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Research Article

Macromorphological Study on the Tongue of the Red Fox *(Vulpes vulpes)* with Special Reference to Its Arterial Supply

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ABSTRACT

The morphology of the tongue and its arterial supply were demonstrated on eight adult healthy foxes of both sex. The gross morphological features of three parts of the tongue; *viz*., apex, body and root of the tongue and their length, width and thickness were recorded. The dorsum of the tongue was rough due to the presence of lingual papillae namely; vallate, conical, foliate filiform and fungiform papillae. The lingual fixation was achieved by its extrinsic muscles; styloglossus, genioglossus and hyoglossus in addition to the presence of four mucous membrane folds; paired palatoglossal, single glossoepiglottic and frenulum linguae. The arterial supply of the fox tongue was by the lingual artery which arouse from the external carotid artery. The lingual artery detached dorsal collateral and middle lingual branches and continued as a deep lingual artery.

Key words: Red fox, Tongue, Morphology, Arterial supply, Anatomy

INTRODUCTION

The present study describes the gross anatomical features and the arterial supply of the tongue of adult Red Fox (*Vulpes vulpes*). The Red Fox (*Vulpes vulpes*) is the largest of the true foxes, as well as being the most geographically spread member of the Carnivorae where they distributed from the Arctic Circle to North Africa. It is dangerous for native mammals and birds. It is considered as one of the most abundant carnivore and most adaptable mammals in Egypt that having been able to survive in a variety of habitats as mentioned by (Basuony et al., 2005). Fedriani et al. (2000) recorded that the Foxes are omnivores and mostly eat small mammals, birds, reptiles, amphibians, fish, insects such as dung beetles, beside the grasses, fruit and eggs. Though lot of work had been carried out on blood supply of mammalian tongue, Viz., in giraffe (Brien *et al.*, 2016), in conjoined twin cattle (Frąckowiak *et al.*, 2016), in goat (Jabbar, 2014), in small oribi (Zdun *et al.*, 2014), in sheep and dog (Rashwan *et al.*, 2011), in Nellore Bos indicus, (Ferreira *et al.*, 2009), in goat (Daghash, 2008), in monkeys (Pizzutto *et al.*, 1989), in dog (Irifune, 1980) . There is paucity of literature available on gross morphometric details in tongue of red fox especially its arterial supply. Hence, the present study is aimed to carry out the morphometric details about the tongue of Red fox.

MATERIALS AND METHODS

Eight adult healthy Red Foxes (Vulpes vulpes) of both sexes were used in this study. Specimens were brought by contractor for animals in college of Faculty of Veterinary Medicine, Cairo University. Before exsanguinations, the foxes were anaesthetized by chloroform inhalation followed by the injection of heparin (Cal Heparin, 5000 I.U.) in thigh muscles to prevent blood clotting. Each specimen was exsanguinated through the common carotid arteries and left to bleed for about fifteen minutes. The whole animals were carefully flushed through the common carotid arteries with saline solution. Three of samples, Latex neoprene 60% colored with red Rottring ink (Neumaeyer, 1932) was injected into the common carotid arteries using a Nelaton catheter of size 8F to 10F (Ma Medical company). The specimens were then preserved in 10% formalin, 4% phenol and 1% glycerin for three days before dissection. The specimens were photographed using Olympus digital camera SP-600UZ 12 mega pixel. Other five specimens were dissected for gross morphological studies and biometrical records were made by using vernier caliper. The Nomenclature used in this work was adopted according to the Nomina Anatomica Veterinaria (2005).

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RESULTS

Morphology

Lingua: The tongue (Fig.A.1,2,3,5,6/T) was rosy red and measured about 8.22 cm in its length (Graph 1). It oriented in the oral cavity proper by two surfaces; the dorsum of the tongue which was in contact with the hard palate (Fig. A.2,5,6/HP) and the ventral one which completely filled- up the floor of the mouth cavity. It consisted of three parts; the apex, the body and the root.

Radix linguae: The root of the tongue (Fig. A.1,2,3,8/Tr) occupied the caudal third of the corresponding organ and attached caudally to keratohyoid, basihyoid and epihyoid parts of the hyoid bone (Fig. A.6,7) and epiglottis by glossoepiglottic fold (Fig. A.3/GE) as well as it fixed laterally to the soft palate by two palatoglossal folds (Fig. A.1,2,3,8/PG). It measured about 2.71 cm in its length (Graph 1), the width is 2.39cm (Graph 2) and the thickness is 1.14 cm (Graph 3).

Corpus linguae: The body of the tongue (Fig. A.1,2,3,8 /TB) was thick fleshy wide, long and measured about 4.25 cm. It oriented by dorsal, ventral and two lateral borders; the dorsum linguae denied to Fossa linguae and torus linguae. The ventrum linguae was connected via mucous membrane fold called a frenulum linguae (Fig. A.2,3/FL) which extended from the middle of the ventral surface of the body of the tongue and measured about 2.28 cm (Graph 1) in its length. The tongue body was classified according to the density of the tongue papillae into rostral and caudal parts. The caudal part (Fig. A.4B) measured about1.98 cm in its width (Graph 2) and thickness was 1.24cm (Graph 3). The rostral part (Fig. A.4D) was represented the middle part of the tongue, its width was 1.76 cm (Graph 2) and the thickness ranged from 0.83 cm (Graph 2).

