

# Morphological and Morphometrical Study of the Tongue with Microscopic structure of Lyssa in Local Adult Dogs (*Canis familiaris*)

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## Abstract

The current study aimed to investigate the morphological and morphometrical features of the tongue of local adult dogs (*Canis familiaris*). Five heads of clinically healthy dogs were collected and used in this study in laboratory of Department of Anatomy and Histology in Veterinary Medicine College/University of Baghdad. The current study showed that the tongue was fixed through the extrinsic muscles which include styloglossus, hyoglossus, genioglossus and by four mucous membrane folds; two palatoglossal, single glossoepiglottic and frenulum linguae. A gross morphological feature of tongue revealed it consists of three parts apex, body and root. Their length, width and thickness were recorded and listed in table. The dorsal lingual surface appeared rough by presence of different types lingual papillae including; circum vallate, conical, foliate, filiform and fungiform. Gross parameters of lyssa including weight, length and width were listed. Current study showed the dog lyssa appeared "pinkish white" color structure forever the median plane of ventral surface with more or less rod shape. Histologically, lyssa made up entirely of adipose tissue enveloped by collagen fibers in the cranial and caudal ends, while it formed of striated muscle bundles lies dorsally to the adipose tissue in the middle part of it.

## INTRODUCTION

The *Canis familiaris* belong to: Family: Canidae, Genus: *Canis*, Species: *Canis lupus* (Bradley et al., 2019). The most phenotypically diverse mammal species known is the domesticated dogs (*Canis familiaris*). Variation in conformation and size among dog breeds increase that among species in dog family Canidae (Wayne, 1986). Differences in behavior and physiology also are considerable (Coppinger and Coppinger, 2001). Tongue is a mobile muscle coated by mucus membrane and kept by hyoid bone caudally side and cranially by the mandible

and lower jaw. Many actions as reception, deglutition and mastication, are fulfilled by a tongue (Ebrahimi-saadatlou, 2011). It is essential for grasping food, bringing it to the mouth, and breaking it down into bite-sized pieces in cooperation with the teeth so that a food bolus is formed that is ready for ingesting and sensation with the taste (Samuelson, 2007).

Lyssa body showed cord-like structure structured of fibrous tissue with skeletal muscle as well as adipose tissue, envelops by connective tissue sheath. This structure is found in carnivores, camels, and pangolin and

porcine located in the ventral part of lingual apex mainly in the carnivores and pangolin (Besoluk et al., 2006; Prapong et al., 2009). Lyssa length about (4 - 5) cm in large dogs (Getty, 1975), while Shoeib et al. (2014) reported length of lyssa ranged between (3 - 4) cm of the mixed breed or mongrel dogs. The lyssa shape differs from rod-like to J-shape according to dog species. This study aimed to describe the morphological and morphometrical features of the tongue with microscopic morphology of lyssa in local bread adult dogs (*Canis familiaris*).

## Methodology

### Collection of specimens

Current study carried out on (ten) clinically healthy local adult dog (*familiaris*) and done in laboratory of Department of Anatomy and Histology, Collage of Veterinary Medicine - University of Baghdad. All animals were weighing (21- 23) kg. The heads were obtained from local supplier in Baghdad city. The collected dogs were anaesthetized intramuscularly with 0.10 ml/kg xylazine (as HCl) and 10 mg/kg ketamine (as HCl) and then killed by exsanguinations from common carotid artery (right) outwardly regaining consciousness. Five specimens used for the gross anatomical features and parameters. The gross morphological study including the location and relationships of the tongue in situ were recorded and photographed using digital camera as well as using dissecting microscope with digital camera SP-600UZ (12) mega pixel. Then after tongue removal from mouth cavity, the morphometrical measurements are recorded including; tongue total length and volume. The length, width and thickness of each part of the (apex, body and root) using the vernier caliber for the length, width and thickness (Abumandour et al.,

