

# Morphological and Morphometrical Study of Tongue in Local Adult Gazelle (*Gazella subgutturosa*)

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## Abstract

This study carried on 5 heads of gazelle. Mean values of gazelle (*Gazella subgutturosa*) tongue; weights, length, width, and thickness are recorded. The gross observations revealed a shallow median longitudinal rut present on the dorsal surface of the apex, as well as torus linguae that rostrally restricted by shallow lingual fossa. Filiform, conical and lenticular papillae showed mechanical function while, the fungiform and vallate papillae with gustatory function. The purpose of this study was to investigate the morphological structure and morphometrical measurements of gazelle tongue.

## Introduction

Wide-ranging ungulate known as the gazelle (*Gazella subgutturosa*) can be found east of Tigris / Euphrates Turkey, north into Caucasus and across Iran into Turkmenistan, Uzbekistan, and Kazakhstan, northern China and Mongolia (Mallon and Kingswood, 2001; Mirzakhah et al., 2015). The tongue is made up of flexible muscle membranes. With its attached root, body, and free apex, it is able to make motions that are both forceful and precise, such as grasping, lapping, grooming, and manipulating food in the mouth, as well as speech articulation (Dyce et al., 2010). A number of papillae, including filiform, conical, lenticular, fungiform, vallate, and foliate, cover the tongue's mucosal surface. Several tiny salivary glands related to these papillae. A transverse ridges on the hard palate and papillae in domestic ruminants help in the prehension and backward movement of food (Nickel et al., 1979; Dyce et al., 2010).

There is lack morphological study of the tongue of local gazelle, therefore the main aims in this study are to investigate the morphological structures including; the types and distribution of gustatory and mechanical papillae and morphometrical parameters of the tongue in gazelle (*Gazella subgutturosa*).

## Materials and methods

Five heads of healthy adult gazelle were obtained from the local trade market in Dyal city, used for the tongue gross observations (location, relationship, shape, color) and the distribution of lingual papillae. Length, width and thickness of each portion of apex, body and root are measured by using the vernier caliber (Abumandour et. al., 2022). The tongue samples are immediately collected after gazelle slaughtering and separation of its heads, then dissected of tongues and removed the extrinsic muscles (styloglossal, hypoglossal and genioglossal) from the tongue

were done and then used to study and recorded the morphometrical parameters. All types of papillae of the tongue surface are examined and photographed by using the dissecting microscope with digital camera. The weight was measured using a sensitive electronic balance after removal the surrounding connective tissue and the fats (Al-Rikabi, 2015; Naser and Khaleel, 2020). Length, width and thickness were measured by electrical digital vernier caliper in a centimeter scale (Mirhish and Kareem, 2015; Kadhim, 2018; Khaleel et al., 2022). The values were expressed as Means  $\pm$  SE.

#### Statistical Analysis

All numerical values were presented as (Mean  $\pm$  SE) (Al-Gharban, 2016; Gharban, 2022).

#### Results and discussion

Currently, the study showed the tongue of gazelle was muscular organ, pinkish in color with spotted black pigments, situated partly on the floor of the mouth cavity and partly in the anterior wall of the oral part of the pharynx, extended rostrally and fill the oral cavity when the upper and lower jaw were closed. It made up of three parts; root, body, and apex, (Fig. 1), this finding similar to (Jabur and Atyia, 2023) in cattle. It anchored with the mandible, hyoid bone through extrinsic lingual muscle; styloglossus, genioglossus, hyoglossus muscle and with soft palate and epiglottis by the mucous membrane and to the oral cavity floor through the median mucosal fold "frenulum linguae" (Fig. 1, 2). Similarly to that of (Murad et al., 2010) and disagrees with the result of (Agungpriyono et al., 1995) in lesser deer this, probably due to difference in animal's size and type of grass.

Total mean tongue weight was (40.67  $\pm$  0.33 g), relative weight (0.0033), Percentage

(0.0033%) and its volume (42.50  $\pm$  0.42 ml) and (9.74  $\pm$  0.09 cm) in total length (Table 1).

The apex of the tongue represent the restral free part, spatula like shaped with wide rounded tip, entirely black in color or spotted with black color presented the dorsal surface which facing the hard palate and the ventral surface that facing the mouth cavity floor with two lateral surfaces (Fig. 1, 3). It was situated apposite the incisors teeth when the mouth was closed (Fig. 1). On the apex dorsal surface, we observed shallow median longitudinal rut and two types of papillae (Fig. 1, 3). It was anchored from the ventral surface by the fold known as frenulum linguae (Fig. 2). These findings are in agreement with (Agungpriyono et al., 1995), and disagree with (Sari et al., 2010) in zavot cattle, in Yak (Shao et al., 2010). The apex of gazelle tongue has not notched in the center was disagree with (Qayyum and Beg, 1975) in Indian goat.