Apex linguae: The apex of the tongue (Fig.A.1,2,3,5,6,8 /TP) was a thin wide compressed dorsoventrally. It margined rostrally by the wide lingual tip which was rounded, its ventral border occupied the caudal surface of the incisor teeth and measured about 0.83, 1.66 and 0.31 cm in its length (Graph 1), width (Graph 2) and thickness (Graph 3) respectively. The vicinity of the ventral surface of the tongue apex was distinguished by the presence of lyssa like structure (Fig. A.8/Ll). The former structure was a thin white rod - shape capsulated tissue and presented along the median plane. Its length measured about 2.36 cm (Graph 1) and the thickness was 0.34 cm. the dorsum of tongue apex characterized by presence of shallow median groove called sulcus linguae (Fig. A.1,3/SL) which extended from the rostral end of the rostral part of the body tongue till the dorsal vicinity of the tongue apex and measured about 2.34 cm (Graph 1) in its length. The apex of the tongue measured about 2.08 cm (Graph 1), 1.97 cm (Graph 2) and 0.52 cm (Graph 3) in its length, width and thickness respectively.

Dorsum linguae: The dorsum of the tongue was rough because of its orientation by five types of lingual papillae that observed on the dorsal surface of the tongue. These papillae were vallate, conical, foliate, filiform and fungiform papillae. The vallate papillae (Fig. A.4A/Va) were circular (in 2 specimens are oval in shape) and presented in the caudal third of the tongue at the junction between the body and root. They were depressed centrally and their periphery was surrounded by a groove that constructed the shape of the papillae. The number of vallate papillae varied from 2-3 symmetrically in one row (in 2 specimens were 3 asymmetrically) on each side of the tongue where it configured in its hierarchy as an inverted V-shaped structure. The former papillae considered as the largest papillae in diameter and measured about 0.21 cm. The conical papillae (Fig. A.4A, 4B/Co) were numerous in number and appear as pointed projections and occupied the dorsal aspects of the foliate and the caudolateral borders of the vallate papillae at the root of the tongue. The foliate papillae (Fig. A.4B/Fo) were two rows of alternative leaf- shape that locate rostral to the palatoglossal fold, on the ventrolateral margin of the root at the level of the commencement of the tongue body. The filiform papillae (Fig. A.4C/Fi) were distributed on the dorsum of the tongue where they were numerous at the dorsolateral aspect of the caudal part of the body and few in number on the dorsal border of the rostral part of the body and the apex of the tongue. The former papillae were caudally directed, with pointed end except the tip of the tongue. The fungiform papillae (Fig. A.4C,4D/Fu) were small clear button-shaped and distributed on the dorsum linguae insinuated between the filiform ones in the middle of the tongue body. They were white in color and ranged from 25 to 30 in number.

The muscles of the tongue were divided into intrinsic and extrinsic muscles, the extrinsic muscles were arranged into three pairs; styloglosuss, hyoglossus and genioglossus. The styloglossus (Fig. A.5,6/SG) was a long ribbon-shape muscle which originated from the lateral aspect of the upper caudal third of the styloid process of the hyoid bone (Fig.A.6,7/SH) laterally to the body and the root of the tongue and directed rostroventrally till the level of the ventrolateral border of the middle of the tongue where it inserted to retract and elevate the corresponding organ. The hyoglossus (Fig. A.5,6/HG) was a thin small flat muscle that emanates from the lateral border of the thyrohyoid bone (Fig. A.6,7/TH). It passed obliquely rostrodorsally below the rostral third of the styloglossus muscle till inserted to the root of the tongue where it lies medially to the tongue. It retracts and depresses the tongue caudally. The genioglossus (Fig. A.5,6/GG) was thin large long muscle and originated from the caudal border of the mandibular symphysis and the medial surface of the mandibular body (Fig. A.6/M) and their fibers passed obliquely caudodorsally and bounded medially by the geniohyoideus and laterally by the medial aspects of the rostral third of the styloglossus and the hyoglossus muscles.

DISCUSSION

Morphology

The tongue fox was consisted of three parts; the apex, the body and the root. These results were similar to AL-Mahmodi (2016) in male rabbit, El- Bably and Tolba (2015) in Egyptian cat, Jabbar (2014) in goat, Murad, Hassan and Abid (2010) in ram Sarma *et al.* (2009) in the

adult civet cats, Besoluk *et al*. (2006) in the domesticated cats and dogs, Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat, Sisson *et al*. (1975) in the dog, Kubota (1967) in the elephant and Habel (1975) in the ox and sheep.

In examined foxes, the tongue was rosy red and its apex had a thin wide compressed dorsoventrally. It margined rostrally by the wide rounded lingual tip. These statements were similar to AL-Mahmodi (2016) in male rabbit, El- Bably and Tolba (2015) Egyptian cat, Jabbar (2014) in goat, Murad *et al.* (2010) in ram, Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat and Sisson *et al*. (1975) in the dog and fox. On the other hand**,** the apex of the tongue was pointed as said by Habel (1975) in cattle, free flattened with a notch at the centre as per Lahkar *et al*. (1985) in the goat, spatula shaped as Sisson *et al*. (1975) mentioned in the horse, blunt pointed as said by Prakash *et al*. (1980) and Dhingra *et al*. (1979) in buffalo and nearly spatula shaped with undulating lateral edges in the Himalayan black bear as Sarma *et al*. (2003) described.

In our study, the biometric records of the root of the tongue measured about 2.71 cm in its length, the width was 2.39cm and the thickness is 1.14 cm. While El- Bably and Tolba (2015) in Egyptian cats recorded that the measurements of the length, width and thickness of root of the tongue were 1.06 cm, 1.73 cm and 1.01 cm respectively. On the other hand, Sarma *et al*. (2009) in civet cat reported that the average measurements were 1.5 cm width and 1 cm thickness and he did not mention the average length. Moreover, Besoluk *et al*. (2006) in the domesticated cats and dogs mentioned that the average length of the root of tongue was 1.3 cm.