2022), while the water displacement for the volume and the weight by digital sensitive balance (Mirhish and Kareem, 2015). All types of papillae of the tongue surface were examined and photographed by using the dissecting microscope with digital camera (Al-Rikabi, 2015; Kadhim, 2018). Lyssa was removed from the lingual ventral surface of collected tongues; it's described macroscopically and measured by using the sensitive balance for its weight and verier caliber for measuring the length and width. For microscopic examination a specimens of lyssa from( five) dogs tongue from the two ends and middle of lyssa were fixed into 10% neutral buffered formalin, then it dehydrated, cleared, and embedded in paraffin blocks. Cut in (5-6- $\mu$ m) thickness in transverse sections (Khaleel et al., 2022) and stained with H&E, and Masson Trichrom stains (Kadhim and Khaleel, 2021; Khaleel and Alkhazraji, 2022). Histological sections of lyssa are examined and Photographed using light microscope in (4X and 10X) magnification (Nikon E-400 attached with DS-5M digital camera.

### Statistical Analysis

All values are presented as Mean  $\pm$  Standard Error (Al-Gharban, 2017).

## Results and Discussion

### Gross anatomy of the tongue

Tongue in dogs appeared as thin, long and a flattened muscular organ with colored pinkish. Lies on floor of mouth cavity and partly in the anterior wall of pharynx oral portion, extended rostrally and fills oral cavity when the lower and upper jaw are closed, it constructed of (apex, body and root), as observed in cattle by (Jabur and Atyia, 2023). The longitudinal median groove sulcus (medianus linguae) is present in the central part of the lingual dorsal

surface. It's extended between the apex and the root divided the tongue into two symmetrical parts (Fig. 1). As reported by (AL- Mahmodi, 2016) in rabbits. Total mean weight of the tongue, relative weight, Percentage, volume and the total length were listed in (Table 1).

The apex or rostral free region showed as rounded with wide margin tip (Fig. 1). The lateral surfaces made up from meeting of the dorsal and ventral surfaces (Fig. 2, 3). The ventral surface contains Cord-like structure "lyssa" it's located along the median plan of lingual apex (Fig. 2, 3, 4). Rostrally, it starts (2-3mm) away from the tongue tip to the frenulum linguae. The rostral first third of lyssa lies superficial just under lingual mucous membrane (Fig. 4), while the caudal (two) thirds of lyssa were seen deeply among lingualintrinsic muscles (Fig. 3, 4). The rostral part of lyssa was easily visible and palpable in the median plane of lingual free tip (Fig. 3). Lyssa structure showed as a fusiform cord, long tapered to thread caudal end with the septum linguae in level of the frenulum with shorter pointed cranial end (Fig. 4, 5). Similarly to that recorded on Egyptian cats (El- Bably and Tolba, 2015).

Mean weight, length and width of lyssa were listed in (Table 2). Mean length, width and thickness of apex (Table 1). The measurements were higher than those of (El-Bably and Tolba, 2015) on Egyptian cats.

Lingual body found as the largest and longer flat part extended between lingual apex and root, with four surfaces, dorsal, ventral and (right and left)lateral surfaces (Fig. 1, 2), as observed in adult civet cats by (Sarma et al. 2009).

Mean body length, width with the thickness of the lingual body was listed (Table 1), while

(El-Bably and Tolba, 2015) reported average width and thickness relatively same average in Egyptian cats. The tongue root was the latest and shorter part, lies caudally to the body and slopes ventrally and caudally to epiglottis base. Its dorsal surface appeared rough with different types papillae (Fig. 1, 6). Tongue root was anchored with the soft palate by palatoglossal fold, pharynx by the glossopharyngeal fold and hyoid bone by the lingual process that was a small projection rostrally from the body of the hyoid bone. Finally, it attached with the epiglottis base by a glossoepiglottic fold (Fig. 6). Mean root length, width and thickness (Table 1). The measurements were less in Egyptian cats and about 1.06 cm, 1.73 cm, 1.01 cm for length, width and thickness respectively for root (El-Bably and Tolba, 2015). The lingual dorsal surface observed pinkish in color, rough and contains the median groove extended with the longitudinal axis of the tongue from the apex to the root and contains many types of papillae (Fig. 7). Same as reported by (Alan, 2014) in red fox.

