# Histological, and Histochemical Studies on the Tongue of Domestic Turkey (Meleagris Gallopavo)

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## 1. Abstract

The purpose of this study was to investigate the micromorphological features of the tongue of domestic turkey (*Meleagris Gallopavo*). The tongue was studied by means of histological and histochemical methods to elucidate its micromorphological features. Six adult male domestic turkeys were used in this study. Samples from the tip, body and root portions of the tongue were fixed in 10% neutral buffered formalin. Stained sections with H&E revealed that the lingual mucosal lining is stratified squamous epithelium keratinized thicker in the dorsal surface than that of the ventral surface throughout the length of the tongue. The core of the tongue had a special lingual structure varied along the length of the tongue started at the apex as hyaline cartilage and changed in the body into fibrocartilage and continued caudally as spongy bone. By Alcian blue pH 2.5 the lingual salivary glands gave a strong reaction and appeared as clusters at the level of the body.

**Key words:** *tongue, histology, histochemistry, Meleagris Gallopavo*

## 2. Introduction

Turkey is a large bird, classified scientifically under kingdom Animalia, phylum Chordata, class Aves, order Californis, family Meleagridinae, genus Meleagris and *M. gallopavo* species **[1].**

Bird species have adapted to various habitats due to the wide variety of accessible food resources. Birds' beaks, tongues, and palates have developed differently **[2]**. The tongue, which plays a major role in food intake and swallowing, exhibits significant morphological variations as a reflection of various ways of life **[3].** The morphological feature of avian tongue varies in shape, epithelization and degree of keratinization according to feeding habits **[4,5].** Various modifications in the avian tongue lead to difference in tongue mobility and the ability in manipulating food in the beak cavity **[5].**

Other characteristic features of the bird's tongue that include the distinct median sulcus, convex lateral parts, different types of papillae, distribution of lingual glands and the crest of the backward giant conical papillae between the tongue's body and root must be taken into consideration **[5,6].**

Many recent studies **[7,8,9,10]** aimed at presenting the morphology of the avian oropharynx and tongue, and their adaptations to the environment and food are taken in consideration.

The goal of this work is to add to existing histological based investigations on the domestic turkey tongue, as well as to give resources for future scientific research on

other morphological features of the tongue of domestic turkey.

## 3. Materials and Methods

### 3.1. Experimental animal:

Tongues from 6 apparent healthy adult male domestic turkeys *(Meleagris Gallopavo)* were collected for the present study. The birds were obtained from Giza and Monib market, Egypt.

### 3.2. Tissue preparation for histological and histochemical procedures:

The tongue was dissected out. Samples for light microscope were fixed in 10% neutral buffered formalin, dehydrated and embedded in paraffin wax. Paraffin blocks were sectioned at 4-5µm. Sections from each block were stained using the following methods: Delafield´s iron haematoxylin and eosin, Masson´s trichrome stain and Alcian blue 2.5pH. **[11]**. Photomicrographs were captured using a (Leica Microsystems, Switzerland) in Faculty of Veterinary Medicine, Cairo University.

### 3.3. Ethical approval:

This research was conducted under ethical protocol approved by the animal experimental local ethics committee at Cairo University. Protocol No. Vet CU16072020193

## 4. Results

Light microscopical investigation revealed that the tongue was divided into three parts: apex, body, and root.

The tongue had two surfaces: dorsal and ventral surfaces. The dorsal surface lined with thick stratified squamous epithelium keratinized with highly branched papillary bodies. On the other hand, the ventral surface was thinner than the dorsal one and lined with thin stratified squamous epithelium with keratin (Fig.1A). There were filiform papillae appeared at the dorsal surface at the level of the body.

The epithelial lining rested on subepithelial dense irregular fibrous connective tissue containing blood vessels, lymph nodules, and nerve endings along the length of the tongue (Fig.1B)

At the level of the root the subepithelial layer had circular arranged skeletal muscle mass dorsal to the spongy bone and two longitudinally arranged skeletal muscle masses in the mid ventral (Fig.1C). Moreover, the ventral surface showed a dome like structure (Fig.1D).

The core of the tongue had a special lingual structure appeared as a cord like in the middle of the tongue. This structure began in apex as a hyaline cartilage surrounded with perichondrium (Fig. 2A) then changed into a fibrocartilage in the body (Fig. 2B& 2B1) which continued posteriorly as two cords like structure of spongy bone “os entoglossum” (Fig. 1C).