In examined foxes, the body of the tongue was thick fleshy wide, long and it was oriented by dorsal, ventral and two lateral borders; the dorsum linguae denied to Fossa linguae and torus linguae. These statements are similar to that mentioned by El- Bably and Tolba (2015) Egyptian cat, Sarma *et al*. (2009) in the adult civet cats, Besoluk *et al*. (2006) in the domesticated cats and dogs, Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat and Sisson *et al*. (1975) in the dog. In contrast to our results Jabbar (2014) in goat, Murad *et al.* (2010) in ram, Kubota (1967) in the elephant and Habel (1975) in ox and sheep had reported clear fossa lingue and prominent torus linguae.

Concerning, the ventrum linguae of the fox tongue, it is connected via a sickle fold of mucous membrane as a frenulum linguae which was extended from the middle of the ventral surface of the body of the tongue to the sublingual floor and was measured about 2.28 cm in its length. On the other hand, El- Bably and Tolba (2015) in the Egyptian cats had average length was 2.43 cm. Sarma *et al*. (2009) in civet cat, Besoluk *et al*. (2006) in the domesticated cats and dogs, Miller *et al*. (1996) in the dog and Nickel *et al*. (1986) in the dog and the cat.

Regarding, the body of the tongue was classified according to the density of the tongue papillae into rostral and caudal divisions. These results were disagreement with the findings by El- Bably and Tolba (2015) in Egyptian cats Samra *et al*. (2009) in the adult civet cat where it was divided into the rostral, the middle and the caudal parts.

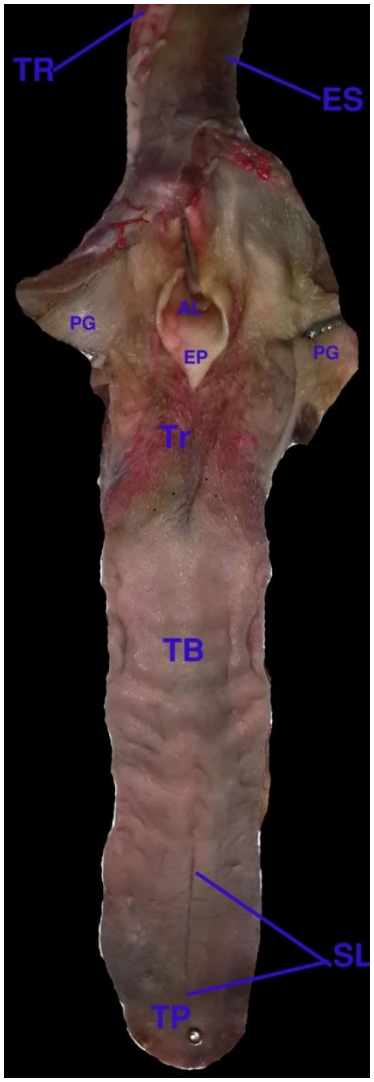


Fig. A1: Photograph showing the dorsal view of the tongue of the fox.

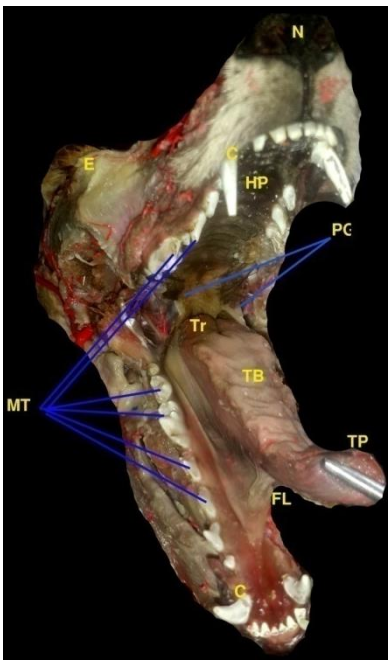


Fig. A2: Photograph showing the left lateral view of the oral cavity of the fox.

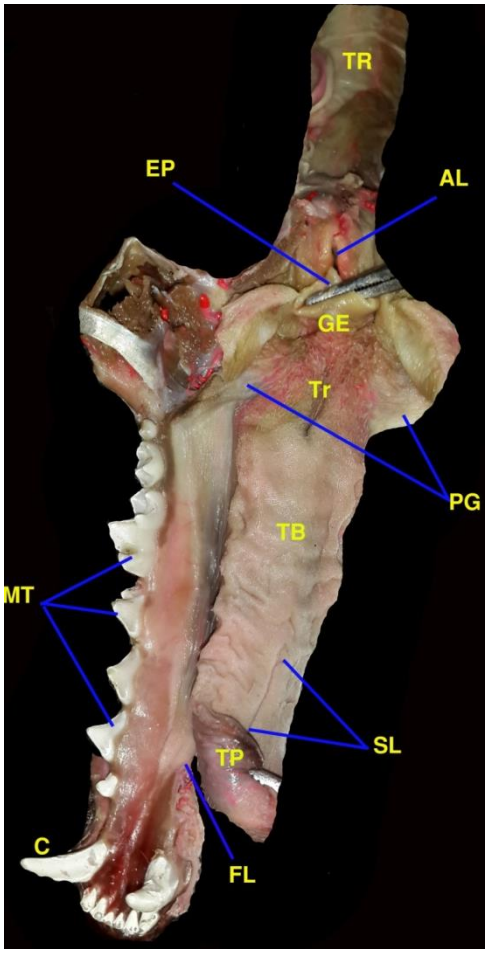


Fig. A3: Photograph showing the left lateral view of the tongue.