The tongue ventral surface was completely filled-up the mouth cavity floor and rest on it, appeared bright, pinkish color with few scattered filliform papillae present in the ventral surface of apex (Fig. 2, 3, 8), Similar finding was observed by (Besoluk et al. 2006) in domesticated cat and dog. Lateral surface separates the dorsal and ventral surface of the tongue. These two lateral surfaces meet rostrally to form the lingual tip, and appeared narrow at the apex then increase in its width toward the root where become more widens (Fig. 2, 3). There were different types of papillae present on the lingual dorsal surface.

Filiform papillae were the first type that observed very dense on lingual apex and body (Fig. 9, 10) then decrease in its density or

absent at the root caudal portion (Fig. 11), similar finding in goats by (Jabur and Atyia, 2023). Filiform papillae have velvety-like appearance, with pointed end caudally directed with broad base (Fig. 8, 9, 10, 11). Similarly to that observed in buffalo by (Al-jebori, 2007).

The second type was a conical papillae, numerous, conical shape and pointed projections, oriented caudally toward the tongue posterior part and present on the root dorsal surface on the dorsal sides of foliate papillae (Fig. 11, 12, 13) and the caudo-lateral borders of vallate papillae of the root (Fig. 11, 14), similar description was reported by (Miller et al. 1996) in dogs. Third type of papillae was the fungiform papillae, which observed as a small, clear convex surface, dome-like shape structures with slightly elevation on the tongue surface and distributed scattered between filiform papillae on the dorsal and lateral tongue surfaces (Fig. 9, 10, 11, 12, 15, 16). This result was parallel to that found in bovine by (Tabata et al., 2006).

The foliate papillae was the fourth type found on the lateral side, rostrally to palatoglossal fold; on root ventrolateral margin of commencement level of lingual body, appeared as a small leaf-like shaped in one row in each side (Fig. 12, 13). Same papillae were recorded in fox and dog by (Emura, 2006). Circum vallate papillae was the last type of the papillae observed in the lingual caudal part at the junction between the lingual body and appeared as circular and its periphery was surrounded by a moat, the anterior two papillae were without anular pad that constructed the papillae shape, while the caudal two papillae were with anular pad (Fig. 11, 14). This result was disagreeing with (Ojima et al. 1997) who describes these

papillae as an ovoid, elongated ovoid and circular shaped in cats.

Vallate papillae number was two in one row it is set up in its hierarchy on each side in an inverted V- form (Fig. 11). These papillae were considered as the largest papillae among other lingual papillae. (Alan, 2014) reported there were (two) vallate papillae in the red fox tongue.

#### Histological study of lyssa

The histological structure of the transverse sections of lyssa of the cranial part of was entirely made up from adipose tissue enveloped by a thick fibrous connective tissue sheath constructed of collagen fibers (Fig. 17).

While from the middle toward the caudal parts it was formed by adipose tissue and striated muscle bundles lei dorsally to the adipose tissue with blood vessels and nerve fibers, enveloped by a thick connective tissue capsule of mostly collagen fibers scattered striated muscle fibers are merged with the adipose tissue (Fig. 18). These finding parallel with (Besoluk et al. 2006; Shoeib et al. 2014).

**Table 1: Anatomical parameters of the tongue in dog**

Parameter	Value
Weight of animal (kg)	21.50 $\pm$ 0.24
Weight of tongue (gm)	77.33 $\pm$ 0.49
Relative weight (gm)	0.0035
Percentage	0.0035%
Volume of tongue (ml)	81.33 $\pm$ 0.49
Total length of tongue (cm)	13.58 $\pm$ 0.11
Length of apex(cm)	4.03 $\pm$ 0.06
Length of body(cm)	5.83 $\pm$ 0.10
Length of root(cm)	3.68 $\pm$ 0.06
Width of apex (cm)	2.43 $\pm$ 0.03

Width of body (cm)	3.83 ±0.04
Width of root (cm)	3.56 ±0.04
Thickness of apex (cm)	0.294 ±0.01
Thickness of body (cm)	1.23 ±0.02
Thickness of root (cm)	2.16 ±0.03