The lingual salivary glands appeared at the body part on both sides of the special lingual structure. They occurred in clusters close to the fibro-cartilage in the body part referred to as anterior salivary glands (Fig.2B). While those close to the spongy bone in the root of the tongue referred to as posterior salivary glands (Fig.2C). They were simple tubulo-alveolar glands, encapsulated by a collagenous connective tissue capsule (Fig.2D). These clusters increased toward the root. Moreover, histochemical studies with Alcian blue (pH 2.5) revealed a positive reaction (Fig.2E).

## 5. Discussion

Bird species have adapted to various settings due to the range of available food options **[2]**. Birds' beaks, tongues, and palates have evolved differently as a result. The tongue, which plays a vital role in food intake and swallowing, exhibits considerable morphological variances as a reflection of diverse life patterns **[3]**. As a result, the microscopic anatomy of the avian tongue, like that of mammals, varies

dramatically depending on feeding patterns **[12]**.

There were two surfaces to the tongue: dorsal and ventral. Thick stratified squamous epithelium keratinized with heavily branching papillary bodies lined the dorsal surface. The ventral surface was thinner than the dorsal one. This agrees with **[13]** in the Chukar partridge, and **[14]** in guinea fowl. On the other hand, **[15]** in the emu found both surfaces are covered with non-keratinized stratified epithelium. The degree of extreme keratinization, particularly on the dorsal lingual surface may be indicative of the association between the seed diet and mechanical effect as documented by **[16]** in other avian species.

Along the length of the tongue, the epithelium lining rested on subepithelial dense irregular fibrous connective tissue containing blood vessels, lymph nodules, and nerve terminals in domestic turkey this agrees with the results of **[15]** in emu.

Light microscopical investigation of the tongue of domestic turkey showed that the core comprised a cord-like structure in the center. This structure began as a hyaline cartilage surrounded by perichondrium in the apex, then transformed into a fibrocartilage in the body, and continued posteriorly as two cords like the spongy bone "os entoglossum". **[13] Erdoğan et al**., in the Chukar partridge described the paraglossum, a hyaline cartilage structure that ran from the lingual apex to the root. Moreover**, [17]** in stork, and **[14]** in guinea fowl found a hyaline cartilage started from the lingual apex section, extending toward caudal. This cartilaginous tissue was ossified in the direction of the corpus region.

In domestic turkey, light histological observation revealed that the lingual salivary glands were simple tubulo-alveolar glands. Although tubular glands are the most prevalent, simple branched tubulo-alveolar, alveolar, compound alveolar glandular structures, serous, and sero-mucous glands can also be observed **[13,15,18,19]** based on the varied sorts of secretions required by different poultry species. Lingual glands were encapsulated by a collagenous connective tissue capsule and mucous secreting this matches the description of **[15]** in emu. **[20]** in quail and **[13]** in the Chukar partridge described the lingual salivary glands as clusters in the body part referred to as anterior salivary glands and those in the root of the tongue referred to as posterior salivary glands same as the results of domestic turkey in this study.

## 6. Conclusion

The purpose of the research is to study the histological, and histochemical features of the tongue of domestic turkey. These features are presence of lingual salivary gland, special lingual structure “hyaline cartilage which changed into fibro-cartilage and continued posteriorly as spongy bone “os ontoglossum”.

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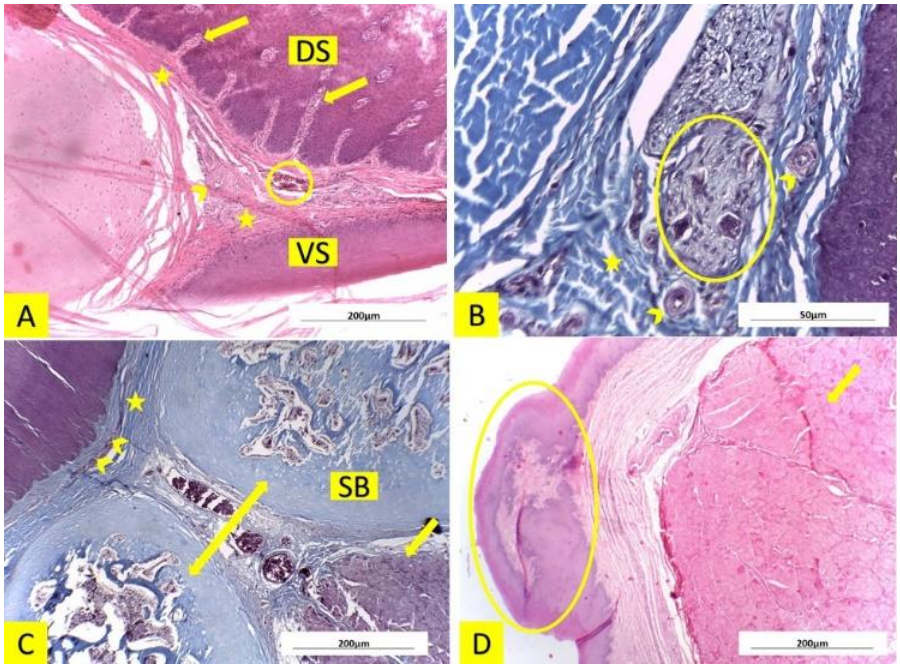


