

Anatomical And Morphometric Study Of The Trachea, Primary Bronchi And Lung In Laughing Dove (*Streptopelia Senegalensis*).

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Abstract:

In the current study use ten of the laughing dove (*Streptopelia senegalensis*) birds from both sexes, the body weight was $(102.811 \pm 3.599 \text{ gm})$. The present study include the morphometric features of the trachea, primary bronchi and lungs. The trachea was appear long flexible tube consist from several number of the cartilage rings closed like (O) shape which refer to the basic unit structure of the trachea. The mean length of the trachea was $(6.166 \pm 0.176 \text{ cm})$ and this form (66.544 %) from the total length of the respiratory system.

The primary bronchi appear as short tubes consist from several number of cartilage rings has (C) shape open from the medial side, connected together by transparent membrane. The length of right and left primary bronchi was $(5.6 \pm 0.4 \text{ mm})$ $(6.6 \pm 0.2 \text{ mm})$ and this form (6.043 %) (7.122%) respectively from the total length of the respiratory system. The lungs was pink into light red color, triangular or pyramidal-shaped. Each lung consist from two surfaces costal and visceral surfaces and three borders were lateral, medial and posterior borders. In the costal surface can be seen the lung contain five impressions. The length of the right and left lungs were $(1.633 \pm 0.02 \text{ cm})$ $(1.533 \pm 0.03 \text{ cm})$ and this form low percentage from the length of the respiratory system reaches into (17.623 %) and (16.544 %) and the thickness of right and left lungs were $(4 \pm 0.44 \text{ mm})$ $(4.6 \pm 0.49 \text{ mm})$, while the weight of the right and left lungs was $(0.325 \pm 0.032 \text{ gm})$ $(0.308 \pm 0.018 \text{ gm})$ respectively.

Key words: Laughing dove (*Streptopelia senegalensis*), trachea, lung, primary bronchia, anatomy and respiratory system.

دراسة تشريحية شكلانية قياسية للرعامي والقصبات الاولية والرئتين للحمام الضاحك (*Streptopelia Senegalensis*).

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الخلاصة

صممت هذه الدراسة لوصف الخصائص التشريحية والقياسات المظهرية المميزة للرعامي والقصبات الهوائية الأولية والرئتين في الحمام الضاحك (*Streptopelia senegalensis*) وباستخدام عشر عينات ومن كلا الجنسين، حيث كان وزن الجسم $(102.811 \pm 3.599 \text{ غم})$.

ظهر الرغامى على شكل أنبوب طويل مرن يتألف من عدد كبير من الحلقات الغضروف التي تأخذ شكل حرف (O) والتي تمثل الوحدة البنائية الأساسية للرغامى. كان متوسط طول الرغامى (0.176 ± 6.166 سم) وهذا يمثل (66.544%) من إجمالي طول الجهاز التنفسي.

أن القصبات الأولية تتكون من أنبوب قصير يتألف من حلقات غضروف تأخذ شكل حرف (C) مفتوح من الجانب الإنسي، وترتبط النهائية معاً عن طريق غشاء شفاف. وكان طول القصبات الأولية اليمنى واليسرى (0.4 ± 5.6 ملم) و (0.2 ± 6.6 ملم) وهذا يشكل (6.043%) و (7.122%) على التوالي من إجمالي طول الجهاز التنفسي.

كانت الرئتين وردية إلى حمراء فاتحة اللون هرمية الشكل. تتكون كل رئة من سطحين سطح ضلعي و سطح حشوي و ثلاثة حواف وحشية وإنسية وخلفية. لوحظ إن السطح الضلعي للرئتين مقسم إلى خمسة فصوص. وكان طول الرئتين اليمنى واليسرى (0.02 ± 1.633 سم) و (0.03 ± 1.533 سم) وهذا شكل نسبة منخفضة من طول الجهاز التنفسي يصل إلى (17.623%) و (16.544%) وكان سمك الرئتين اليمنى واليسرى (4 ± 0.44 ملم) و (4.6 ± 0.49 ملم)، في حين كان وزن كل من الرئة اليمنى واليسرى (0.032 ± 0.325 غم) و (0.308 ± 0.018 غم) على التوالي.

