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Research Article
Morphology of oropharyngeal cavity in guinea fowl (*Numida meleagris*)

S. Jayachitra, K. Balasundaram, K. Iniyah, S. Sivagnanam and S. Tamilselvan

Department of Veterinary Anatomy,Veterinary College and Research Institute, Namakkal- 637002

Corresponding Author : *jaichitravet@gmail.com*

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Abstract

The present study was carried out to obtain information about gross morphological features of oropharyngeal cavity in guinea fowl. A common oropharyngeal cavity was observed that had no clear demarcation between the oral and pharyngeal cavities. The beak was triangular in shape and was covered by horny sheath. The roof of oropharynx was formed by the hard palate. The chonal cleft was bounded by orbital folds and was narrow anteriorly and broad posteriorly. Six tranverse rows of caudally directed filliform papillae were seen on either side of the choanal cleft. The infundibular cleft was found immediately behind the sixth row of papillae. The floor of the oropharynx contained a concave triangular depression and the tongue was found on the rostral part of the floor of the oropharynx. A row of transverse caudally directed pharyngeal papillae limited the floor of the orophayngeal cavity behind the glottis.

Introduction

Bacillary dysentery and enteric fevers continue to be impor- Birds have different feeding habits with corresponding differences in the structure of their oropharyngeal cavity, so the anatomy of the avian oropharyngeal cavity is important to identify the structural variations that may influence nutrition, food intake and ingestion. The guinea fowl is an omnivorous bird and therefore has a diet that primarily included worms and insects on the ground, along with seeds and berries. Some attention has been given to the study of the morphology of the avian oropharynx and tongue in recent times (Crole and Soley, 2009; Igwebuike and Eze, 2010; Tivane et al., 2011; Erdogan and Alan, 2012). However, specific information on the anatomy of the oropharynx of the guinea fowl is still very minimum. Hence, the present study was undertaken with the aim to investigate the gross morphological differences of oropharynx in guinea fowl.

Materials and Methods

The present study was conducted at Department of Veterinary Anatomy and Histology, Veterinary College and Research Institute, Namakkal. The heads used in the present study were collected from six adult normal healthy guinea fowl slaughtered at an organized poultry farm in Namakkal. They were washed in normal saline and studied in terms of their shape, physical appearance and in situ topographical relationships and photographed by digital camera. To obtain good observation, the beak angles were incised and mouth cavity was exposed. The anatomical position and shape of all the structures located in the oropharyngeal cavity were studied in detail and noted in Fig. 1.

Results and Discussion

General Morphology

In guinea fowl, there was no clear line of demarcation between the oral and pharyngeal cavity as in mammals due to lack of soft palate and so producing common oropharyngeal cavity. It extended from the beak to the oesophagus as mentioned by the Igwebuike and Anagor, 2013 in muscovy duck. The common oropharynx was triangular in shape with anterior apex which

confined to the shape of the beak. The oropharyngeal cavity consisted of roof formed by incomplete hard palate and the floor formed by mandible, tongue and laryngeal mound. The lips and teeth were absent and their function was replaced by the edges of the beak and the gizzard. These findings are similar to the observations of Abumandour, 2014 in Eurasian Hobby. The boundaries of the oropharyngeal cavity of the guinea fowl described in this study is in agreement with the general pattern in most avian species (Mclelland, 1993).

Beak

The beak was triangular in shape, the upper was formed by premaxilla, the lower was formed by mandible and both were covered by the thick horny sheath. The borders of the upper horny sheath was extended beyond the sheath of lower beak, so that the upper beak completely covered the lower beak when mouth was closed as reported in fowl and pigeon (Nickel *et al*. 1977). The upper beak was curved and convex and the lower beak was concave which adapted to the tongue. The angular commissure between the upper and lower beak was covered with very thick horny lamellae. In the present study, the beak was triangular with pointed apex, but the shape of the beak varied in different species, broad and shovel shaped in Muscovy duck (Igwebuike and Anagor, 2013), curved, flat, hard with a sharp extremity in partridge (Rossi *et al.* 2005), spoon-shaped in duck and goose (Nickel *et al.* 1977) flat spoon-shaped in ostrich (Tadjalli *et al*. 2008) and sharp, thin and pointed rostrally in Eurasian Hobby (Abumandour, 2014). The wide variation in the morphology of the avian beak was related to the adaptation for prehension, type of food, feeding methods, climate conditions and assisted in the incomplete break-down of food (Iwasaki, 2002).