**Fig. (1):** Histological micrograph of the tongue of domestic turkey showing: (A): dorsal and ventral surfaces (DS, VS) at the level of the tongue apex. The epithelial lining of the dorsal surface has deep and branched papillary bodies (arrow). The subepithelial connective tissue (star) containing lymph nodules (circle), and small blood vessel (chevron) (H&E, X100). (B): subepithelial dense irregular fibrous connective tissue (star) containing small blood vessels (chevrons), and nerve ending (circle) (Masson's trichrome stain, X400). (C): the root with os entoglossum (left-right arrow) spongy bone (SB). Two longitudinally arranged skeletal muscle masses (arrow) and few circularly arranged (chevrons) (Masson's trichrome stain, X100). (D): dome shaped structure (circle) (H&E, X100).

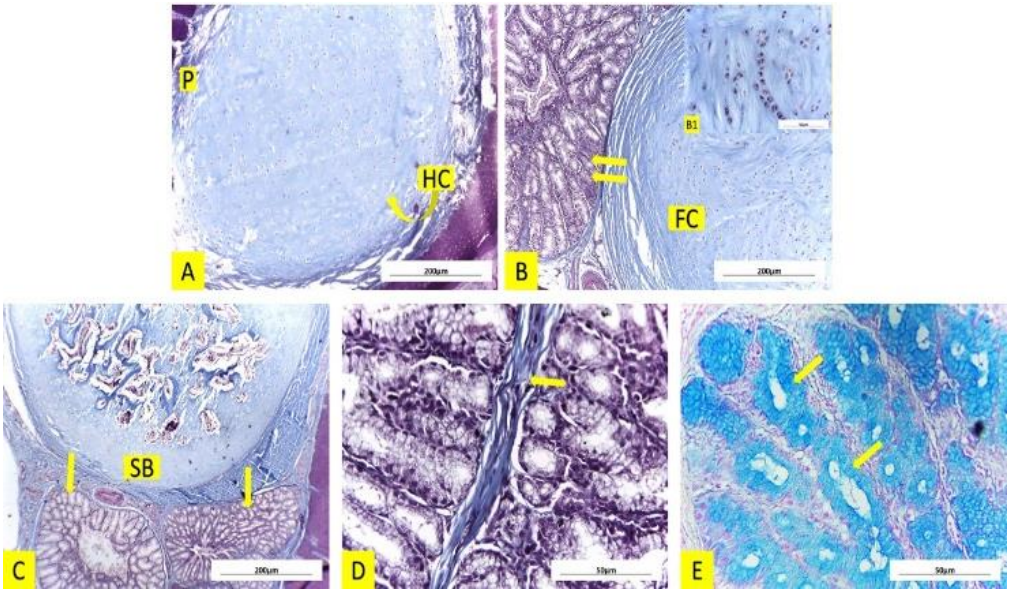


**Fig. (2):** Histological micrograph of the tongue of domestic turkey showing: (A): the apex with hyaline lingual structure (HC) surrounded with perichondrium (P) (H&E, X100). (B): the body with lingual salivary glands (double arrow) and fibrocartilage (FC) (H&E, X100). (B1) a high magnification for the fibrocartilage (H&E, X400). (C): the root with salivary lingual glands (arrow) beside the os entoglossum spongy bone (SB) (H&E, X100). (D): salivary lingual glands surrounded with connective tissue capsule (arrow) (Masson's trichrome stain, X400).(E): Alcian blue positive reaction with acinar cells of the lingual salivary glands (arrow). (Alcian blue pH 2.5, X400)