# MORPHOLOGICAL STUDY OF THE AIR SACS IN *(Colombialavia Domestica)* PIGEONS

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## ABSRACT

The aim of this study wasto study the morphology of the air sacs (*Saccipneumatici*) in mature pigeons (*Colombialavia Domestica*). Post euthanized the birds; cold acrylic was injected by way of trachea and left several days for polymerization. Then they were macerated with 3% potassium hydroxide at 40 °C, cleaned with tap water, colored and examined. The cervical air sacs are paired sacs. They communicated with the lung via the first Medio-ventral secondary bronchi grow and had two diverticula. Clavicular air sac was formed by the fusion of the bilaterally diverticula and had connection with the lungs through the third Medio-ventral bronchi. The cranial thoracic air sacs were smaller than the caudal sacs pneumatising the second to seventh ribs by their diverticula. The caudal thoracic air sacs had no diverticulum. The left abdominal air sac consists of two parts cranial and caudal.

**Key words:** Air sacs, mature pigeon, pneumatising, bronchi.

## INTRODUCTION

Voice production, respiration, thermoregulation and balancing of body weight during flight are the most air sacs functions in birds (King, 1975 ; Nickel *et al*., 1997). They are connected through the extra-pulmonary extensions of the bronchi. These extending sacs invade around several visceral organs and into many bones of the skeleton in different levels (Hogg, 1990 ; King and Kelly, 1956 ; King and McLelland, 1984). The volume of the air sacs varies greatly among the species. The volume increases as the stretch of the muscles on the body wall changes (Butler and Bishop, 2000). There are remarkable, large, thin walled, membranous, non-vascular, non-muscular air sacs present around the lungs of pigeon. Their total volume is several times more than the volume of lungs and they fill up much of the body cavity making the body light. The air sacs arise from the main branches of bronchus which pierce out of the lungs at different places.

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## MATERIALS AND METHODS

This study was conducted on 10 adult pigeons (*Colombealavia domestica*) (5 female and 5 male) obtained from field. Cold acrylic was injected to all birds by way of trachea after euthanasia by intramuscular administration of ketamine HCl 60 mg/kg and xylazine 6 mg/kg combination (Rigdon *et al.*, 1958). Then, animals were kept in a cold room for polymerization. Later, they were macerated with 3% potassium hydroxide at 40 °C for 48 hours as described by Taşbaş *et al.*, 1994 and Taylor *et al.*, 1962. They were rinsed with running tap water and dried at room temperature. Each sac was externally colored with carmine dye.

## RESULTS AND DISCUSSION

There are four air sacs in connected with pigeon respiratory system arranged from cranial to caudal as cervical, clavicular, thoracic and abdominal air sacs associated (Fig.1). No sexual differences associated with air sacs in pigeons were noted in this study, this result was agreed with the result of King (1975), King & McLelland, (1984), and Nickel *et al*., (1997). The prominent features of each sac were described as follows.

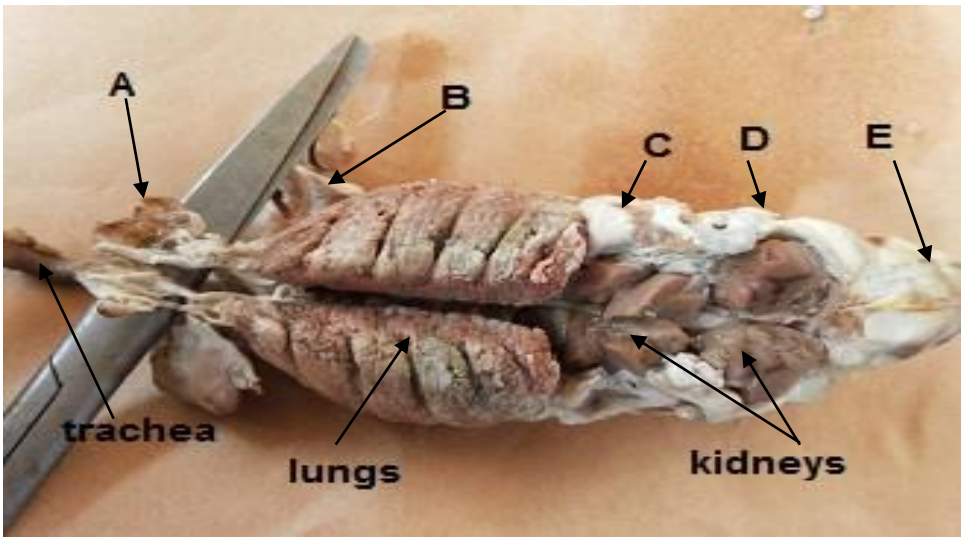


**Fig1. Air sacs in pigeon (dorsal view). cervical air sacs(A), clavicular air sac(B), cranial thoracic air sac(C), caudal thoracic air sac(D), abdominal air sac (E).**

### The cervical sac

Two sacs located bilaterally to the last two cervical and first two thoracic vertebrae, and cranio-medially to the lungs (Fig.1), the cervical sac with its diverticula was similar to what was described in earlier studies (King and McLelland, 1984 ; Nickel *et al*., 1997). They communicated with the lungs via (Medio-ventral bronchi). The cervical sac aerated the first two thoracic and all the cervical vertebrae. In contrast, the last five thoracic vertebrae were aerated

directly by the lungs. The second cervical vertebra and the first two ribs were aerated by this sac in the pigeon. Differ from other species like domestic chickens (Hogg, 1984 ; King, 1957).

