

AGE RELATED GROSS ANATOMICAL FEATURES OF THE HARD PALATE AND OROPHARYNX IN BROILER CHICKS

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ABSTRACT

A study was conducted on gross anatomical features of hard palate of 15 broiler chicks at 7, 11, 18, 25 and 32 days of age. The results illustrated that the rostral 1/3rd of hard palate was characterised by a median swelling, from the caudal end of which the lateral palatine ridges were diverging caudally and medially and it was bound on either side by maxillary ramphotheca. At 18 days of age, the median swelling was present in the form of a pointed arrow head. In between the lateral palatine ridges, orbital folds were localized. The openings of anterior maxillary glands were present at the point of union of lateral palatine ridges with the median swelling, and these glands were most conspicuous at 25 days onwards of age. The choanal cleft separated the orbital folds. The openings of medial and lateral palatine glands were present on the mucosa of orbital folds. The transversely arranged rows of papillae were present on the orbital folds which were of varying shapes and size. The rostral part of choanal cleft was devoid of the papillae whereas, the lateral border of the choanal cleft was having a linear row of very large sized conical papillae. At 25 days of age, a row of longitudinally placed papillae were appeared on the medial border of the orbital fold.

Key words: Maxillary ramphotheca, median swelling, choanal cleft, anterior maxillary glands

Fowl production is one of the fastest growing segments of the agricultural sector in the world. Variations in food resources have resulted in adaption of fowl to different environments leading to difference in shape and structure of the palate (Nickel *et al.*, 1977). The palate and oropharyngeal cavity play an important role in maintenance of food in oral cavity, movement and in swallowing of bolus as a reflection of the different lifestyle of avian species (Dehkordi *et al.*, 2010). The present study was undertaken to identify the anatomical features in the palate and oropharynx of the fowl.

MATERIALS AND METHODS

The present study was conducted on 15 broiler chicks of 7-32 days of age. These birds were divided into five groups having 3 birds in each group. The head of dead birds were collected after post-mortem examination at 7, 11, 18, 25 and 32 days of age and rinsed in running tap water to remove traces of blood. The specimens were immediately fixed in 10% neutral buffered formalin. The heads were incised along the commissure of mouth to expose the hard palate to provide the information on its gross anatomical features.

RESULTS AND DISCUSSION

A common oropharyngeal cavity was observed that had no clear demarcation between the oral and pharyngeal cavities. The roof of oropharynx was formed by the hard palate which was bound on either side by maxillary ramphotheca. The boundaries and components of the oral and pharyngeal cavities agreed with the general avian pattern as previously described (McLelland, 1979) and with the brief description by Bezuidenhout (1999). The features were:

7 Days of Age: The hard palate presented a median swelling, from the caudal end of which the lateral palatine ridges were diverging caudally and medially (Fig. 1). At the union of median and lateral palatine ridges, there was an opening of maxillary gland one on either side of the median plane. The orbital folds presented transversely arranged rows of papillae of varying shape and size. The lateral border of palatine cleft presented a row of linearly arranged very small sized papillae. The pharyngeal region started from the caudal border of the orbital folds. The pharyngeal region was present in between the caudal aspect of hard palate and cranial aspect of esophagus. On either side of infundibular cleft the openings of pterygoidae glands were present. The rest of pharyngeal fold presented 2-3 rows of small sized papillae which were transversely

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oriented and were embedded in mucosa. The pharyngeal papillae were nine in number on either side of median plane which were directed caudally and size of papillae increased from medial to lateral side. These conical small sized papillae were present at the junction of pharynx and esophagus and they were scattered throughout. Caudally the pharynx was guarded by a single row of large sized papillae.

11 Days of Age: There was an increase in size of all the structures and number of papillae with the advancement of the age (Fig. 2). Some isolated papillae appeared in between the transversely oriented rows of papillae. The rostral part of choanal cleft was devoid of papillae and the cleft became broader and groove present between maxillary ramphotheca and lateral palatine ridge was shallow as compared to previous stage. The papillae in the pharyngeal fold were prominent and visible grossly. The choanal cleft was wider and size of papillae on either side of cleft increased as compared to that at 7 days of age. The infundibular cleft was wider and laterally on either side was flanked by slopped wall like structure.

