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HYPOBRANCHIAL APPARATUS IN CHICKEN AND GOOSE (With 1 Table and 3 Fig.)

By

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الجهاز التحت خيشومي في الفراخ والأوز

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يتكون الجهاز تحت خيشومي من جزء وسطى وحيد وقرنين خيشوميين . وعظمة اللسان الداخليه متطوره اكثر في الأوز عنها في الفراخ وهى اطول عظمة في الفراخ من بين عظام الجزء الوسطى . ومعدل الحركة لهذه العظمه أكبر في الأوز عنها في الفراخ تبعاً لنوع المفصل . العظمه . الخيشوميه الاساسيه الاماميه ضيقه في الوسط في الفراخ أما في الأوز فانها تقل في الاتساع في اتجاه الخلف . وحيث ان القرني الخيشومي قصير في كل من الأوز والفراخ لذلك فان اللسان في هذه الانواع لا يبرز خارج الفم . ودرجة انفراج القرنين في الفراخ اكبر مما هو عليه في الأوز تبعاً لشكل الفك السفلى للمنقار .

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SUMMARY

The hypobranchial apparatus consists of unpaired median part and two branchial horns. The entoglossal bone is well developed in goose than in chicken. It is the longest bone (34.20 mm) in the latter one among the bones of the median part. The range of the movement of the articulation of the above bone with the rostral basibranchial bone is higher in goose than in chicken depending upon the type of the synovial joint. The rostral basibranchial bone is narrow in the middle in chicken, but in goose it decreases in width caudalwards. The branchial horns are relatively short in both examined species. Therefore their tongue are non-protrusible. The degree of divergence of these horns is higher in chicken than in goose basing on the shape of the Lower beak.

INTRODUCTION

Although the hypobranchial apparatus plays an important role in determination the degree of the movement of the tongue in birds, the obtained literature contains a little anatomical knowledge about this apparatus. consequently the aim of this investigation is to study in detail the different segments of the hypobranchial apparatus in chicken and goose.

MATERIAL and METHODS

The present work was carried out on ten birds each of chicken and goose. The investigated birds were bled and the hypobranchial apparatus was dissected and studied in relation to the structures of the Lower beak. The apparatus was removed from the head after its separation from the attached soft structures. The nomenclature used is that adopted by Nomina Anatomica Avium (1983).

RESULTS

The hypobranchial apparatus (hyoid bone) consists of unpaired median part and two branchial horns. The median part is divided into three segments which are Os entoglossum, Os basibranchiale rostrale and Os basibranchiale caudale.

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Os entoglossum:

The entoglossal bone (Fig. 2, 3/1) is the most rostral part of the hypobranchial apparatus. It occupies most of the apex of the tongue and extends caudally within its body where it ends shortly in front of the transverse row of the lingual papillae. This bone is closely attached; especially rostrally, with the substance of the free part of the tongue.

The entoglossal bone has two ends, two surfaces and two borders. The rostral end begins about 2.80 mm in chicken and 10.60 mm in goose caudal to the free tip of the tongue. It is nearly pointed in the former bird but blunt in the latter one. In goose the rostral end continues with a small cartilagenous part; supraentoglossal cartilage. The caudal end terminates about 2.00 mm in chicken and 4.20 mm in goose in front of the transverse row of lingual papillae. In chicken this end has a small concave facet which articulates with a small convex facet of the rostral basibranchial bone forming uniaxial synovial joint. Moreover, this end bifurcates to form two cornua. In goose the caudal end forms a small elevation containing a distinct saddle shape articular surface which is convex longitudinally and concave transversely. It articulates with the corresponding articular surface of the rostral basibranchial bone making a biaxial synovial joint.

The dorsal surface is nearly convex from side to side in both examined species. The ventral surface is flat in chicken and goose. In the former bird it separates from the rostral basibranchial bone by a small triangular depression. The base of this depression is directed caudally. But in the goose it contains in its caudal fourth a median groove. The lateral borders are thin.

The length of the entoglossal bone (Fig. 1) is 9.80 mm in chicken and 34.20 mm in goose. The width in the former and latter species is 1.00 mm and 3.20 mm slightly caudal to the rostral end, 2.70 mm and 7.70 mm at the middle as well as 3.30 mm and 5.90 mm at the caudal end respectively. The thickness is 0.60, 1.10 and 1.70 mm in chicken and 1.40, 1.70 and 4.60 mm in goose at the foregoing levels respectively.