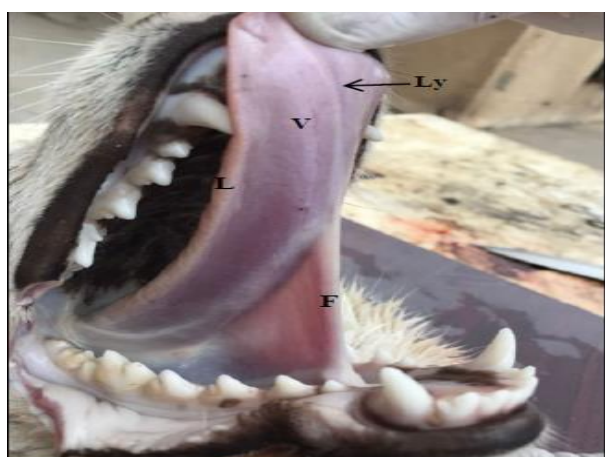
**Table 2: Anatomical parameters; weight, length and width of lyssa in Dog**

Parameters	Mean ± SE
Weight of lyssa (gm)	0.11 ± 0.010
Length of lyssa (cm)	5.40 ± 0.052
Width of lyssa from med (cm)	0.322 ± 0.004

**Fig. 1: Photograph of gross anatomy of the dorsal surface of the dog tongue shows: A- Apex, B- Body, R- Root, M- Median longitudinal groove**



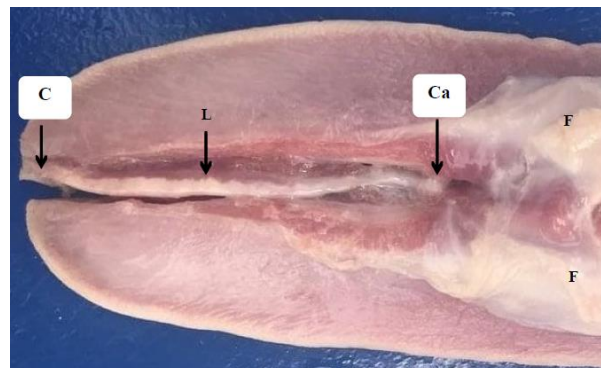
**Fig. 2: Photograph of gross anatomy of the dog tongue shows: L- Lateral surface, F- Frenulum linguae, V- Ventral surface, Ly- Lyssa**



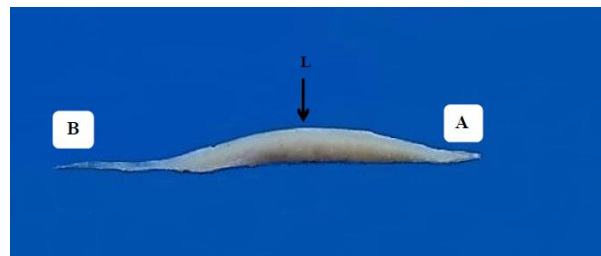
**Fig. 3: Photograph of the gross anatomy of the dog tongue shows: A- Ventral surface, B- Lateral surfaces, C- Lyssa, D- Frenulum linguae**



**Fig. 4: Photograph of gross anatomy of the ventral surface of the tongue in dog shows: L- lyssa body, F- Frenulum linguae, C- Cranial end, Ca- Caudal end**

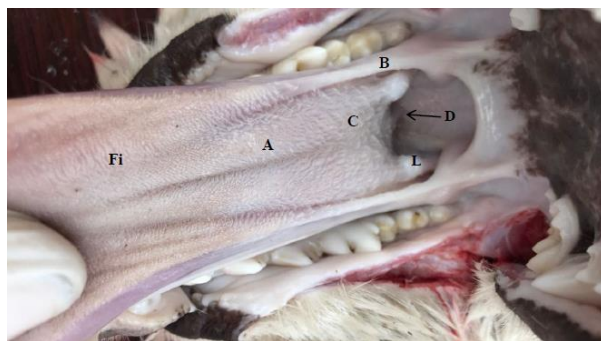


**Fig. 5: Photograph of the gross anatomy of lyssa in the dog tongue shows: A- Cranial end, B- Caudal end, L- Lyssa body**