18 Days of Age: The openings of maxillary glands were more evident. The median swelling was presented in the form of pointed arrow head (Fig. 3). The isolated papillae present in between the transverse rows of papillae now appeared in rows of 2-3 papillae. The papillae present on the orbital folds were more pronounced than previous age groups. At this age the papillae were more in number and bigger in size which were embedded in pharyngeal mucosa. A fold appeared in between the rows of pharyngeal papillae and cranial part of oesophagus. The rest of the features were similar as in previous stage except that there was an increase in size of structures with advancement of age.

25 Days of Age: The openings of the anterior maxillary glands were more conspicuous than that at 18 days of age and the row of longitudinally placed papillae were present on the medial border of the orbital fold which showed undulating appearance (Fig. 4). The papillae in the pharyngeal folds increased in numbers at this age. The size of longitudinally arranged papillae was more and they were slender and conical at their apices. The width of choanal cleft was uniform. Pharyngeal folds presented large sized, caudally directed and better developed papillae. At this stage, the papillae appeared to be arranged in rows as compared to scattered distribution

in previous age groups. The pharyngeal papillae towards lateral aspect of the row were bigger in size as compared to the papillae on the medial aspect.

32 days of age: On either side of the median palatine ridge, the lateral palatine ridge extended to the whole length of the palate as revealed in the rhea and ostrich (Tivane *et al.*, 2011). Along the convex border, there was opening of maxillary gland which appeared as two small depressions, one on either side of the median plane. The orbital folds localized between the two lateral palatine ridges were caudally followed by the pharyngeal folds (Fig. 5). The line of demarcation between the two was the large sized papillae of the palate. The anterior most portions of these orbital folds were united with each other. At the point of union, the different rows of papillae were observed. The orbital folds presented transversely arranged rows of papillae which were of varying shapes and size and were separated from each other by the smooth surface of the palate where these papillae were absent. Later on these folds were separated from each other by the choanal cleft or the palatine cleft which extended beyond the level of the transversely oriented large sized papillae of the palate and led into the pharyngeal folds. An elongated median choanal cleft with the long rostral narrow and the caudal wide part observed in the present study was similar to that described in guinea fowl (Jayachitra *et al.*, 2015). At the point of starting of choanal cleft an overhanging pattern of papillae was observed.

There were five transverse rows of caudally directed papillae on either side of the choanal cleft, however, there were no papillae on the hard palate and roof of the oropharynx of Muscovy duck (Igwebuike and Anagor, 2013). Tadjalli *et al.* (2008) also reported that the anterior two third of hard palate contained no papillae, while the caudal part of the palate had short and slender papillae surrounding choanal cleft in ostrich. The papillae organized around choanal cleft obstructed escaping of food into cleft and the others facilitated the movement of feed/ingesta into the esophagus. The transversely oriented papillae extended up to the lateral margin of the choanal cleft and thus presented the corrugated appearance. A large sized longitudinal groove extended up to the level of large sized papillae on either side of the orbital fold of the hard palate where the openings of the lateral palatine glands were present. On either side

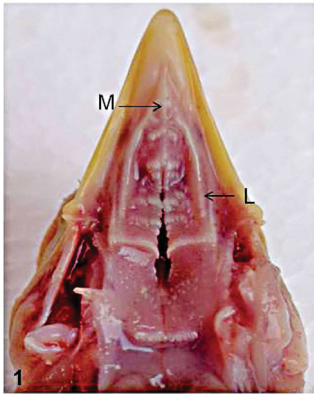


Fig. 1. Photograph showing the median palatine ridge (M), lateral palatine ridge (L) and narrow rostral part of the choanal cleft at 7 days of age.

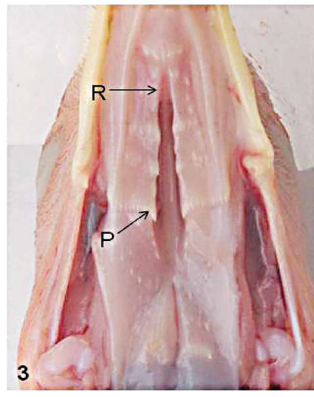


Fig. 2. Photograph showing the widening of rostral portion of choanal cleft and palatine papillae (P) at 11 days of age.