Roof of the Oropharynx

In the present study, the roof of the oropharynx was formed by the hard palate which was cream coloured, the anterior two third of the hard palate was divided into right and left halves by median palatine ridge with median swelling infront and posterior one third was formed by choanal cleft. On either side of the median ridge, lateral palatine ridges extended to the whole length of the palate. These are in concurrence with the findings in rhea (Gussekloo, 2006), emu (Crole and Soley, 2009) and ostrich (Tivane et al., 2011). Anteriorly the lateral palatine ridges joined the median ridge at an acute angle. The part of the palate area framed by the lateral palatine ridges was the choanal field which corresponded to the dorsal surface of the tongue. Contrast to this there were numerous orderly arranged rows of notches called lamellae situated on the lateral borders of the hard palate and many transverse narrow mucosal folds extend obliquely between the median longitudinal fold and the lamellae and also two transverse ridges that demarcate the caudal aspects of the hard palate from the choanal slit was noticed in Muscovy duck (Igwebuike and Anagor, 2013) and there was no such lamellated mucosal folds in the guinea fowl.

The choanal cleft (median slit) was long, narrow anteriorly and broad posteriorly and bounded by orbital folds on either side and formed the permanent communication between the oral and nasal cavities. Species-specific difference in the shape of the avian choanal cleft were noticed. An elongated median choanal cleft with the long rostral narrow triangular part and the caudal wide part in Eurasian hobby (Abumandour, 2014), oval depression with two compartments in Muscovy duck (Igwebuike and Anagor, 2013), very long in fowl and pigeon, short in duck and goose (Nickel *et al.* 1977) and inverted V-shaped depression in herons and ducks (McLelland, 1979), while the choanal cleft may take the bell-shape in ostrich(Catarina *et al.* 2011). As in most avian species, behind the median palatine ridge, six tranverse rows of caudally directed filliform papillae were seen on either side of the chonal cleft and most posterior one was made up of very well developed large papillae which marked the end of the oral cavity arbitrarily. But the lack of papillae on the hard palate and roof of the oropharynx has been demonstrated in muscovy duck (Igwebuike and Anagor, 2013), rhea (Gussekloo and Bout, 2005) and ostrich (Tivane *et al.* 2011) which showed faint papillae only in its caudal part. Tadjalli *et al.* 2008 also reported that the anterior two thirds of hard palate contain no papillae, while the caudal part of the palate contain short and slender papillae surrounding choanal cleft in ostrich. Our study agrees with the study in European magpie (Erdogan and Alan, 2012) and Eurasian Hobby (Abumandour, 2014). The papillae organizing around choanal cleft obstruct escaping of foods into cleft and the others facilitate the movement of nutrients into the esophagus. The palate of fowls and pigeons has caudally pointing papillae arranged in several transverse rows, but the palate of goose has a median and 2-3 paramedian longitudinal rows of blunt papillae and in the duck, these papillae were confined only to the apical region (Nickel *et al.* 1977).

The infundibular cleft begins at the most caudal transverse row of papillae of hard palate and this cleft was bounded by pharyngeal folds and it lead to the auditory tubes. It is in accordance with the Abumandour, 2014 who reported that the roof of the pharynx was characterized by the presence of two oval pharyngeal folds separated by very narrow, small, shorter and more caudal midline slit-like opening in Eurasian hobby. The most posterior limit of the oropharyngeal cavity was limited by one transverse row of caudally directed pharyngeal papillae which separated the oropharyngeal cavity from the oesophagus. The present study agree with Erdogan and Perez, 2014 who reported that the caudal border of pharyngeal folds contain only one papillary row of very small papilla, which marked the end of pharyngeal cavity and the beginning of the esophagus in Southern lapwing. In contrast to our result, Tadjalli *et al.* 2008 mentioned that the ostrich oral cavity was characterized by the lack of this transverse row of papillae caudal to infundibular cleft. In addition, the present study observed the absence of papillae on or around the oval pharyngeal folds.

Floor of the oropharynx

The floor of the oropharynx contained a concave triangular depression between the rami of mandible which adopts triangular shaped tongue. The laryngeal mound was located in the caudal part of the floor. In the ostrich, Tadjalli *et al.* (2008) noted that the floor of mouth was a concave depression for the tongue in the lower beak. Bailey *et al.* (1997) reported that the tongue was laid in the floor of the oropharyngeal cavity in a fossa between the rami of the mandible in captive bustards. The ratites were characterized by short tongue which was described as rudimentary tongue that occupied very little part of the concave depression meant for the tongue in the lower beak (Crole and Soley, 2009). Emura *et al.* (2009) observed elongated tongue in wood-peckers.