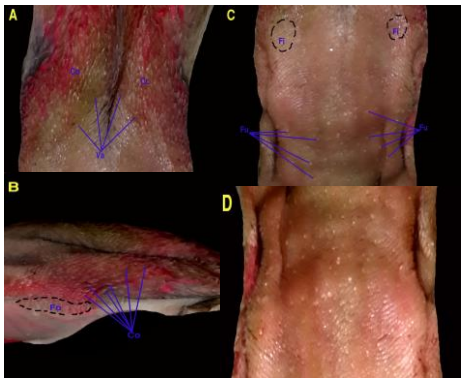


Fig. A4: Photograph showing the tongue papillae.

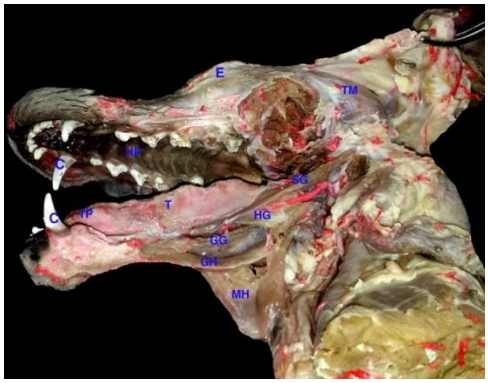


Fig. A5: Photograph showing the left lateral view of the tongue muscles.

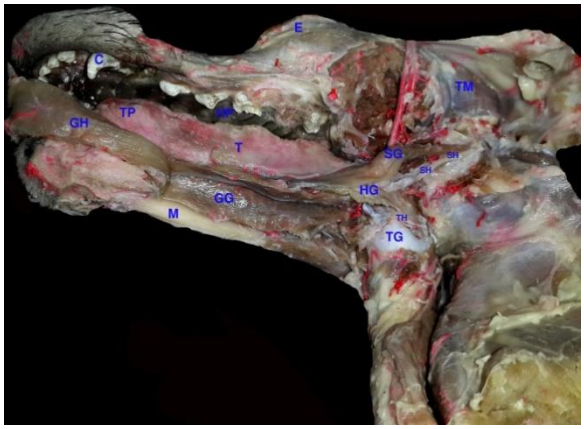


Fig. A6: Photograph showing the left lateral view of the tongue muscles.

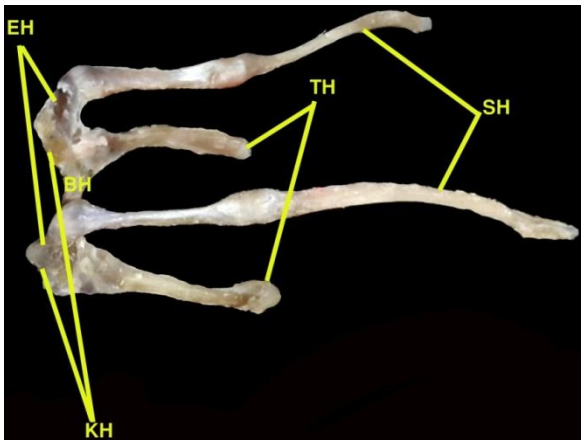


Fig. A7: Photograph showing the hyoid bone of the fox.

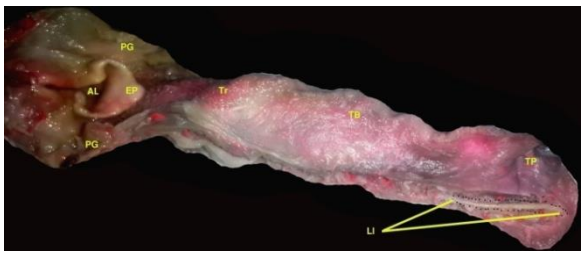


Fig. A8: Photograph showing lyssa - like structure of the fox tongue.

Legend (Figs. A1-8): Morphology of the fox tongue

T.	Tongue	GH.	geniohyoideus muscle
Tr.	Tongue root	TM.	Temporalis muscle
TB.	Tongue body	SH.	Stylohyoid bone
TP.	Tongue apex	TH.	Thyrohyoid bone
Ll.	Lyssa linguae	BH.	Basihyoid bone
SL.	Sulcus linguae	KH.	Keratohyoid bone
Fi.	Filiform papillae	EH.	Epihyoid bone
Fo.	Foliate papillae	TR.	Trachea
Fu.	Fungiform papillae	ES.	Esophagus
Va.	Valate papillae	AL.	Aditus laryngeus
Co.	Conical papillae	MT.	Molar teeth
FL.	Frenulum linguae	C.	Canine teeth
GE.	Glossoepiglottic fold	E.	Eye
PG.	Palatoglossal fold	M.	Mandible
SG.	Stlyoglossus muscle	HP.	Hard palate
HG.	hyoglossus muscle	EP.	Epiglottis
GG.	Genioglossus muscle	N.	Nose
MH.	mylohyoideus muscle	TG.	Thyroid cartilage

In the examined specimens, The caudal part of the tongue body measured about1.98 cm in its width and thickness is 1.24cm while the rostral part was represented the middle part of the tongue and its width is varying from 1.52 cm to 1.76 cm and the thickness ranges from 0.62 to 83 cm. On the other hand, El-Bably and Tolba (2015) Egyptian cat observed that the average width and thickness of the middle part of the tongue were 2.12 cm and 1.22 cm respectively. However, Samra (2009) in the adult civet cat tabulated that the middle part of the tongue was measured 1.82 cm width and 1.13 cm thickness.