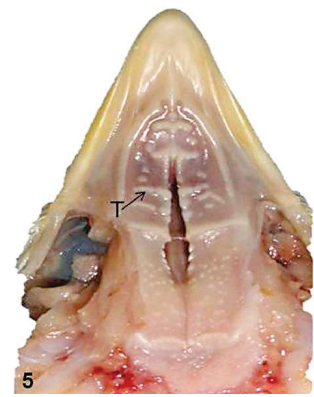


Fig. 3. Photograph showing the median palatine ridge which became pointed arrow shape. Note transverse rows of papillae (T) at 18 days of age.

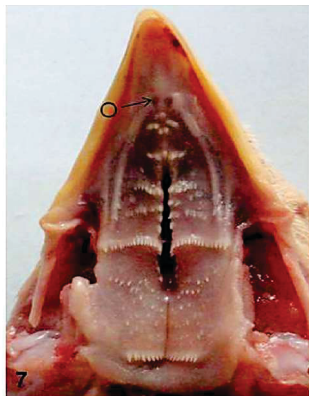


Fig. 4. Photograph showing the row of longitudinally placed papillae which were having the undulating appearance and opening of anterior maxillary gland (O) at 25 days of age.

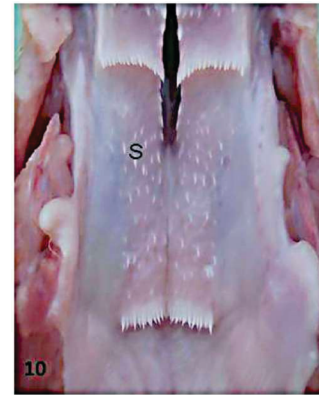


Fig. 5. Photograph showing dense arrangement of the papillae (S) on the pharyngeal folds at 32 days of age.

of choanal cleft, the openings of medial palatine glands were present. The lateral border of palatine cleft presented a row of very small sized papillae which were linearly arranged, whereas conical papillae were located particularly in the palatine mucosa surrounding the choanal cleft in the African pied crow (Igwebuike and Eze, 2010), common raven and European magpie (Erdogan and Alan, 2012). The line of demarcation between the orbital and the pharyngeal folds was the large sized papillae of the palate. During the present study, in the birds of 32 days age, the papillae present towards choanal cleft were placed more caudally whereas, the papillae present at lateral palatine ridge were placed more rostrally and rest of the structures showed increase in size with advancement of age.

The pharyngeal region started from the caudal border of the orbital folds extending between the caudal

aspect of hard palate and cranial aspect of esophagus. Towards cranial aspect, the pharyngeal region was separated by choanal cleft after short distance and caudally separated by infundibular cleft which extended up to last row of pharyngeal papillae. The most distinct features of the pharynx observed were the presence of large pharyngeal folds and a long infundibular cleft which was similar to the findings reported in ostrich (Tivane *et al.*, 2011). The pharyngeal cleft was described as a median longitudinal fissure which connected the infundibulum to the pharynx as reported in other avian species (McLelland 1979). The emu pharyngeal fold had an extra feature in the form of a small caudo-lateral projection which formed a pocket between its ventral and the dorsal surfaces as reported by Crole and Soley (2010). On either side of infundibular cleft, the openings of pterygoid glands were present. The rest of pharyngeal

fold presented small sized papillae which were transversely oriented in 2-3 rows and they appeared to be embedded in mucosa. The size of these papillae was smaller than the most caudally placed large sized papillae. The pharynx was caudally guarded by a single row of large sized papillae. The pharyngeal papillae were 9 in number, present on either side of median plane and were directed caudally. The size of papillae increased from medial to lateral side. These papillae were present at the junction of pharynx and esophagus and their size were large and conical in shape. In contrast, Erdogan and Perez (2014) observed that the caudal border of pharyngeal folds contained only one papillary row of very small papillae, which marked the end of pharyngeal cavity and the beginning of the esophagus.