Only in chicken a ridge shaped cornua (Fig. 2, 3/ 2) project caudolaterally from the both sides of the caudal end of the entoglossal bone. Each cornu lies ventral to the most lateral three lingual papillae of the transverse row. The cornu measures 5.20 mm long, 1.70 mm wide and 1.50 mm thick. The distance between the free ends of the right and left cornua is about 7.90 mm.

Os basibranchiale rostrale:

The rostral basibranchial bone (Fig. 2,3/ 3) represents the middle segment of the unpaired median part of the hypobranchial apparatus. It locates mainly in the root of the tongue extending from the level slightly in front the transverse row of lingual papillae rostrally to the level of the rostral end of the laryngeal inlet caudally.

This bone has two ends, two surfaces and two borders. The rostral end in chicken has a small convex facet articulating with entoglossal bone. In goose it has a ventrorostal articular surface which is concave longitudinally and convex transversely. Moreover, this end is wide dorsally and narrow rostrally to adapt the articular surface of the caudal end of the entoglossal bone. The caudal end fuses with the caudal basibranchial bone caudally. Laterally the caudal end has an elongated concave articular surface which articulates with the elongated convex articular surface of the branchial horn forming uniaxial synovial joint. The degree of the concavity and convexity of the articular surfaces is higher in goose than in chicken.

The dorsal surface has a longitudinal median ridge extending along the length of the body, There is a longitudinal groove on each side of this ridge. In chicken the foregoing ridge has the same thickness (1.10 mm) throughout its length, In goose it is thicker rostrally (2.00 mm) than caudally (1.40 mm). Therefore in the latter species the ridge decreases in thickness caudalwards. The ventral surface is convex from side to side in chicken but in goose it contains ill-distinct median ridge which continues rostrally with the narrow ventral part of the rostral end and caudally with the caudal basibranchial bone. The lateral borders are thin, moreover they are slightly concave at their middle in chicken and they meet rostrally in goose.

The length of the rostral basibranchial bone (Table 1 and Fig.1) is 10.20 mm in chicken and 5.00 in goose. The width is 2.90, 2.30 and 3.80 mm in chicken as well as 2.00, 4.40 and 7.30 mm in goose at the rostral end, at the middle and at the caudal end respectively. The thickness of this bone in chicken is 1.80, 1.90 and 2.40 mm while in goose is 1.70 3.90 and 3.10 mm at the above mentioned levels respectively.

Os basibranchiale caudale:

The caudal basibranchial bone (Fig. 2,3/ 4) is the caudalmost segment of the unpaired median part of the hypobranchial apparatus. It is considered the caudal continuation of the preceding bone. It lies between the two branchial horns and ventral to the caudal portion of the

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pharyngeal floor. This bone is flattened dorsoventrally with thin lateral borders in chicken, but in goose it is flattened from side to side.

The length of the studied bone measures 16.60 mm in chicken and 20.30 mm in goose. The width of this bone in chicken is 2.60, 1.90 and 0.50 mm as well as in goose is 3.30, 1.40 and 0.40 mm at the level of the rostral end, the middle and the caudal end respectively. While the thickness in chicken is 1.70, 0.90 and 0.30 mm as well as in goose is 2.60, 1.40 and 0.50 mm at the same afore mentioned levels. These dimensions explain that the caudal basibranchial bone decreases in width and thickness caudalwards. Therefore the attached rostral end is larger than the free caudal end.

Cornua branchiale:

The branchial horns (Fig. 2,3/ 5,6) are the longest parts of the hypobranchial apparatus measuring 46.40 mm long in chicken and 68.50 mm in goose. They lie ventrally and laterally to the neurocranium. Each horn joins rostrally the lateral aspect of the caudal end of rostral basibranchial bone. It extends caudolaterally ventral to the corresponding side of the laryngeal mound, nearly at the angle of the mandible the horn curves to ascend parallel to the caudal border of the M. depressor mandibulae to terminate above the level of the ear by 7.30 mm in chicken and 9.40 mm in goose.