In the present study, the vicinity of the ventral surface of the tongue apex was distinguished by the presence of lyssa like structure. The former structure was a thin white rod - shaped capsulated tissue and presents along the median plane. Its length measures about 2.36 cm and the thickness is 0.34 cm. These results were simulated to that reported by El-Bably and Tolba (2015) in Egyptian cats and Capellari *et al*. (2001) in the cats while the lyssa of Egyptian cats was shorter and measured about 1.21 cm. However, Besoluk *et al*. (2006) in the domesticated cats and dogs achieved that it was spiral-shaped in the cat and J-shaped in the dog.

The results applied on our study revealed that the apex of the tongue was measured about 2.08cm, 1.97 cm and 0.52cm in its length, width and thickness respectively. These results were differed to that reported by El- Bably and Tolba (2015) in Egyptian cat where the authors stated that the average length, width and thickness of the apex of the tongue were 2.2 cm, 0.96 cm and 0.23 cm respectively while Sarma *et al*. (2009) in civet cat, reported that the average measurements were 2.22 cm length, 0.91 cm width and 0.14 cm thickness.

In the present study, the dorsum of the tongue (dorsum linguae) was rough because of its orientation by five types of lingual papillae that observed on the dorsal surface of the tongue. These papillae are vallate, conical, foliate, filiform and fungiform papillae. These statements were similar to that of El-Bably and Tolba (2015) in Egyptian cat, Alan (2014) in red fox, Sarma *et al*. (2009) in the adult civet cat, Besoluk *et al*. (2006) in the domesticated cats and dogs, Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat and Sisson *et al*. (1975) in the dog. While Murad *et al*. (2010) in ram and Jabbar (2014) in goat mentioned that the tongue papillae were filiform, fungiform, conical, lenticular and circumvallate papillae. On the other hand, AL-Mahmodi (2016) in male rabbit and Jacowiak Jerbi, Skieresz-Szewczyk, Ahmed and Prozorowska (2014) in Tunisian donkey demonstrated that there were four types of lingual papillae that distributed on the tongue surfaces; filiform, circumvallate, foliate, and fungiform papillae.

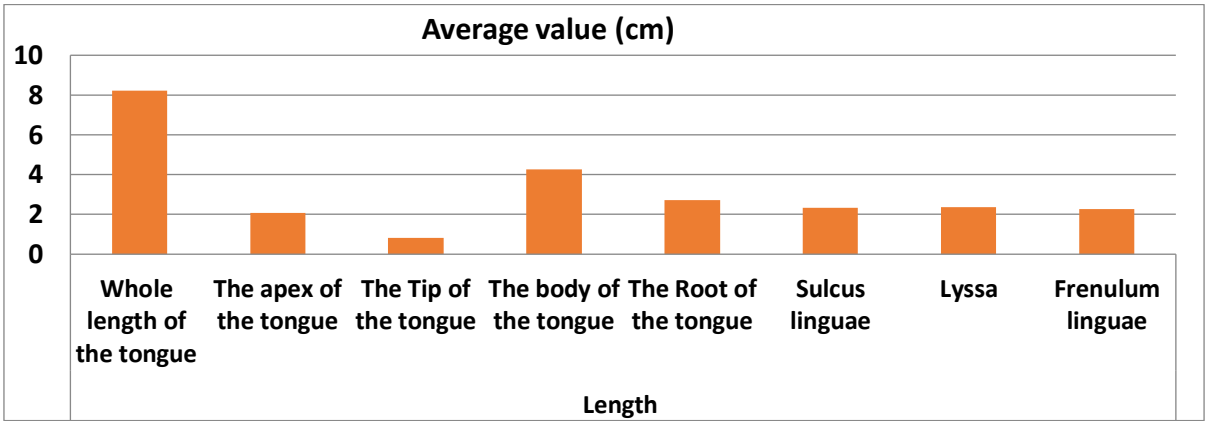
In the present study, the vallate papillae were circular (in 2 specimens were oval in shape) and presented in the caudal third of the tongue at the junction between the body and root. They were depressed centrally and their periphery was surrounded by a groove that constructed the shape of the papillae. The number of vallate papillae vary from 2-3 symmetrically in one row (in 2 specimens are 3 asymmetrically) on each side of the tongue where it configured in its hierarchy as an inverted V-shaped. The former papillae considered the largest papillae in diameter and measures about 0.21 cm. These statements similar to that confirmed by El- Bably and Tolba (2015) in Egyptian cat, Gregório *et al*. (2007), Hudson *et al* (1993), Tichy (1993), Ojima (1995), Ojima *et al*. (1996) and Ojima *et al*. (1997) in cats and there were 2 vallate papillae in red fox (Alan, 2014). On the other hand, Gregório *et al*. (2007), Tichý (1993) and Ojima (1995) in cats cited that, these papillae were being as oval and spherical, round elliptical and elliptical. However, Ojima *et al*. (1996) and Ojima *et al*. (1997) described them as being oval, elongated oval and circular in shape.

The description of our results explained that the conical papillae were numerous in number and appear as pointed projections and occupy the dorsal aspects of the foliate and the caudolateral borders of the vallate papillae at the root of the tongue. These findings were similar to that constructed by Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat and Sisson *et al*. (1975) in the dog. While, these descriptions were disagreement with El-Bably and Tolba (2015) in Egyptian cat where the conical papillae were marked as rounded elevations covered the root of the tongue.