Mean length of apex was (2.71  $\pm$  0.04 cm), mean width and thickness of it were (1.64  $\pm$  0.04 cm) and (0.355  $\pm$  0.01 cm) (Table 1).

The body was the tongue middle part, lies caudally to apex and rostral to the root and represents the bulk of the tongue. Lies in the inter-mandibular space and on the caudal half of body dorsal surface there was an elliptical prominence (torus linguae) which was limited rostrally by lingual fossa; shallow transverse depression (Fig. 1). The body appeared narrow in the beginning then become narrower, then gradually increased in its width caudally (Fig. 1). The tongue body was attaching to mouth cavity floor and showed four surfaces (dorsal, ventral and two lateral surfaces) (Fig. 1, 2).



Fig. 1: photograph gross anatomy of the gazelle tongue shows dorsal surface: A- Apex, B-Body, R-Root, Torus linguae, F- Lingual fossa, M- Median longitudinal groove, H- Hyoid bone, P-Pharynx.



Fig.2: Photograph of the gross anatomy of the gazelle tongue shows: V-Ventralsurface, L- Lateral surface, F- Frenulum linguae, Fi-Filiform papillae, Fu-Fungiform papillae.

Table 1: Anatomical parameter of the tongue in gazelle represented by Mean  $\pm$  SE

Measurements	Mean $\pm$ SE
Weight of animal (kg)	12.02 $\pm$ 0.12
Weight of tongue (gm)	40.67 $\pm$ 0.33
Relative weight (gm)	0.0033
Percentage	0.0033%
Volume of tongue (ml)	42.50 $\pm$ 0.42
Total length of tongue (cm)	9.74 $\pm$ 0.09
Length of apex (cm)	2.71 $\pm$ 0.04
Length of body (cm)	5.02 $\pm$ 0.04
Length of root (cm)	2.01 $\pm$ 0.06
Width of apex (cm)	1.64 $\pm$ 0.04
Width of body (cm)	1.83 $\pm$ 0.04
Width of root (cm)	2.43 $\pm$ 0.03
Thickness of apex (cm)	0.355 $\pm$ 0.01
Thickness of body (cm)	1.79 $\pm$ 0.03
Thickness of root (cm)	2.87 $\pm$ 0.02
Total Number of circumvallate papillae	27.5 $\pm$ 4.38
Number of Left side	(14.3 $\pm$ 1.06)
Number of Right side	(13.2 $\pm$ 1.02)

Dorsal surface of cranial part of body contains filliform and fungiform papillae as the apex, while anterior portion of torus linguae, showed many types of papillae including; conical and

lenticular papillae (Fig. 5, 6). A few numbers of filliform and fungiform papillae were present on rostralateral surfaces of torus linguae (Fig. 5, 6). This result was coincided with (Konig, and Liebich, 2009) in Sambar deer, Rocky goats (Sreeranjini et al., 2010), Reeves muntjac deer (JinHua Zheng and Kan Kobayashi, 2006) this perhaps be due to similarity with this animals as a grass eating artiodactyls, but in contrast to (Agungpriyono et al., 1995) in lesser deer, this lingual prominence plays a vital role when the animals masticate foods in the mouth, pressing it between the torus linguae and palate, also they stated that this prominence is characteristic for the mammals eating fibrous vegetation as the grass. Mean tongue body length was (5.02  $\pm$  0.04 cm), while the mean width and thickness was (1.83  $\pm$  0.04 cm) and (1.79  $\pm$  0.03 cm) respectively (Table 1).

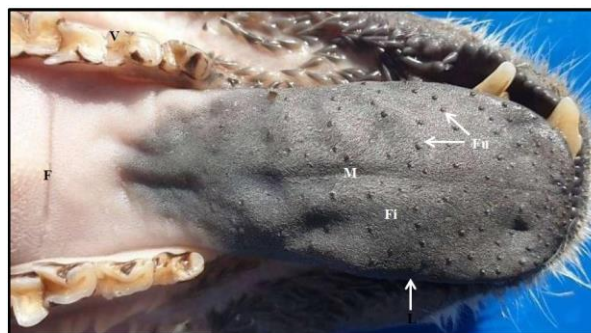


Fig.3: Photograph of the gross anatomy of dorsal surface of the tongue in gazelle shows: the apex was spatula shaped with Fi- Filiform papillae, Fu- Fungiform papillae, M- Median longitudinal groove, L- Lateral surface, F-Lingual fossa.



Fig. 4: Photograph of the gross anatomy of dorsal surface in apex of the gazelle tongue shows: Fi- Filiform papillae, Fu- Fungiform papillae, M- Median longitudinal groove.