Introduction

The laughing dove was rare in Iraq. Observed for the first time in northern Iraq in 1970, while in the middle and southern regions was appearance in 2005. This type of pigeons entered into northern Iraq through Iran. It was characterized by small size and slimmer of the body, the feathers was reddish brown in color, frequently seen in parks and residential areas. It was not afraid from human (1 and 2). In birds the respiratory system differ from mammalian in more specialty features, which relationship with the flight and the voice production such as air sac and syrinx organ (3). The respiratory system in bird consist of nasal cavity, larynx, trachea, syrinx, bronchi, lungs and air sacs (3; 4 and 5), while in mammals it consist of nostrils, nasal cavity, larynx, trachea, bronchi, lungs (6). The trachea in bird bifurcation at the syrinx into the left and right primary bronchi, both primary bronchi enter the target lungs during the hilus at septal surface (7; 8; and 9).

Materials and Methods:

In the present study used ten specimens of adult laughing dove (*Streptopelia senegalensis*) weighed (102.811 ± 3.599 gm) of both sex collected from Al-Diwanyia province

in Al-Daghra city parks, catching the bird by using the fishing machine. After that put the pigeon on the table and made incision from the thoracic inlet up to the cloaca to show and snap image to trachea, primary bronchia, and lung. After that separate the respiratory system (trachea, primary bronchia and lungs) to record morphological measuring. In the morphometric study used some instruments such as (vernier, thread, digital balance and digital camera Sony) to recorded the following:

- 1- Measured the weight of bird body, respiratory system was (included larynx, trachea, syrinx, primary bronchia and lungs) , trachea, primary bronchia and lungs.
- 2- Measured the length of the respiratory system (it measured from the anterior end of the larynx into posterior border the lung), length of the trachea (record the measured from rostral border of the first tracheal ring into the posterior border of last tracheal ring which connect with voice box), length of primary bronchi (it measured from posterior end of syrinx into entrance of primary bronchia in the hilus of lung) and length of lung (it measured from proximal extremity into distal extremity and border lung).

3- Measured the diameter of trachea.

4- Measured the thickness of lung.

Results

The trachea was appear long flexible tube consist from several number of the cartilage rings (O) shape which refer to the basic unit structure of the trachea. It was extend along the left side of the neck, ventrally to the esophagus and then enter the thoracic cavity (Fig. 1). The trachea extend from the larynx rostrally into the syrinx posteriorly (Fig1&2). The mean length of the trachea was $(6.166 \pm 0.176 \text{ cm})$ and this form (66.544%) from the total length of the respiratory system (Table: 2) whereas weighed (0.366 ± 0.028) and this form low percentage from the weight of the respiratory system reaches into (37.46%) (Table: 1). The diameter of the trachea approximately equal in the anterior, middle and posterior parts of the trachea was $(3 \pm 0.01 \text{ mm})$ (Fig: 3).

The primary bronchi and lung located inside of the thoracic cavity among the ribs (Fig. 1). The primary bronchi appear as short tubes consist from several number of cartilage rings has (C) shape open from the medial side, connected together by transparent membrane. The primary bronchia was extend from the syrinx into the hilus of the lung at the proximal third of the lung at the visceral surface. The length of right and left primary bronchi was $(5.6 \pm 0.4 \text{ mm})$ $(6.6 \pm 0.2 \text{ mm})$ and this form (6.043%) (7.122%) respectively from the total length of the respiratory system (Table: 2). The weighed of the right and left primary bronchi was $(0.0054 \pm 0.0018 \text{ gm})$ $(0.0044 \pm 0.0013 \text{ gm})$ respectively and this form low percentage from the weight of the respiratory system

reaches into (0.552%) and (0.0450%) (Table: 1).

The lungs was pink into light red color, triangular or pyramidal-shaped, the top of the pyramid toward anteriorly. It was extend from first into sixth ribs and firmly attached with it. Each lung consist from two surfaces costal or dorsal and visceral or ventral surfaces and three borders were lateral, medial or vertebral and posterior borders. The costal (dorsal) surface was convex from side to side. It was can be seen fourth deep grooves derivation embedded the second into the fifth ribs guide which separate the lung into five impressions the first and last impression was smaller than other lobes (Fig. 2 and 3). The visceral (Ventral) surface concave and covered by thin shiny membrane. It was contain the hilus which refer to enter the primary bronchi on the proximal third of the lung (Fig. 2). The longer border of the right and left lung was lateral border $(2.675 \pm 0.209 \text{ cm})$ and $(2.3 \pm 0.070 \text{ cm})$ while the shorter border in the right and left lungs was posterior border $(0.75 \pm 0.028 \text{ cm})$ and $(0.8 \pm 0.040 \text{ cm})$ respectively (Table: 1).