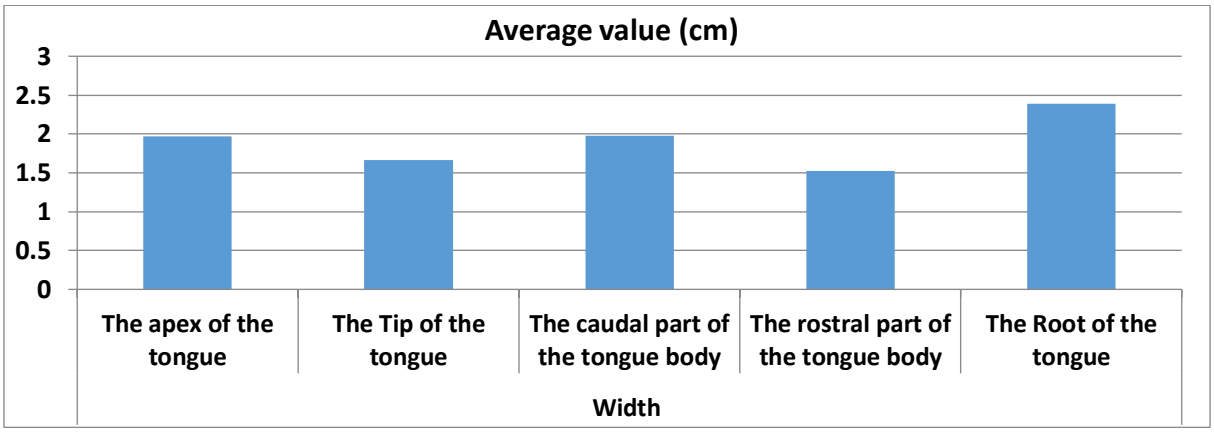
The foliate papillae are two rows of alternative leaf-shaped that located rostral to the palatoglossal fold, on the ventrolateral margin of the tongue root at the level of the commencement of the tongue body. These results were in agreement with El-Bably and Tolba (2015) Egyptian cat, Sisson *et al*. (1975) in the horse, Nickel *et al*. (1986) in the dog and the cat and Sarma *et al*. (2003) in the Himalayan black bear. On the other hand, the former papillae were seen on lateral aspect of the tongue, their laminae fused with the bases of the conical papillae that were observed by Emura (2006) in the dog and fox.

The filiform papillae were distributed on the dorsum of the tongue where they were numerous at the dorsolateral aspect of the caudal part of the body and few in number on the dorsal border of the rostral part of the body and the apex of the tongue. The former papillae have caudally directed pointed ends that devoid the tip of the tongue. In contrast, the corresponding papillae in Egyptian cats El- Bably and Tolba (2015), Miller *et al*. (1996) in the dog, Nickel *et al*. (1986) in the dog and the cat, Kubota (1967) in the elephant and Habel (1975) in the ox and sheep were populated on the dorsum of the body, but their number decreased towards the tip where they increased in length but they were numerously distributed on the rostral portion of the dorsum linguae. However, El-Bably and Tolba (2015) in Egyptian cats and (Boshel *et al*. 1982) in the cat cited that the succeeding papillae on the tip of the tongue were short and exhibited several conical processes from the base of each papilla. Further the more, Sarma (2009) in the civet cat mentioned that in the region of the vallate area, the filiform papillae were shorter and more conical than those on the mid-portion of the tongue.

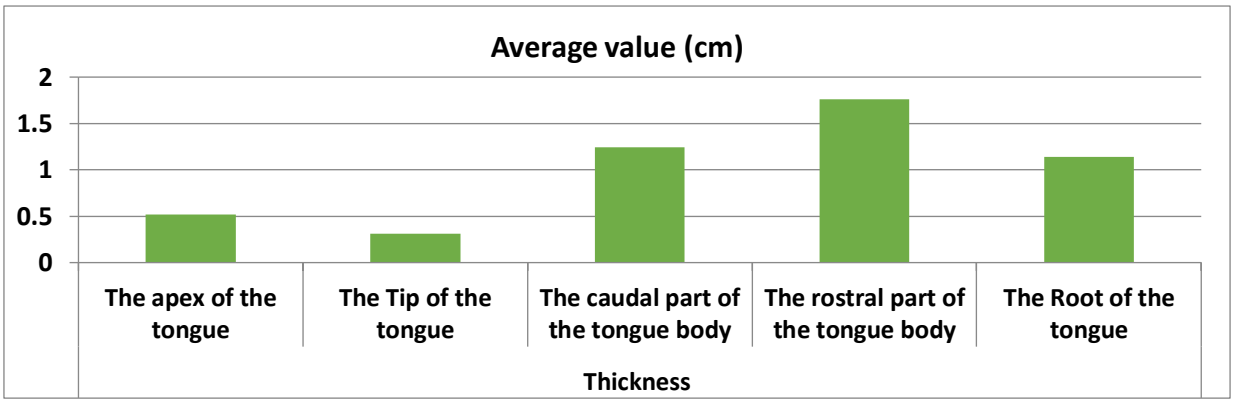
Concerning to the distribution of the fungiform papillae are white coloration, small, scattered, button-shape elevations and presented on the dorsum linguae insinuated between the filiform ones in the middle of the tongue body. They were ranged from 25 to 30 in their number. These studies were simulated to that documented by El-Bably and Tolba (2015) Egyptian cat, Mariappa *et al*. (1986) in the elephant, Nickel *et al*. (1986) in the pig and cat.



Graph 1: Showing the average values of parts of the tongue length.



Graph 2: Showing the average values of parts of the tongue width.



Graph 3: Showing the average values of parts of the tongue thickness.