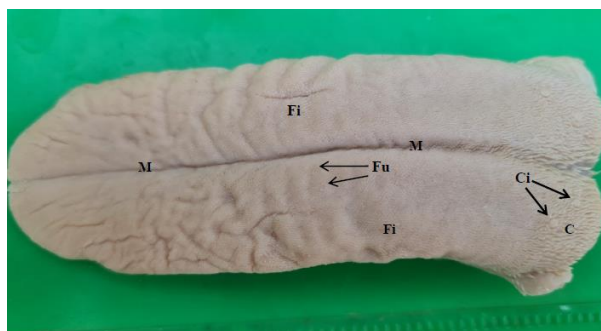




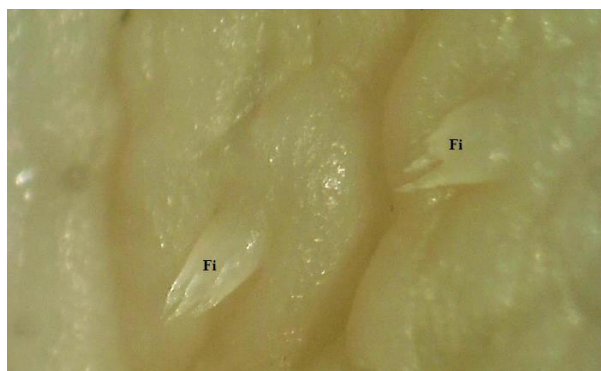
**Fig. 6:** photograph of the anatomy of tongue root in dog shows: A- Root. B- Palatoglossal fold, C- Conical papillae D- Glossoepiglottic fold Fi- Filiform papillae, L- Lingual process of hyoid bone



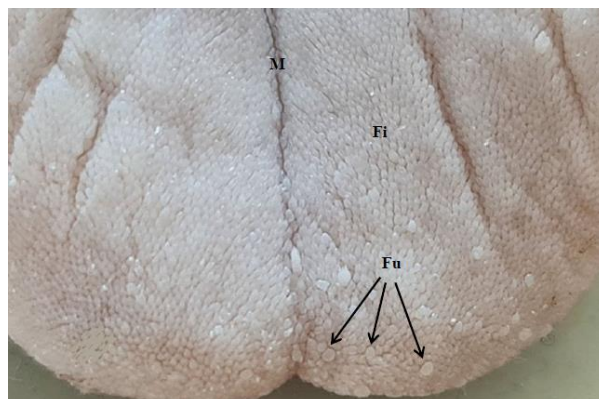
**Fig. 7:** Photograph of dorsal surface of the dog tongue shows: Fi- Filiform papillae. Fu- Fungiform papillae, Ci- Circum vallate papillae, C- Conical papillae, M- Median longitudinal groove



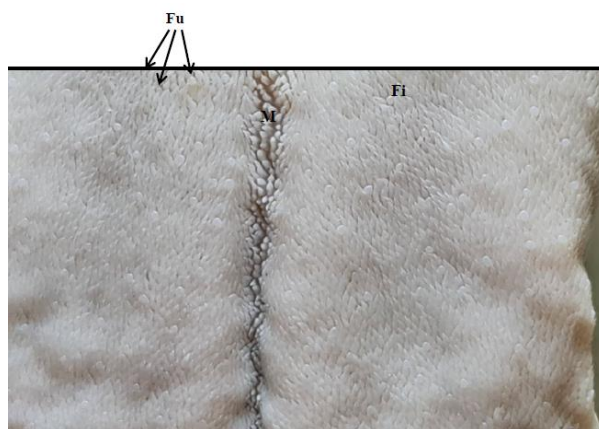
**Fig. 8:** Photograph of the gross anatomy of the ventral surface of the tongue apex in the dog shows: Fi- Filiform papillae (Dissecting microscope 4X)