The branchial horn consists of two bones, a rostral and caudal. The rostral one is the ceratobranchial bone which forms the horizontal part of the horn, its length (Table 1) is 25.60 mm in chicken and 37.40 mm in goose. The width of this bone in chicken is 2.40, 1.00 and 1.10 mm while in goose is 3.30, 1.30 and 1.50 mm at the level of the rostral end, the middle and the caudal end respectively. The thickness in chicken is 1.70, 0.70 and 0.80 mm, while in goose is 3.10, 1.10 and 1.30 mm at the aforementioned levels respectively. The latter bone is the epibranchial bone which forms the vertical part of the branchial horn. It is shorter than the former bone measuring 22.10 and 31.10 mm long in the chicken as well as goose respectively. The width of this bone in chicken is 1.20, 0.70 and 0.40 mm while in goose is 1.80, 1.10 and 0.60 mm at the level of the rostral end, at the middle and at the caudal end respectively. The thickness of this bone in chicken is 1.00, 0.60 and 0.30 mm, however in goose is 1.70, 0.90 and 0.50 at the before mentioned levels respectively. The two bones are connected with each other by a short cartilagenous portion which is located nearly at the level of the curvature of the branchial horn in goose or about 5.20 mm rostral to this curvature in chicken. The length of this portion is 1.70 mm in

chicken and 3.10 mm in goose but the thickness is 1.30 mm in the former bird and 2.20 in the latter one.

The distance between the two horns in chicken is 6.10, 22.20 and 19.60 mm, however in goose is 7.30, 19.90 and 22.00 mm at the level of the rostral ends, the curvature and the caudal ends.

The previous results indicate that the ceratobranchial bone is generally longer, wider and thicker than the epibranchial bone, moreover within the same bone the rostral portion is thicker than the caudal portion. The degree of divergance in chicken is relatively higher than that of the goose, in addition the distance between the two horns reaches its maximum at the curvature in chicken and at their caudal ends in goose.

DISCUSSION

The present work shows that the entoglossal bone in chicken and goose is unpaired median bone which is bifurcated caudally only in the former species. The same results was also given by *MCLELLAND* (1975). On the contrary, this bone was described as double bone in *Melopsittacus* (*EVANS*, 1969), in chicken (*NICKEL et al.*, 1977) and in parrots (*PETRAK*, 1982).

The ventral surface of the entoglossal bone is flat in the examined chicken and goose. On the other hand, *MCLELLAND* (1975) stated that in chicken the caudal half of the ventral surface of the above bone is strongly concave.

Although the joint between the entoglossal bone and the rostral basibranchial bone is synovial in type in both examined species, it performs a different movements according to the shape of the articular surface. The joint is uniaxial in chicken and biaxial in goose, consequently the range of movement of the apex of the tongue is higher in the latter bird than the former one. In this respect, *MCLELLAND* (1975) described the aforementioned joint in chicken as also a synovial hinge joint.

KING and MCLELLAND (1975) as well as *DYCE et al.* (1987) reported that in domestic fowl the tongue is adapted mainly for moving the bolus within the oropharynx and consequently it is a relatively thicker and non-protrusible structure. This statement corresponds the present work as the apex of the tongue is supported by the entoglossal bone. The latter bone is closely attached; especially rostrally, with the substance of the free part of the tongue. This result is confirmed by *TUCKER* (1966) who stated that the aforementioned bone is rostrally joined the apex of the tongue by connective tissue

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sustentaculum.

NICKEL et al. (1977) mentioned that the rostral basibranchial bone joins the caudal basibranchial bone in a synarthrosis or synostosis. According to the present findings and what was observed in parrots by PETRAK (1982) these bones are fused together and function as one bone. In the latter species and corresponding to that recorded by MIVART (1895) the rostral basibranchial bone possesses a caudal enlargement from which a dorsolateral process arises on each side. This enlargement is not observed in the investigated birds.

In accordance to the width of the rostral basibranchial bone, the present study indicates that this bone in chicken is narrow in the middle and wide in both ends but the caudal end (3.80 mm) is wider than the rostral one (2.90 mm). In the same bird, MCLELLAND (1975) pointed up that the rostral and caudal ends of this bone are relatively wide. On the contrary, the foregoing bone in examined goose decreases in width caudalwards. In this respect PETRAK (1982) stated that in budgerigar the rostral basibranchial bone is narrow rostrally and widens to form lateral wings caudally.