Regarding the classification of the muscles of the tongue were divided into internsic and externsic muscles, the externsic muscles were three pairs of the muscles, which are styloglosuss, hyoglossus and genioglosuss, this was in agreement with El-Bably and Tolba (2015) Egyptian cat, Miller *et al*. (1996), Dyce *et al*. (2010) and Konig *et al*. (2006) in the dog.

The styloglossus of fox was a long ribbon-shape muscle which originated from the lateral aspect of the upper caudal third of the styloid process of the hyoid bone laterally to the body and the root of the tongue and directs rostroventrally till reach the level of the ventrolateral border of the middle of the tongue where it is inserted to retract and elevate the corresponding organ. These wares in agreement with El-Bably and Tolba (2015) in Egyptian cat and Dyce *et al*. (2010), Konig *et al*. (2006) and Miller *et al*. (1996) in the dog.

The hyoglossus of the examined foxes was a thin small flat muscle that emanated from the lateral border of the thyrohyoid bone. It passes obliquely rostrodorsally below the rostral third of the styloglossus muscle till inserted in the root of the tongue where it lies medially to the tongue. It retracts and depresses the tongue caudally while El-Bably and Tolba (2015) in Egyptian cat cited that the hyoglossus originated from the thyrohyoid, ceratohyoid and basihyoid. On the other hand, Miller *et al*. (1996), Konig *et al*. (2006) and Dyce *et al*. (2010) in the dog and cat described that the former muscle was originated from thyrohyoid and basihyoid only.

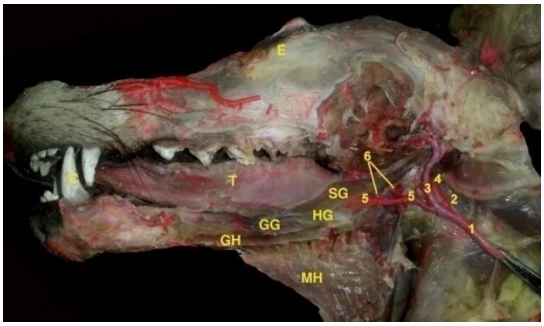


Fig. B1: Photograph showing branches of lingual artery.

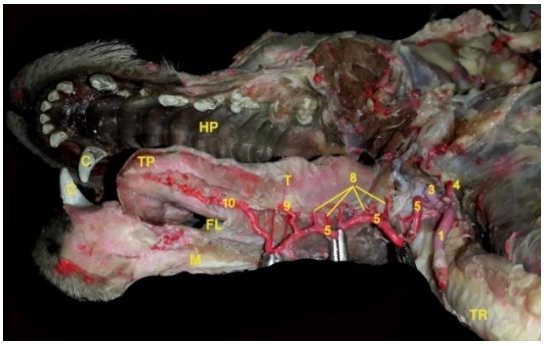


Fig. B2: Photograph showing the lingual artery distribution.

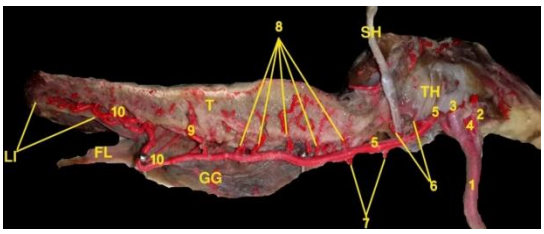


Fig. B3: Photograph showing branches of lingual artery and its distribution.

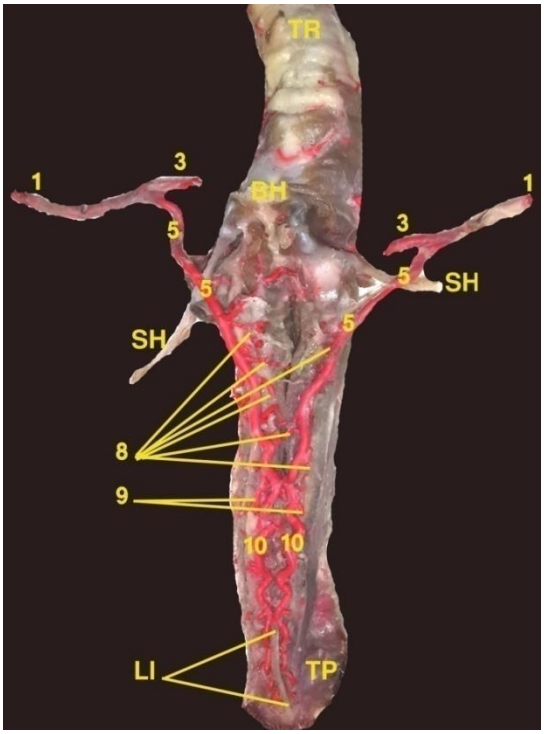


Fig. B4: Photograph showing the lingual artery distribution.

Legend (Fig. B1- 4): Arterial supply of the fox tongue

1.	A.carotis communis	6.	Rr.musculares
2.	A.occipitalis	7.	Rr.sublinguales
3.	A.carotis externa	8.	Rr.dorsales collaterals
4.	A.carotis interna	9.	R.mediana lingualis
5.	A.lingualis	10.	A.profunda lingualis
T.	Tongue	GG.	Genioglossus muscle
TP.	Tongue apex	MH.	Mylohyoideus muscle
FL.	Frenulum linguae	GH.	Geniohyoideus muscle
Ll.	Lyssa linguae	TR.	Trachea
SH.	Stylohyoid bone	M.	Mandible
TH.	Thyrohyoid bone	C.	Canine teeth
BH.	Basihyoid bone	HP.	Hard palate
SG.	Styloglossus muscle	E.	Eye
HG.	Hyoglossus muscle		

The genioglossus muscle of examined tongues was thin large long muscle and arised from the caudal border of the mandibular symphysis and the medial surface of the mandibular body and their fibers run obliquely caudodorsally where were oriented at the middle line of the ventral aspect of the tongue and bounded medially by the geniohyoideus and laterally by the medial aspects of the rostral third of the styloglossus and the hyoglossus muscles. These statements were in agreement with El-Bably and Tolba (2015) Egyptian cat and Miller *et al*. (1996), Dyce *et al*. (2010) and Konig *et al*. (2006) in the dog and cat.