The posterior border of the left lung observed closed from left kidney while the posterior border of the right lung was contact with right kidney and formed impression because the right kidney was introduced more than the left kidney. The length of the right and left lungs were $(1.633 \pm 0.02 \text{ cm})$ $(1.533 \pm 0.03 \text{ cm})$ and this form low percentage from the length of the respiratory system reaches into (17.623%) and (16.544%) . The thickness of right and left lungs were $(4 \pm 0.44 \text{ mm})$ $(4.6 \pm 0.49 \text{ mm})$, while the weight of the right and left lungs was $(0.325 \pm 0.032 \text{ gm})$ $(0.308 \pm 0.018 \text{ gm})$ respectively (Table: 1).

Table (1): The Body, respiratory and trachea weight of the laughing dove.

Parameters	Mean ± SEM	% Body weight	% Respiratory weight
Body weight.	102.811 ± 3.599 gm	100 %	-----
Weight of the respiratory system.	0.977 ± 0.099 gm	0.950 %	100 %
Weight of the trachea.	0.366 ± 0.088 gm	0.355 %	37.46 %
Weight of the right primary bronchi	0.0054 ± 0.0018 gm	0.00525%	0.552 %
Weight of the left primary bronchi	0.0044 ± 0.0013 gm	0.00427%	0.450 %
Weight of the right lung	0.325 ± 0.032 gm	0.316%	33.26 %
Weight of the left lung	0.308 ± 0.018 gm	0.299%	31.52 %

Table (2): Length of the respiratory system, trachea, primary bronchi and lungs in the of laughing dove.

Parameters	Mean ± SEM	% Respiratory length
Length of respiratory system.*	9.266 ± 0.266 cm	100%
Length of trachea.	6.166 ± 0.176 cm	66.544%
Length of the right primary bronchi.	0.56 ± 0.04 cm	6.043%
Length of the left primary bronchi.	0.66 ± 0.024 cm	7.122%
Length of the right lung.	1.633 ± 0.02 cm	17.623%
Length of the left lung .	1.533 ± 0.03 cm	16.544%

* Length of respiratory system include:(larynx, trachea, primary bronchia, syrinx and lung).

Table(3): Length of the lung borders in the laughing dove.

Parameters	Length of lateral border	Length of medial (vertebral) border	Length of posterior border
Right lung	2.675 ± 0.209 cm	1.475 ± 0.062 cm	0.75 ± 0.028 cm
Left lung	2.3 ± 0.070 cm	1.5 ± 0.083 cm	0.8 ± 0.040 cm