The root was the last region of the tongue, lies caudally to the tongue body namely root (radix linguae, caudal extremity) which slopes toward the epiglottis base. Found a small opening on both side of the glosso-epiglottic folds which are orifices of lingual tonsils (Fig.1, 6). These finding was disagree with (Murad et al., 2010) in ram who reported the root dorsal surface was free from papillae.

Mean length of this region was ( $2.01 \pm 0.06$  cm), mean width ( $2.43 \pm 0.03$  cm) and its thickness was ( $2.87 \pm 0.02$  cm) (Table 1).

Grossly, there were (five) types of papillae present on the lingual gazelle including mechanical (filiform, conical, lenticular papillae) and the gustatory papillae; fungiform and circumvallate papillae. Anatomical findings in the current study showed the filiform papillae are soft "horny thread-like" structures slanted posteriorly (Fig. 9). They were small in size or fine and the most dominant papillae from all the lingual papillae and densely distributed on the dorsal surface, apical part and the two lateral sides of ventral surface of the apex (Fig. 3, 4, 8). While less distributed on both dorsal and lateral surfaces of the body part (Fig. 5, 7) as observed in goats by (Jabur and Atyia, 2023). These papillae were increased in its size and decreased in its density when directed caudally toward the root (Fig. 5, 6). This result was agreement with (Agungpriyono et al., 1995; Sari et al., 2010; Shao et al., 2010; Sreeranjini et al., 2010; Parvez and Rahaman, 2005).

The conical papillae, these papillae appeared conical elongated in shape with broad round base, triangular with ramified tips and arranged in rows on the torus. These papillae were oriented posteriorly with different sizes; small, middle, and large conical papillae. They

present caudally to the fossa and caudally continuous on the dorsal surface of the torus and increase in the density, to reach the anterior region of circumvallate papillae (Fig. 5, 6, 10, 11, 12), these result was disagree with (Sari et al., 2010) who stated the distribution of these papillae begins from the root and extended caudally in zavot cattle, but disagree with Agungpriyono et al. (1995) in lesser deer which were absent, and in agreement with (Parvez and Rahaman, 2005) cow. The difference may be due to species differences and due to variation in eating habits.

Lenticular papillae, they were observed in two different shapes: as large rounded flat or lens-shape papillae of different size along the median plane of torus, some of them scattered between the conical papillae on the torus linguae and on the lateral sides of the torus linguae (Fig. 6, 11, 12), they appeared smaller than circumvallate papillae (Fig. 6, 10), As noted in sambar deer (Sreeranjini et al., 2010).

Fungiform papillae, these papillae were present as small, clear, rounded, convex, button-like structure, with small elevation on the lingual surface. Scattered among the filiform on both lateral and dorsal surfaces of apex and ventral surface apical portion of apex (Fig 2, 3, 4, 5, 8), dorsal and lateral surfaces of the body (Fig. 2, 7) and the root dorsal surface, this result disagree with the result of (JinHua Zheng and Kan Kobayashi, 2006) in Reeves muntjac deer that appeared don't extend to the torus linguae. The dorsal and lateral surfaces of the apex have a higher density of distribution, while the lateral surface and anterior part of the body contains less density of these papillae (Fig. 2, 5, 6).



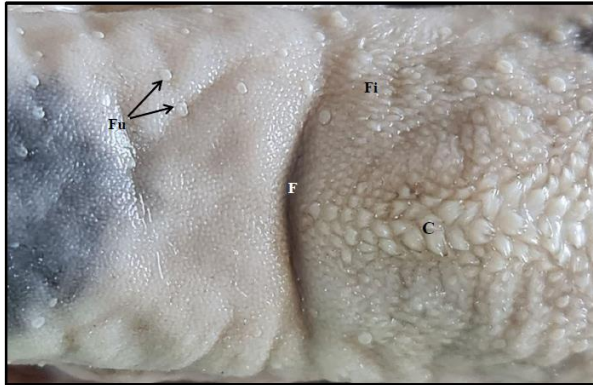


Fig. 5: Photograph of the gross anatomy of the dorsal surface of the tongue body in the gazelle shows: Fi- Filiform papillae, Fu- Fungiform papillae, C- Conical papillae, F- Lingual fossa, Torus linguae.

