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RESEARCH ARTICLE

HISTOARCHITECTURE OF TONGUE IN ADULT EMU BIRDS (*DROMAIUS NOVAEHOLLANDIAE*)

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ABSTRACT

Twenty apparently healthy adult emu birds of either sex were utilized for gross and histomorpological observations. Microscopically the tongue of emu consisted of epithelium, submucosa and lingual muscles and bones. The mucosa of the tongue was covered by keratinised stratified squamous epithelium on both dorsal and ventral surface. The dorsal and ventral epithelium was interrupted at regular intervals by ducts of lingual glands. Taste buds were observed in the intraepithelial in position. The lingual submucosa made up of dense, irregular connective tissue layer was observed underlying the epithelium on all parts of the tongue. The lingual glands were observed on the full width of the apex, body and root of this layer except lateral lingual papillae. The glandular acini was lined with cuboidal cells with basally located round nuclei and basophilic cytoplasum. The herbst corpuscles were large, round or oval shaped scattered randomly and closely associated with lingual glands. The corpuscles were covered by thin connective tissue capsule. The inner core was formed by loosely arranged concentric lamellae with centrally located nuclei. The core of the body of the tongue was formed by lingual skeleton. The lingual muscles were made up of skeletal muscle fibers noticed ventral to the paraglossum.

INTRODUCTION

The emu husbandry provides rural employment to about 1.5 lakh labourers. Over the past decade the emus commercial value has been recognized for their marketable products. These birds provide a healthy financial returns in the form of eggs and chickens for 25-27 years of age. After it stops reproducing, it is a minimum of 50 Kg bird to sell for various products like meat, oil, skin and still makes money for the farmer. The upper gastrointestinal tract comprises of oral cavity, tongue, pharynx, oesophagus, proventriculus and gizzard. The tongue plays an important role for the transport of food through the mouth cavity and for pushing food items into the oesophagus during deglutition in birds that swallow relatively small food items. Reports are available on histology of avian upper gastrointestinal tract in avian species but literatures are few regarding the gross morphology, histology and histochemistry of the upper gastrointestinal tract in emus. Therefore, the current observation was undertaken to reveal the histoarchitecture of the tongue in adult emu birds.

MATERIALS AND METHODS

The tongue of 20 apparently healthy adult emu birds of either sex were procured from a well organized farm in the neighborhood of Namakkal. The body weights of the live birds were recorded. The tissue pieces from tongue were collected immediately after slaughter of birds. The collected samples were washed in normal saline and mopped in blotting paper. The tissues collected from tongue were fixed in 10 per cent neutral buffered formalin, Bouin's fluid and Zenker's fluid. Fixed tissues were processed through ascending grades of alcohol, cleared in xylene and embedded in paraffin wax at 58-60ºC. Paraffin sections of 3-5 µm thickness were cut and utilized for this study. Freshly collected unfixed frozen tissues and post fixed in formal calcium were cut at 20 µm thickness were utilized for demonstration of lipids and enzymes. For histological observations, Ehrlich's Haematoxylin - Eosin method. Van Gieson technique for collagen fibres. Gomori's method for reticular fibres. PTAH method for muscle fibres, Standard toluidine blue method for mast cells, Periodic acid-Schiff (PAS) technique for carbohydrates, Alcian blue method at pH 2.5 for acid mucopolysaccharides (Bancroft and Stevens, 1996) were employed. Microanatomical parameters were recorded using an image analyzer to record the thickness of both dorsal and ventral epithelium, dorsal and ventral lingual glands and paraglossal cartilage of tongue.

RESULTS AND DISCUSSION

The mucosa of the tongue of emu was covered by keratinised stratified squamous epithelium (Fig.1,2) on both dorsal and

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ventral surface of apex, body and root. This finding is in accordance with Kadhim *et al.* (2011) in red jungle fowl, Parchami and Dehkordi (2013) white eared bulbul. But contradicting with this Pasand *et al.* (2010) stated that the mucosa was lined by non keratinised stratified squamous epithelium in ostrich. This is assumed the variation in the keratinization might be due to its food and feeding habits. The dorsal surface of the epithelial thickness was 43.28 ± 7.21 µm and ventral surface was 41.42 ± 6.90 µm. The lingual submucosa made up of dense, irregular connective tissue layer was observed underlying the epithelium on all parts of the tongue. The lingual glands (Fig.2, 3) were observed on the full width of the apex, body and root of this layer except lateral lingual papillae. The glands were varied in size and shape and made up of simple branched tubular glands in the middle of the lingual parenchyma. According to its location the lingual glands were observed as dorsal, ventral and root lingual glands. The dorsal and ventral gland thickness was 188.69± 31.44 and 247.89 ±41.31µm respectively. This in not reported any of the authors in the reviewed of any other species. The lingual glands helps to create of a protective barrier on the tongue surface and moisturize the beak cavity and the food moved into the oesophagus.