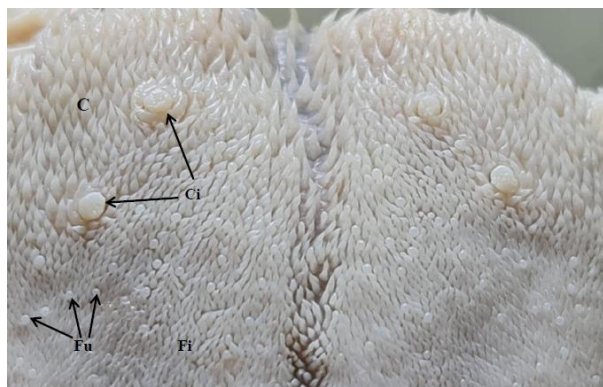
**Fig. 9:** Photograph of the gross anatomy of the dorsal surface of the tongue apex in the dog shows: Fi-Filiform papillae, Fu-Fungiform papillae, M- Median longitudinal groove (Dissecting microscope 1.5X)



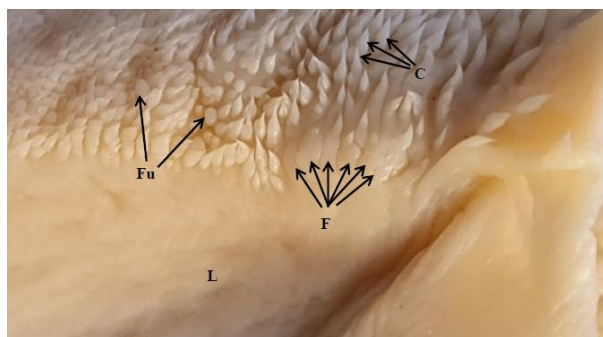
**Fig. 10:** Photograph of the dorsal surface of the tongue body in the dog shows: Fi- Filiform papillae, Fu- Fungiform papillae, M- Median longitudinal groove (Dissecting microscope 1.5X)



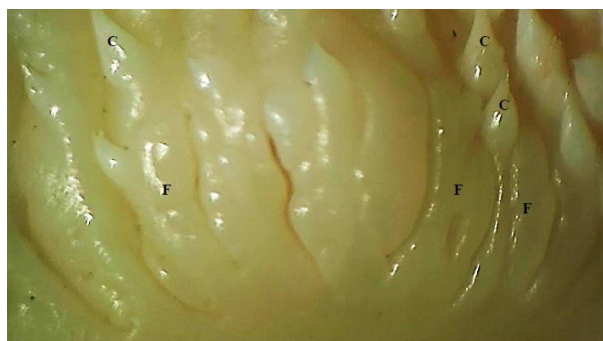
**Fig. 11: Photograph of the gross anatomy of the dorsal surface of the tongue root in the dog shows: Fi-Filliform papillae, Fu-Fungiform papillae, C- Conical papillae, Ci- Circum vallate papillae (Dissecting microscope 1.5X)**



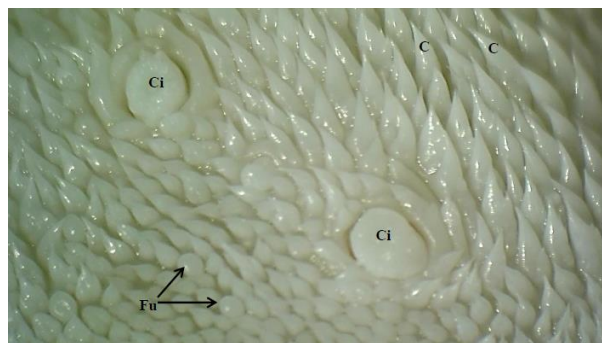
**Fig. 12: Photograph of the gross anatomy of the tongue root in dog shows: Fu- Fungiform papillae, F- Foliate papillae, C- Conical papillae, L- Lateral surface**



