾ in chicken who explain that syrinx is lined by stratified squamous.

The present study showed that, pessusulus of duck cartilaginous ossified that agreed with ⁽²⁷⁾ in European starling, ⁽²⁸⁾ in white eared bulbul and, ⁽⁴¹⁾ in singing birds, while cartilaginous in chickens ⁽⁴²⁾. While it disagreed with ^(33,43), they showed that the pessusulus contains connective tissue same as in ostrich and turkeys.

Histochemistry revealed positive reaction to PAS stain as indication to presence of muco polysaccharides and carbohydrates. Bone trabeculae and submucosa of Drake in addition to hyaline cartilage of Duckling seems positive to Mallory stains due to its contents of collagen fibers. This results agreed with ⁽²⁷⁾ who pointed that in European starling, the hyaline cartilage, collagen fiber and elastic fiber appeared blue colored with Mallory stain.

مقارنة تشريحية، ونسجية و كيمياء نسجية (الحنجرة ،القصبة الهوائية وعضو التغريد) ما بين الذكور البالغة وغير البالغة في البط المحلي (*Anas platyrhynchos*)

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الخلاصة

تهدف هذه الدراسة إلى مقارنة التراكيب التشريحية والنسجية و الكيمياء نسجية للحنجرة والقصبة الهوائية وعضو التغريد ما بين ذكور البط البالغ وغير البالغ (*Anas platyrhynchos*) . قسمت اثني عشر بط خالي من الأمراض من ذكور البط المحلي الى مجموعتين . ستة بط بالغ في عمر سنة واحدة وستة بط غير بالغ في عمر ثلاثة أشهر. للدراسة التشريحية للحنجرة ، القصبة الهوائية وعضو التغريد تم اجراء قياسات تشريحية بأستخدام مسطرة التشريح الألكترونية . للدراسة النسجية للحنجرة ، القصبة الهوائية وعضو التغريد تم تثبيتها في الفورمالديهايد بنسبة ١٠ ٪ و ثم الطمر بشمع البارافين .الخطوة التالية الشرائح قطعت بأستخدام جهاز التقطيع وصبغت بالصبغة الروتينية والصبغات الخاصة. كشفت النتائج التشريحية أن الحنجرة ،القصبة الهوائية وعضو التغريد في كل من البط البالغ وغير البالغ لهم نفس الموقع في الجسم ، ولكن يختلفون في الحجم. كشفت النتائج النسجية أن الحنجرة لكل من البط البالغ وغير البالغ مبطن بالأنسجة الظهارية الحرشفية الكيراتينية الكاذبة والتي تظهر أكثر سماكا في البط البالغ من الغير بالغ. و القصبة الهوائية للبط البالغ مبطن بواسطة الظهارية العمودية المهذبة (طبقيّة) الكاذبة مع عدد مخاطية ،مدعمة بواسطة غضاريف متعظمة في البط البالغ و بواسطة الغضروف الشفاف في البط الغير بالغ . عضو التغريد في كل من البط البالغ و الغير البالغ مبطن بواسطة الظهارية العمودية المهذبة (طبقيّة) الكاذبة مع عدد قليل من الخلايا الكأسية .الصفحة المخاطية و التحت المخاطية تحتوي على نسيج رابط مفكك مع الأوعية الدموية وكمية من ألياف الكولاجين والألياف المطاطة ، في البط البالغ تحتها حواجز العظام الإسفنجية التي تحتوي على ثغرات العظام ممثلثة بالخلايا العظمية ، بينما في الغير بالغ تحتها الغضروف الزجاجي ، يتكون الغضروف الزجاجي من الثغرات التي تحتوي على خلايا غضروفية.

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