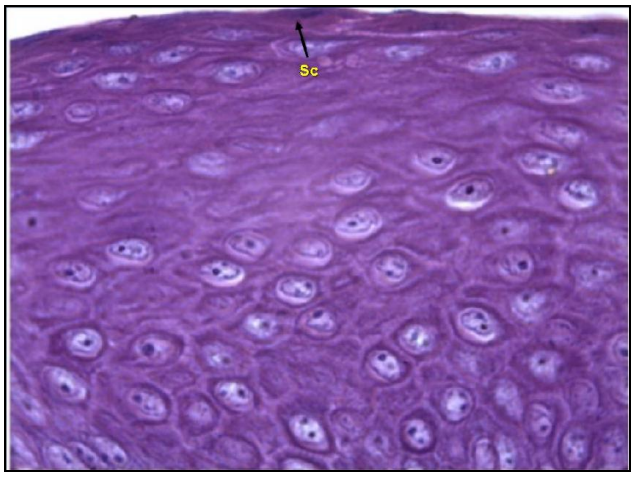

Figure 1. Photomicrograph showing stratum corneum of lingual epithelium of adult emu. Sc - Stratum corneum. (H&E x 1000)

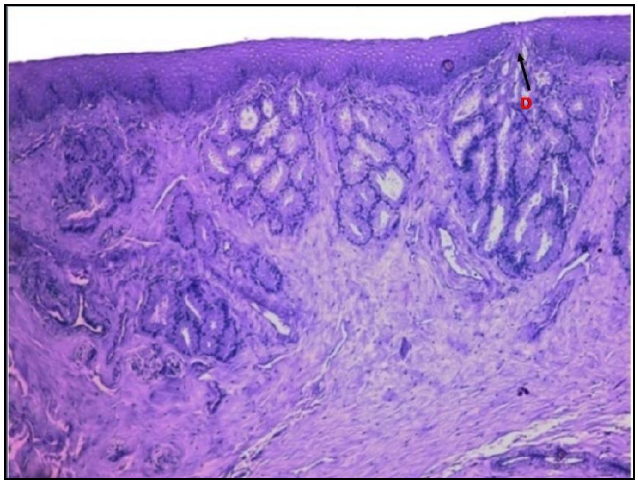

Figure 2. Photomicrograph showing ducts of lingual glands in epithelium of tongue in emu. D - Ducts of lingual glands. (H&E x 100)

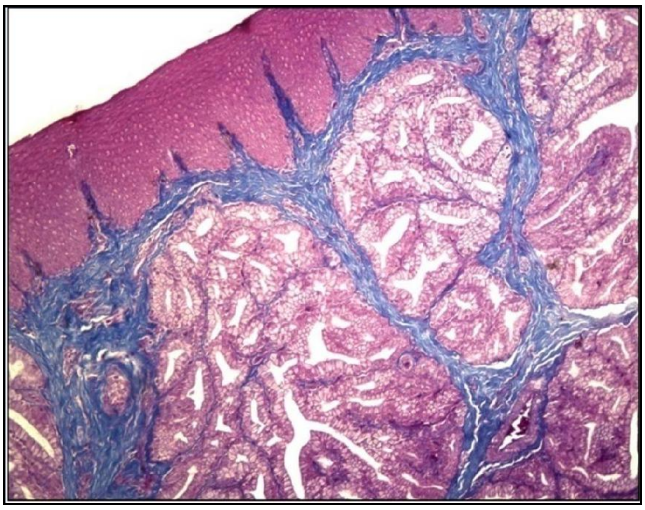

Figure 3. Photomicrograph showing collagen fibers (Blue colour) in between the lingual glands. (Masson's Trichome x 100)

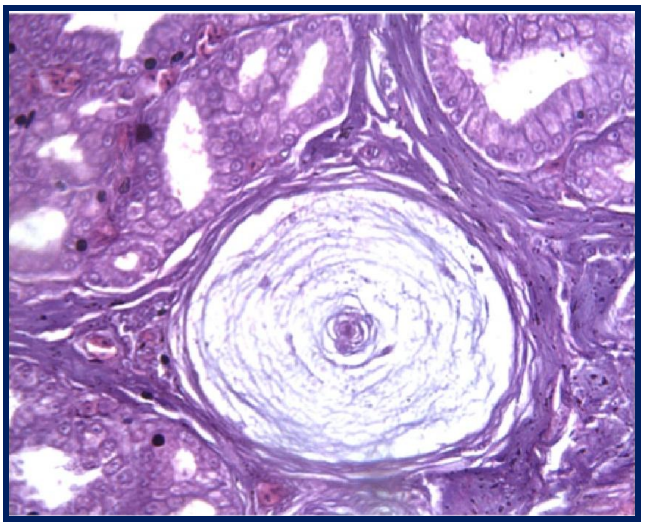

Figure 4. Photomicrograph Herbst corpuscles in lingual submucosa of adult emu birds. (H&E x 400)