**The clavicular sac**

Unique sac formed by two lateral diverticula under the trachea (Fig.1). This sac had connection directly with trachea and with lungs through (third Medio-ventral bronchi). This sac surrounded by the thoracic girdle, sternum, and the heart occupied the entire cranial thoracic apertura. The clavicular sac possessed six diverticula arranged intra- and extrathoracally. Cardiac diverticula, sternal diverticula, intrathoracal diverticula, extrathoracal diverticula, among them were the subscapular diverticula, lateral to those the axillary diverticulum, the subpectoral diverticulum, the last extrathoracal diverticulum. Location and number of the diverticula of the clavicular sac was described in King (1975), King & McLelland (1984) and Nickel *et al*. (1997). This diverticulum aerating the humerus was the most developed of all. The supra humeral diverticulum giving air to the humerus was highly developed as compared to the other extrathoracal diverticulum. The cranial thoracic diverticula which were reported not to aerate any bones and not to possess any diverticula (King, 1993), but in this study, it gave diverticula for the second to seventh ribs.

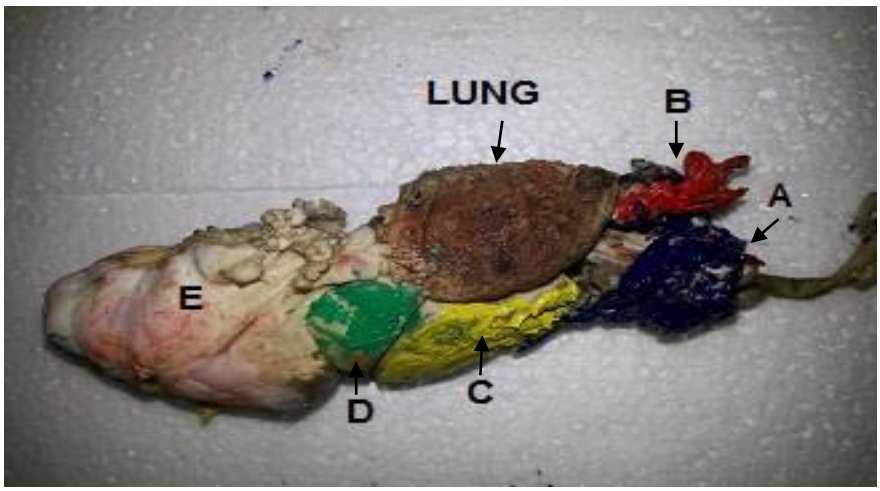


**Fig 2. Air sacs in pigeon side view. cervical air sacs(A), clavicular air sac(B), cranial thoracic air sac(C), caudal thoracic air sac(D), abdominal air sac (E).**

**The cranial thoracic sac**

Irregular sac connected medially to the lung via two bronchi was symmetrically located under the lateral wall of the body. It is larger than the caudal thoracic air sac (Fig. 2), this result mentioned by Taşbaş *et al*. 1994. It

was found ventro-lateral to the lungs, medial to the sternal ribs, and lateral to the heart, liver and the caudal portion of the esophagus.

**The caudal thoracic sac**

The caudal thoracic sac was symmetrically located caudo-ventral to the lungs, receiving air via one bronchus (Fig. 2). It was almost two times larger than the cranial sac. Its caudal portion had relation with the gizzard. The caudal thoracic sac was enclosed dorsally by the abdominal sac, and ventrally by the cranial thoracic sac.

**The abdominal sac**

Its occupying the most of the coelom was asymmetrically located as two parts in the abdomen (Fig 2). It extended from the caudal border of the lungs to the cloacae. This sac had connection with the lungs dorso-laterally via three bronchi on the right and two bronchi on the left side. It consisted of left and right portions. Right one was longer than the left. Both parts aerated synsacrum. The right abdominal sac in pigeon was longer than the left one, similar to the studies of King (1993), King and McLelland (1984) and Nickel *et al*. (1997) unlike with Taşbaş *et al*. (1994).

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## دراسة شكليائية للاكياس الهوائية في الحمام الزاجل

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**المستخلص**

الهدف من هذه الدراسة هو دراسة شكلياء الاكياس الهوائية في الحمام البالغ بعد اجراء عملية القتل الرحيم ثم حقن القالب البارد عن طريق القصبة الهوائية وترك الطيور لعدة ايام لكي تحصل عملية البلمرة. بعدها اجراء عملية الانحلال باستخدام هيدروكسيد البوتاسيوم بتركيز3% عند درجة حرارة 40 درجة مئوية ثم تنظيفها باستخدام الماء وتلوينها ودراستها. الاكياس الهوائية العنقية زوج من الاكياس الهوائية تتصل بالرئة بوساطة القصيبة الهوائية البطنية الانسية وتمتلك طيتان. الكيس الهوائي الترقوي يتكون من اندماج طيتان وحشيتان ويمتلك ارتباط مع الرئة عن طريق القصبة البطنية الانسية الثالثة، اما الاكياس الهوائية الصدرية الامامية فتكون اصغر من الاكيس الصدرية الخلفية ويجهز الضلع الثاني الى الضلع السابع بوساطة طية. الاكياس الصدرية الخلفية لا تمتلك طية .الكيس البطني الايسر مكون من جزئين امامي وخلفي.

**الكلمات المفتاحية**: الاكياس الهوائية، الحمام البالغ، تهوية، القصبة الهوائية.