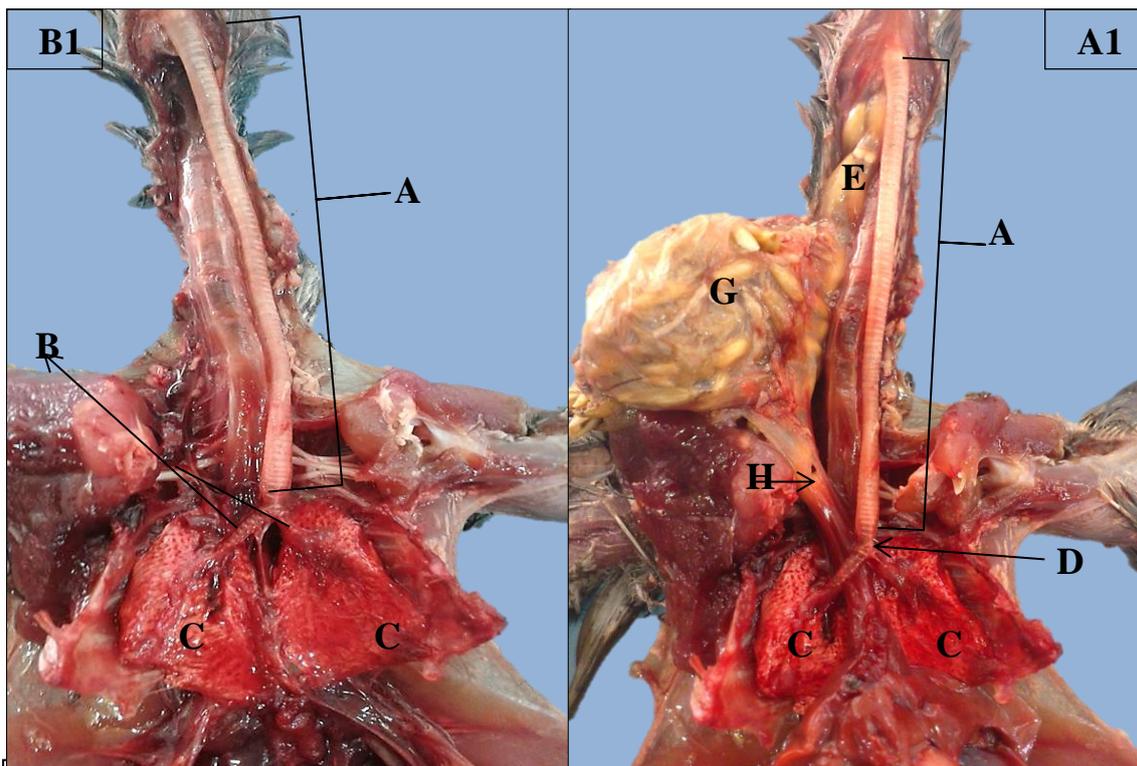


Fig 1 (A1&B1): Ventral view of the respiratory system in laughing dove. A- Trachea. B- Primary bronchi. C- Right and left lungs. D- Syrinx. E- Esophagus. G- Lateral sac of crop. H- Proventriculus.

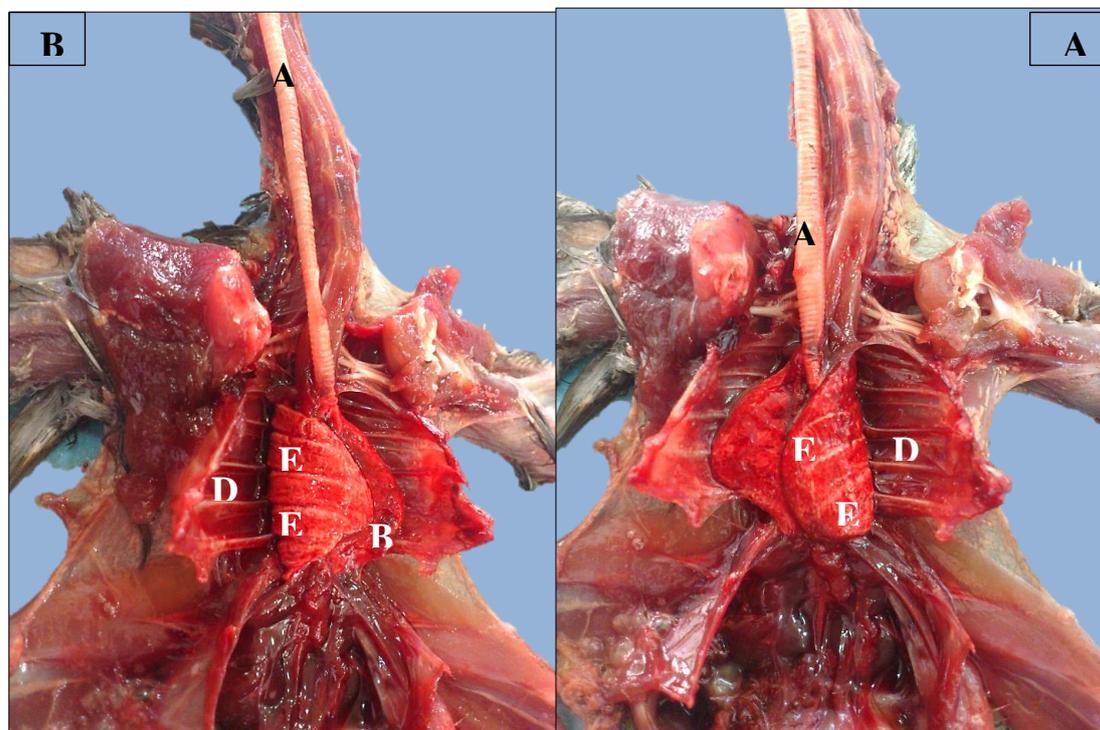


Fig2 (A2&B2): Trachea and dorsal view of the lungs in laughing dove. A- Trachea. B- Right lungs. C- Left lung. E- Impression of lungs. D- Ribs.