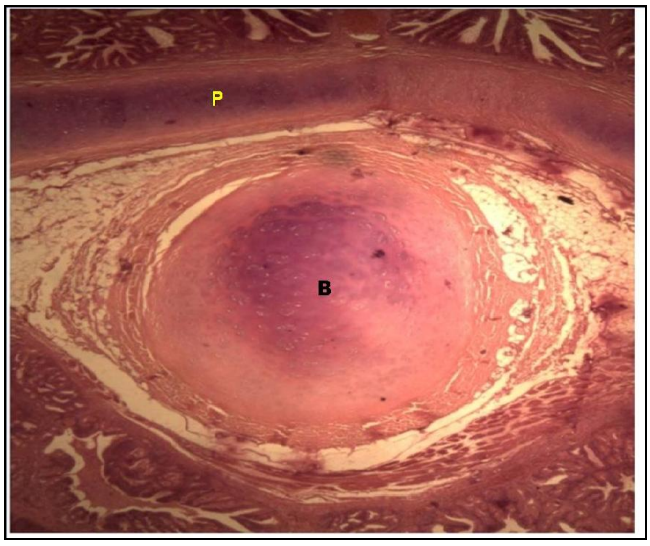

Figure 5. Photomicrograph showing lingual skeleton P - Paraglossum and B - Basihyale (H&E x 40)

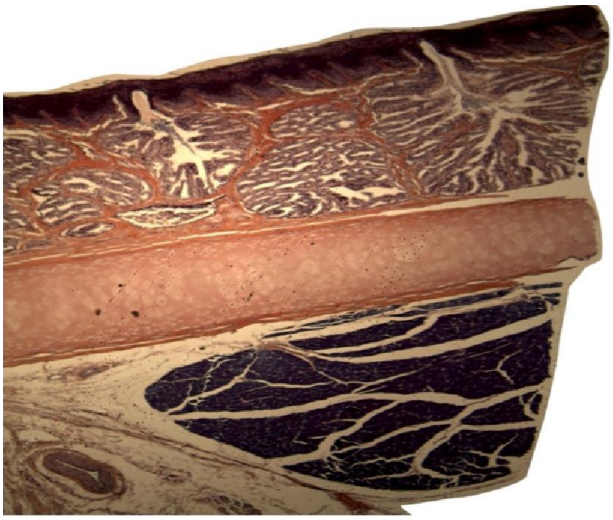

Figure 6. Photomicrograph showing lingual muscle fibers in adult emu. (PTAH X 40)

These findings are similar to Erdogan *et al.* (2012) in chucker partridge. Contrast to this, Liman *et al.* (2001) stated that lingual glands consisted of lateral and medial portion in Japanese quail. The connective tissue layer contained collagen, elastic and few reticular fibers with blood capillaries. The glandular acini was lined with cuboidal with basally located round, dark nuclei with basophilic cytoplasum. Numerous small, simple tubular mucus glands were located in the intraepithelial region. In accordance with Rodrigues (2012) in macaw, infiltration and aggregation of lymphocytes were observed below the epithelium. The tongue of the lymphoid tissue act as a protective to compact the microorganism. The mast cells were noticed in the connective tissue of the sub mucosa. In the submucosa, the sensory nerve endings were observed in the form of herbst corpuscles (Fig.5). These corpuscles were large, round or oval shaped which was scattered randomly and closely associated with lingual glands. The corpuscles were covered by thin connective tissue capsule. The inner core was formed by loosely arranged concentric lamellae with centrally located few nuclei. These corpuscles were response to sensory receptors and sensitive to pressure and vibration.

The core of the body of the tongue was formed by lingual skeleton (Fig.6) which was extended from the tongue body to the apex. Ventral to the paraglossum, the anterior projection of the basihyale was present. In cross section, the paraglossum was composed of hyaline cartilage and covered by thin perichondrium and adipose tissue as reported by Kadhim *et al.* (2011) in red jungle fowl. The paraglossal cartilage thickness was 135.73±22.62 µm. This in not reported any of the authors in the reviewed of any other species. Lingual skeleton may serve to provide for firmness the lingual muscles of the tongue and voluntary control of lingual protrusion as well as movement of the body during feed intake. In compliance with the findings of Kodayashi *et al.* (1998) in penguin, the lingual muscles were made up of skeletal muscle fibers which were noticed ventral to the paraglossum. The muscle fibers were arranged into circular and longitudinal direction in the tongue body. The lingual muscles help to movement of tongue during eating and drinking.

Conclusions

Microscopically the tongue was consisted of epithelium, submucosa and lingual muscles and bones. The mucosa of the tongue was covered by keratinised stratified squamous epithelium on both dorsal and ventral surface of apex, body and root. The lingual glands were observed in the submucosa. The glands were surrounded by connective tissue layer which contained collagen, elastic and few reticular fibers with blood capillaries. The herbst corpuscles were large, round or oval shaped structure which were scattered randomly and closely associated with lingual glands. The core of the body of the tongue was formed by lingual skeleton which was extended from the tongue body to the apex. The lingual muscles were made up of skeletal muscle fibers noticed ventral to the paraglossum. The muscle fibers were arranged into circular and longitudinal in direction in the tongue body.

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