KING and MCLELLAND (1975) reported that the branchial horns are very long in birds like woodpeckers which have an extraordinary protrudible tongue. While PETRAK (1982) mentioned that in parrots these horns are not long therefore they limit protrusion of the tongue. In this condition, it is found that in the examined birds the branchial horns are relatively short where the tongue of these birds is non-protrusible.

The present study explains that the bones of the median part of the hypobranchial apparatus are arranged from longer to shorter as follow, caudal basibranchial, rostral basibranchial and entoglossal bone in chicken, but in goose entoglossal, caudal basibranchial and rostral basibranchial bone. Therefore the entoglossal bone is the longest bone (34.20 mm) in goose, on the other hand it is the shortest bone (9.80 mm) in chicken. In general the median part of the hypobranchial apparatus in goose (69.50 mm) is longer than in chicken (36.60) to adapt the elongated shape of the lower beak in the former species.

corresponding to the distance between the branchial horns, it is found that this distance reaches its maximum at the curvature (22.20 mm) in chicken and at the caudal ends (22.00 mm) in goose. Generally, the degree of divergance of the horns is higher in the former species than in the latter one depending upon the shape of the lower beak.

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LEGENDS

- Fig. 1 : Showing the relation between the lengths of the different bones of the hypobranchial apparatus.
- Fig. 2,3: Showing the hypobranchial apparatus; dorsal view (Fig.2) and ventral view (Fig.3), in chicken (right) and goose (left).
- 1- Os entoglossum.
 - 2- Cornu of No.1.
 - 3- Os basibranchiale rostrale.
 - 4- Os basibranchiale caudale.
 - 5- Os ceratobranchiale.
 - 6- Os epibranchiale.

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Table (1) : Showing length , width and thickness (in mm) of the different bones of the hypobranchial apparatus in chicken and goose .

Bone	Length		Width		Thickness	
	Chicken	Goose	Chicken	Goose	Chicken	Goose
Entoglossal	9.80	34.20	1.00	3.20	0.60	1.40
			2.70	7.70	1.10	1.70
			3.30	5.90	1.70	4.60
Rostral basibranchial	10.20	15.00	2.90	2.00	1.80	1.70
			2.30	4.40	1.90	3.90
			3.80	7.30	2.40	3.10
caudal basibranchial	16.60	20.30	2.60	3.30	1.70	2.60
			1.90	1.40	0.90	1.40
			0.50	0.4	0.30	0.50
Ceratobranchial	25.60	37.40	2.40	3.30	1.70	3.10
			1.00	1.30	0.70	1.10
			1.10	1.50	0.80	1.30
Epibranchial	22.10	31.10	1.20	1.80	1.00	1.70
			0.70	1.10	0.60	0.90
			0.40	0.60	0.30	0.50

Length in mm

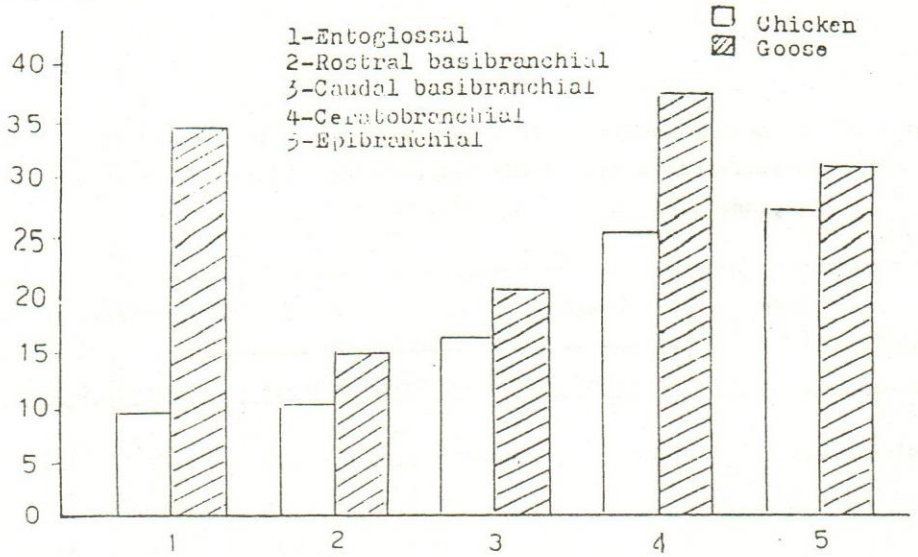


Fig.(1)