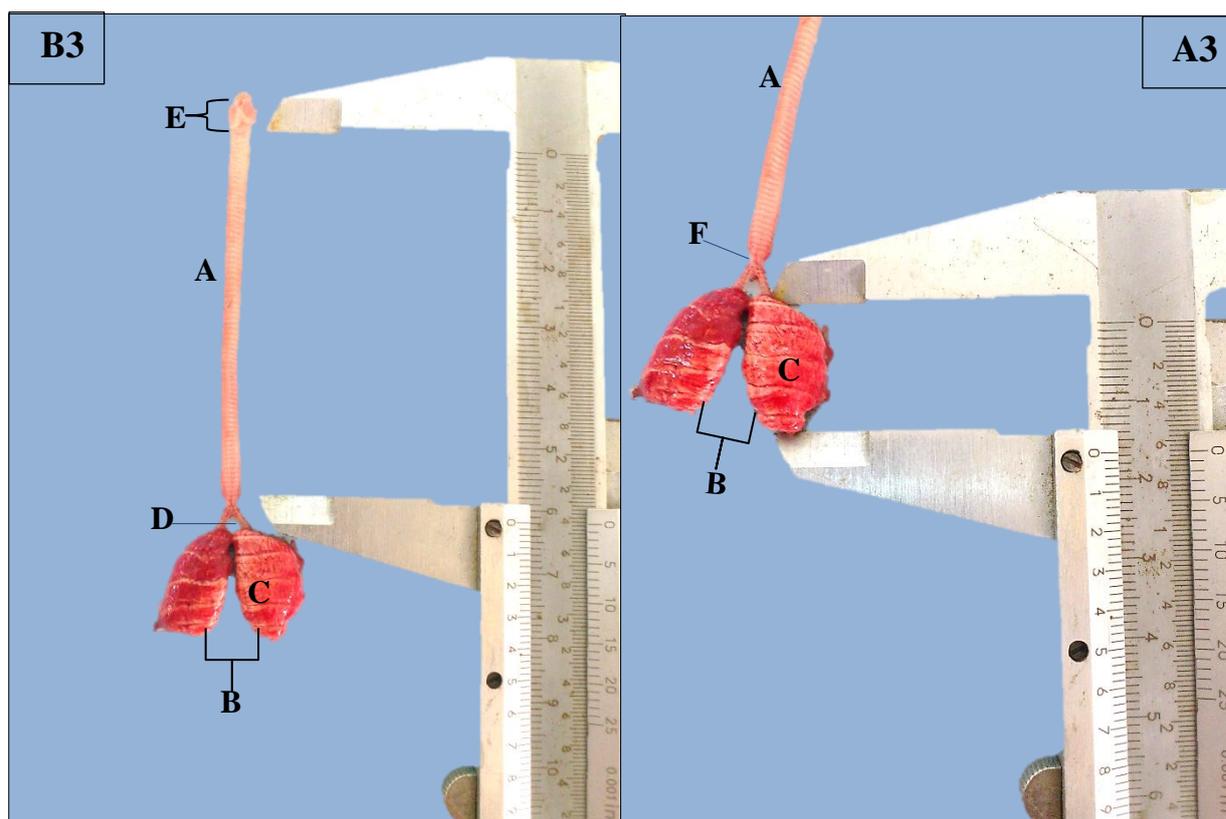


Fig3 (A3&B3): Measured the length and the diameter of trachea and lungs in laughing dove. A- Trachea. B- Right and left lungs. C- Impression of lungs. D-Right & left primary bronchi. E- Larynx. F- Syrinx.

Discussion:

The trachea was appear long flexible tube consist from several number of the cartilage rings (O) shape which refer to the basic unit structure of the trachea. It was extend along the left side of the neck. The trachea extend from the larynx into the syrinx. This results agree with previous studies (5,9,10,11,12 and13) in birds generally.

The mean length of the trachea was $(6.166 \pm 0.176 \text{ cm})$. This result disagreement with (13,14,15,16 and 17) explain the mean length of trachea in budgerigars (*Melopsittacus undulates*) approximately (5 cm); ostriches (78 cm) ; in West african guinea fowl ($26.363 \pm 0.383 \text{ cm}$); in scaup (*Aythya marila*) was $(15.8 \pm 0.53 \text{ cm})$ and in turkeys ($26 \pm 1.23 \text{ cm}$) this difference due to species and body volume of birds.