Results of arterial supply

A.lingualis: The lingual artery (Fig.B.1,2,3,4/5) was along stout vessel and measured about 5.2 cm. It arises from the rostromedial aspect of the external carotid artery (Fig.B.1,2,3,4/3) and passed obliquely rostrodorsally between the medial aspect of the caudal part of the styloglossus and the caudal border of hyoglossus muscles till reaches the middle of the tongue at the level of the first lower molar teeth where it continued rostrally as deep lingual artery. During its course it detached muscular, sublingual, dorsal collateral and middle lingual branches.

Rr.dorsales collaterals linguales: The dorsal collateral lingual branches (Fig.B.2,3,4/8) were 8- 12 pairs of short stout vessels that arranged into parallel medial and lateral branches. They emerged from the dorsomedial wall of the lingual artery then directed rostrodorsal obliquely till reached the vicinity of the tongue root and the caudal part of the body to supply their corresponding parts of the tongue by 2-3 fine arborized rami.

R.mediana lingualis: The middle lingual branch (Fig.B.2,3,4/9) was torous long artery and measured about 1.2 cm in its length. It emanated from the dorsolateral aspect of the lingual artery at the level of the 3rd lower molar teeth and passed obliquely rostrodorsally to supply the middle part of the body by 3-4 fine twigs.

A.profunda lingualis: The deep lingual artery (Fig.B.2,3,4/10) was a long cylindrical vessel and measured about 3.8cm. It considered as the direct continuation of the lingual artery where it passed in a zigzag pattern insinuated between the lower aspect of the intrinsic and the genioglossus muscles of the tongue till reaches the level of the rostral end of the lingual lyssa at

the apex of the tongue. Along its course, it gave off 14-16 fine branches that supplying the rostral part of the body and the apex of the tongue.

Discussion arterial supply

Concerning the origin of the lingual artery which emanated from the rostromedial aspect of the external carotid artery in accordance with (Daghash, 2008) in goat, (Rashwan *et al.,* 2011) in sheep and dog and (Brien *et al.,* 2016) in giraffe. On the other hand (Frąckowiak *et al.*, 2016) in conjoined twin cattle, (Zdun *et al.,* 2014) in small oribi, (Ferreira, *et al.,* 2009) in Nellore Bos indicus, (Pizzutto, *et al.,* 2006) and (Brugge *et al.,* 1989) in monkeys reported that the facial artery diverged together with the lingual artery in a common lingofacial trunk from the external carotid artery. However, (Irifune, 1980) in dog stated that the corresponding artery aroused from the facial artery. Furthermore, Jabbar (2014) in goat added that the external carotid artery gave transverse facial artery and continuous deeply as a lingual artery which supplied the tongue.

Regarding the distribution of the lingual artery which was detached into muscular, sublingual, dorsal collateral and middle lingual branches and continued rostrally as a deep lingual artery which ramified into 14 to 16 fine dorsal branches. These results were differed from that stated by (Daghash, 2008) in goat where the lingual artery gave off muscular, sublingual, dorsal collateral branches and continued as a deep lingual artery. While (Brugge *et al.,* 1989) in monkeys said that the succeeding artery gave off dorsal, sublingual branches and ran rostrally as deep lingual artery. On the other hand, (Brien *et al.,* 2016) in giraffe mentioned that the lingual artery distributed as Laryngeal, pharyngeal, parotid, muscular branches and divided into deep lingual and sublingual arteries. However, (Pizzutto *et al.,* 2006) in monkeys, reported that the lingual artery divided into dorsal, deep, and sublingual arteries. Furthermore, (Ferreira *et al.,* 2009) in Nellore Bos indicus concluded that the lingual continued as deep lingual artery and this artery gave off sublingual, dorsal and apex tongue branches. Moreover, (Rashwan *et al.,* 2011) In sheep revealed that the lingual artery ramified into muscular, glandular, Dorsal, sublingual, deep lingual branches and authors in dog added that the corresponding artery detached into ascending palatine, muscular and continued as a deep lingual branches

In the current study, the dorsal collateral lingual branches were 8- 12 pairs of short stout vessels that arranged into parallel medial and lateral branches and emerged from the dorsomedial wall of the lingual artery to supply the tongue root and the caudal part of the body. These results were disagreement with (Daghash, 2008) in goat where they recorded that the dorsal lingual branches were 15-18 in number and arose from the deep lingual artery and sometimes, the first one or two dorsal lingual branches arose from the lingual artery. While (Rashwan *et al.,* 2011) in sheep and dog and (Ferreira *et al.,* 2009) in Nellore Bos indicus the dorsal lingual branches originated from the deep lingual artery.

The middle lingual branch is long stout torous vessel and measures about 1.2 cm in its length. It emanates from the dorsolateral aspect of the lingual artery at the level of the 3rd lower check molar teeth and passes obliquely rostrodorsally to supply the middle part of the body by 3-4 fine twigs. These results were not documented by available literatures.

Conclusion

The arterial supply of the fox tongue was oriented by the lingual artery which arouse from the external carotid artery. The former artery detached dorsal collateral and middle lingual branches and continued as a deep lingual artery.

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