Tongue

The tongue was triangular with pointed anterior end and found on the rostral part of the floor of the oropharynx. The triangular form of the tongue is the most common among the avian species as noted by Rossi, *et al.* (2005) in partridge and quail, Iwasaki and Kobayashi, (1986) in domestic fowl, whereas, it was elongated in Eurasian Hobby (Abumandour, 2014). An elongated and oval tongue was a characteristic feature in water birds such as duck and goose (Iwasaki *et al.* 1997) whereas the ratite was characterized by semicircular, short and broad tongue as noted by Catarina *et al.* (2011) . So our result suggested that the morphological differences and variations appearing in the tongue of avian species were directly associated with dietary specialization and food type they consume and adaptation to environmental conditions surrounding them. The most distinguishing structure on the lingual body was a single posterior row of caudally directed lingual papillae which marked the posterior limit of the tongue that played major role in directing food to the esophagus and also played important role in preventing the regurgitation of small and large nutrients guiding them to oesophagus from the lingual surface (Erdrogan and Perez, 2014). The caudally directed papillae were also reported in Eurasian Hobby (Abumandour, 2014). In our work, the tongue had one transverse row of lingual papillae pointed caudally toward the pharynx as in fowls and pigeons (Nickel *et al.* 1977), African pied crow (Igwebuike and Eze, 2010) and in bustards (Bailey *et al.* 1997). However, in duck and goose, there were two rows of upright, horny papillae situated at the edges of the tongue (Getty, 1975).

Laryngeal Mound

As in all avian species, a raised structure called laryngeal mound was located immediately caudal to the tongue (close to lingual root) and carried oval laryngeal cleft (glottis) (Catarina *et al.* 2011). Behind the mound, a row of transverse caudally directed pharyngeal papillae limited the floor of the orophayngeal cavity as noted by Erdogan and Alan, (2012) in raven and magpie species. Abumandour, (2014) reported two transverse rows of large sized, caudally directed conical pharyngeal papillae on the caudal border of laryngeal mound and Onuk *et al.* (2010), observed conical papillae settled irregularly at the laryngeal mound and around the glottis in goose, which didnot coincidence with our observation in Guinea fowl.

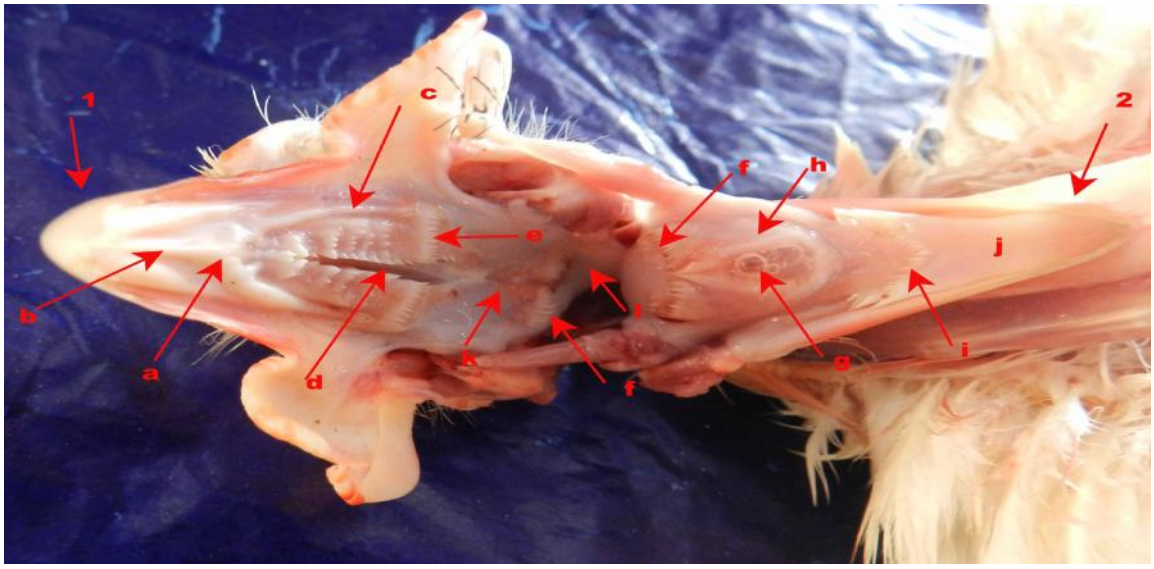

Fig. 1 Photograph showing upper and lower jaw of guinea fowl.
1 – upper beak, 2- lower beak a – median palatine ridge, b- median swelling c – lateral palatine ridge, d – palatine cleft or choanal cleft e- papillae of hard palate, f – pharyngeal papillae, g – Layngeal cleft (glottis), h – laryngeal mound, i- lingual papillae, j- tongue, k – infundibular cleft l- oesophagus

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