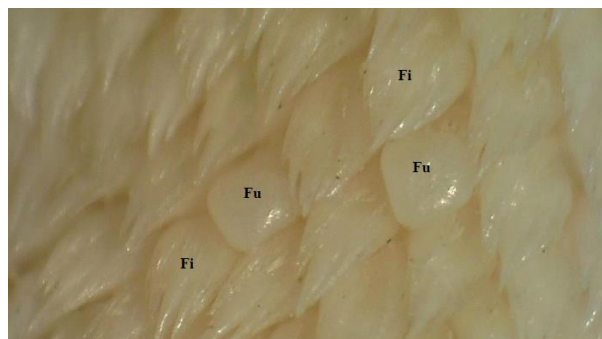
**Fig. 13: Photograph of the gross anatomy of lateral surface of the tongue root in dog shows: F- Foliate papillae, C- Conical papillae (Dissecting microscope 4.5X)**



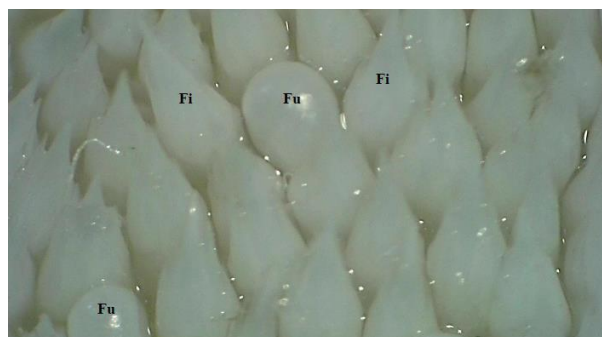
**Fig. 14: Photograph of the gross anatomy of the tongue root in dog shows: C- Conical papillae, Ci- Circum vallate papillae, Fu- Fungiform Papillae (Dissecting microscope 2.5X)**



**Fig. 15: Photograph of the gross anatomy of the tongue body in dog shows: Fi- Filiform papillae, Fu- Fungiform papillae (Dissecting microscope 4.5X)**

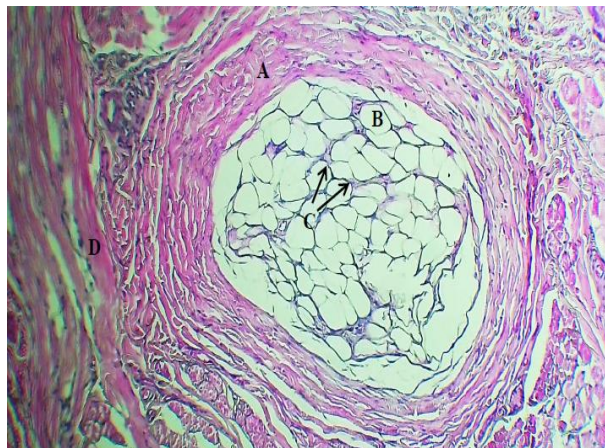


**Fig. 16: Photograph of the gross anatomy of the dorsal surface of tongue body in dog shows: Fi- Filliform papillea, Fu- Fungiform papillae (Dissecting microscope 4 X)**

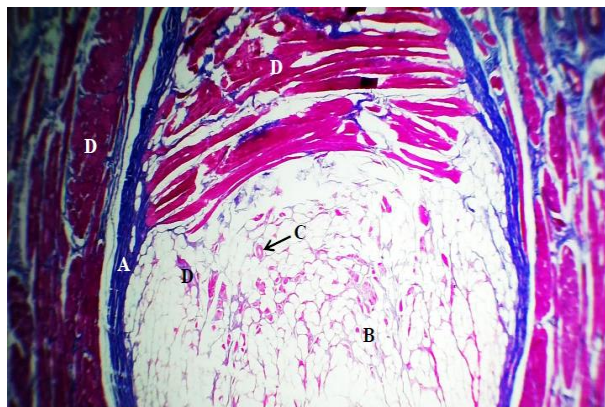




**Fig. 17: Histological section of the cranial part of lyssa in the lingual apex in dog: A- Connective tissue capsule, B- Adipose tissue, C- Collagen fibers, D- Muscle (H&E), (100X)**



**Fig. 18: Histological section of middle part body of lyssa of lingual apex in dog: A- Collagenous connective tissue capsule, B- Adipose tissue, C- Blood vessel, D- Striated Muscle Fibers (Massons Trichrome) (40X)**



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