REFERENCES

- Abumandour, M.M.A. (2014). Gross anatomical studies of the oropharyngeal cavity in the Eurasian hobby (*Falconinae: Falco Subbuteo*, Linnaeus). *J. Life Sci. Res.* **1**: 80-92.
- Bezuidenhout A.J. (1999). The Ostrich: Biology, Production and Health. CABI Publishing, Wallingford, UK.
- Catarina, Marcio, T.N.R., John, T.S., and Herman, B.G. (2011). Gross anatomical features of the oropharyngeal cavity of the ostrich (*Struthio Camelus*). *Pesq. Vet. Bras. Junho.* **31**: 543-550.
- Crole, M.R. and Soley, J.T. (2010). Gross morphology of the intra-oral rhamphotheca, oropharynx and proximal oesophagus of the emu (*Dromaius novaehollandiae*). *Anat. Histo. Embryol.* **39**: 207-218.
- Dehkordi, R.A.F., Parchami, A. and Bahadoran, S. (2010). Light and scanning electron microscopy study of the tongue in the zebra finch (*Carduelis carduelis*). *Slovenian Vet. Res.* **47**: 139-144.
- Erdogan, S. and Alan, A. (2012). Gross anatomical and scanning electron microscopic studies of the oropharyngeal cavity in the European magpie (*Pica pica*) and the common raven (*Corvus corax*). *Microscop. Res. Tech.* **79**: 379-387.
- Erdogan, S. and Perez, W. (2014). Anatomical and scanning electron microscopic characteristics of the oropharyngeal cavity (tongue, palate and laryngeal entrance) in the Southern lapwing (Charadriidae: *Vanellus Chilensis*, Molina 1782). *Acta Zoo. (Stockholm)* **96**: 264-272.
- Gupta, S.K., Pathak, A. and Farooqui, M.M. (2015). Anatomy of oropharyngeal cavity of fowl (*Gallus domesticus*). *Indian J. Vet. Anat.* **27**: 12-14.
- Gussekloo, S.W.S. and Bout, G.R. (2005). The kinetics of feeding and drinking in palaeognathous birds in relation to cranial morphology. *J. Expt. Biol.* **208**: 3395-3405.
- Igwebuike, U.M. and Eze, U.U. (2010). Anatomy of the oropharynx and tongue of the African pied crow (*Corvus albus*). *Vet. Arhiv.* **80**: 523-531.
- Igwebuike, U.M. and Anagor, T.M. (2013). The morphology of the oropharynx and tongue of the Muscovy duck (*Cairina moschata*). *Veterinarski Arhiv* **83**: 685-693.
- Jayachitra, S., Balasundaram, K., Iniyah, K., Sivagnanam, S., and Tamilselvan, S. (2015). Morphology of oropharyngeal cavity in guinea fowl (*Numida meleagris*). *Int. J. Adv. Multidisciplinary Res.* **24**: 99-102.
- King, A.S. and McLelland, J. (1984). Birds: Their Structure and Function. (2nd edn.), Bailliere Tindal.
- McLelland, J. (1979). Digestive System. Form and Function in Birds. Vol. I. King, A.S. and McLelland, J. (eds.), Academic Press, San Diego, California.
- Nickel, R., Schummer, A. and Seiferle, E. (1977). Anatomy of the Domestic Bird. Verlag Paul Parey, Berlin-Hamburg.
- Obike, O.M., Oke, U.K., and Azu, K.E. (2011). Comparison of egg production performance and egg quality traits of pearl and black strains of guinea fowl in a humid rain- forest zone of Nigeria. *Int. J. Poult. Sci.* **10**: 547-551.
- Sisson, S. and Grossman, J.D. (1955). The Anatomy of the Domestic Animals. (4th edn.), W.B. Saunders Company, Philadelphia.
- Tadjalli, M., Mansouri, S.H. and Poostpasand, A. (2008). Gross anatomy of the oropharyngeal cavity in the ostrich (*Struthio camelus*). *Iranian J. Vet. Res.* **9**: 316-323.
- Tivane, C., Rodrigues, M.N., Soley, J.T. and Groenwald, H.B. (2011). Gross anatomical features of the oropharyngeal cavity of the ostrich (*Struthio camelus*). *Pesq. Vet. Bras.* **31**: 543-550.