The distal part of the trachea after forming syrinx is bifurcates into two short tubes were the left and right primary bronchi which enter the proximal third of the visceral surface of the lungs through the hilus, agreement with (13,16,17,18 and19). The reason for this similarity that most of the birds were similar in anatomy of the respiratory system.

When comparing the ratio of the weight of the body to the weight of the respiratory system (0.950 %) note a significant decrease is due to the nature of the anatomy that made up the respiratory system and of compositions hollow structure (the larynx and tracheal, syrinx, bronchi and air sacs), and also compositions spongy structure (lungs), and this system designed in this form for the purpose of accommodating the air inside.

The weight of the trachea was (0.366 ± 0.088 gm) and this form a highly percentage (37.46 %) from the respiratory system due to the anatomical structure of the trachea, which consists large numbers of cartilage rings and disagreement with (16) the weight of trachea in scaup (*Aythya marila*) was (3.66 ± 0.66 gm). While the length of the trachea was (6.166 ± 0.176 cm) and this form a high percentage (66.544%), this because the anatomical structure of the trachea was a long tube, runs along the neck and enters the thoracic cavity and this course gives the highly ratio of the trachea length when compared to the respiratory tract, in addition to the physiological function to control and serves to warm the inspired air and also prevent enter the trap dust particles present in inhaled air and last but not least the length of the tracheal affect of process of sound production in birds (20).

The diameter of the trachea in laughing dove approximately equal in the cranial, middle and caudal parts of the trachea was (3 ± 0.01 mm), this result disagree with (13,15 and 21) which explain the diameter of the tracheal cartilage rings was unequal, this difference due to species of birds.

The primary bronchia was extend from the syrinx into the hilus of the lung at the proximal third of the lung at the visceral surface. It was appear as short tubes consist from several number of cartilage rings has (C) shape open from the medial side, connected together by transparent membrane, this result similar to (7) in adult Male Pigeon (*Columba domestica*); (22) in the *Columba palumbus* pigeon and (23) in Bee-eater birds.

The length of right and left primary bronchi was (5.6 ± 0.4 mm) ($6.6 \pm$

0.2 mm) and this form (6.043 %) (7.122%) respectively from the total length of the respiratory system. disagree with (7,17,22 and 23) who mentioned that in Turkey the right and left bronchi are (5cm) and (4cm), in adult Male Pigeon (*Columba domestica*) right and left bronchi was (0.76 ± 0.04 cm) (0.64 ± 0.24 cm); in the *Columba palumbus* pigeon the right and left bronchi are (0.65 cm) and (0.7 cm) and in the Bee-eater bird the left and right primary bronchi are (1.025 cm) and (1.075 cm), this difference due to species of bird and body volume.

The lungs in laughing dove was pink into light red color, triangular or pyramidal-shaped,. It was extend from first into sixth ribs and firmly attached with it. This results agreement with (5) in the duck, and (24) in Japanese quail, (13) in West african guinea fowl (17) in Turkey; (7) in adult Male Pigeon (*Columba domestica*); (22) in the *Columba palumbus* pigeon and (23) in Bee-eater birds.

In the present study each lung consist from two surfaces (costal and visceral) and three borders (lateral, medial and caudal borders). In the costal surface can be seen fourth deep grooves derivation embedded the second into the fifth ribs guide which separate the lung into five impressions, this result agree with (22) in the *Columba palumbus* pigeon and (23) in Bee-eater birds, but disagreement with (25) in Japanese quail; (17) in Turkey; (7) in adult Male Pigeon (*Columba domestica*) that show the lung consist from three surfaces and two borders, this difference due to species of bird and body volume.

The mean length of the right and left lungs in laughing dove were (1.633 ± 0.02 cm) (1.533 ± 0.03 cm) and this form low percentage from the length of

the respiratory system reaches into (17.623 %) and (16.544 %) and the thickness of right and left lungs were (4 ± 0.44 mm) (4.6 ± 0.49 mm), disagreement with (7,22 and 23) that show the length of right and left lungs were (3.1± 0.66cm) in adult Male Pigeon; (2.8 ± 0 cm) and (2.75 ± 0.05 cm) in the pigeon; and (1.77 ± 0.17 cm) and (1.6 ± 0.15 cm) in Bee-eater bird, observe the differences in the type one as in the pigeons, these variations due to species of bird.

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