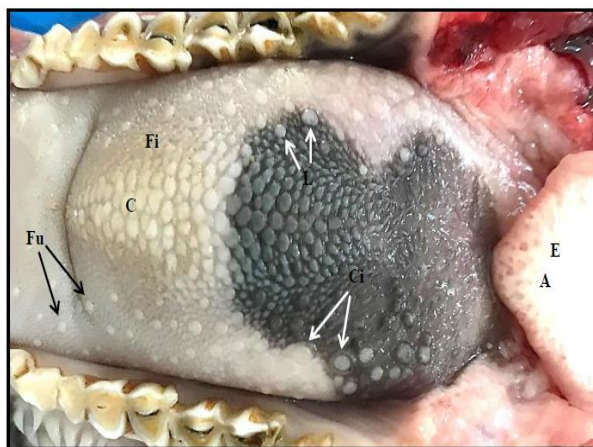


Fig. 6: Photograph of the gross anatomy of the body and root of the gazelle tongue shows: Fi- Filiform papillae, Fu- Fungiform papillae, C- Conical papillae, L- Lenticular papillae, Ci- Circumvallate papillae, E- Epiglottis.

They were increase in its size and decrease in its number when directed caudally toward the circumvallate papillae (Fig. 5, 6). This finding agree with that of (Qayyum et al., 1988) in camel, (Agungpriyono et al., 1995) in samber, (Unsal et al., 2003) in Akkaraman sheep, (Sreeranjini et al., 2010) in lesser mouse deer and (Murad et al., 2010) in adult ram.

Circumvallate papillae found as rounded to oval-shaped structures, with few elevation from the dorsal surface, surround by a deep moat and without an annular pad, observed on caudal portion of torus on both sides of it, somewhat arranged in two rows (Fig. 6, 11, 13). Similar with other small ruminant (Qayyum and Beg, 1975; JinHua Zheng and

Kan Kobayashi, 2006., Kurtul and Atalgin, 2008) and disagree with (Agungpriyono et al., 1995., Martinez et al., 1998). The total number was ( $27.5 \pm 4.38$ ). The number of these type of papillae on the left side was more than of the right side, their number on the left side was ( $14.3 \pm 1.06$ ), while on the right side was ( $13.2 \pm 1.02$ ) (Table 1), and the number in outer row was more than that in inner row. These finding agree with that of (Murad et al., 2010) in rams.

The foliate papillae were absent in the gazelle tongue, this finding was observed mostly in ruminant, but disagree with (Kobayashi et al., 2005) in horse (Yoshimura et al., 2009) in Hippopotamus, raccoon (Miyawaki et al., 2010) In chinchilla (Martinez et al., 2000) and agouti (Cien et al., 2013).

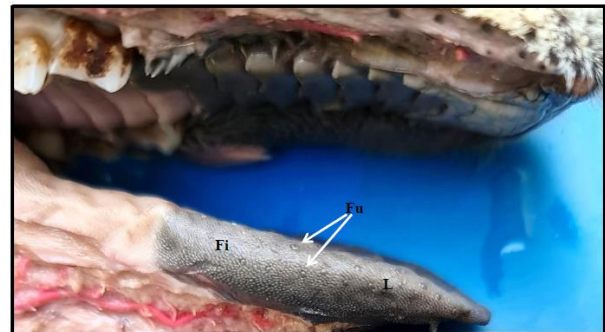


Fig. 7: Photograph of gross anatomy of the tongue apex in gazelle shows: L- Lateral surface, Fi- Filiform papillae, Fu- Fungiform papillae.

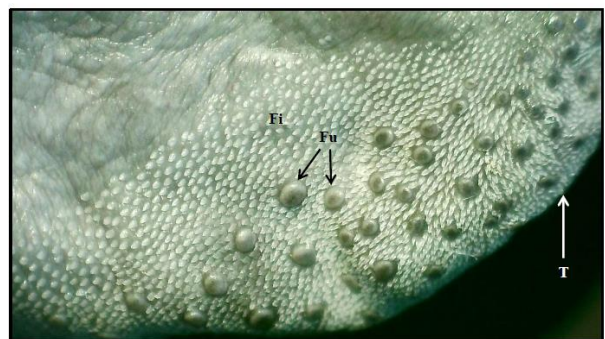


Fig.8: Photograph of the gross anatomy of ventral surface of the tongue apex in gazelle shows: Fi- Filiform papillae, Fu- Fungiform papillae, T- Tip (Dissecting microscope 4X).



Fig. 9: Photograph of the gross anatomy of the tongue in gazelle shows: Fi- Filiform papillae (Dissecting microscope X3).



Fig. 10: Photograph of the gross anatomy of the torus linguae in gazelle shows: C- Conical papillae (Dissecting microscope 3X).



Fig. 11: Photograph of the gross anatomy of the torus linguae tongue root in gazelle shows: L- Lenticular papillae, Fi- Filiform papillae, C- Conical papillae, Ci- Circumvallate papillae (Dissecting microscope 0.7X).



Fig. 12: Photograph of the gross anatomy of the dorsal surface of the tongue root in gazelle shows: L- Lenticular papillae, C- Conical papillae (Dissecting microscope 3X).

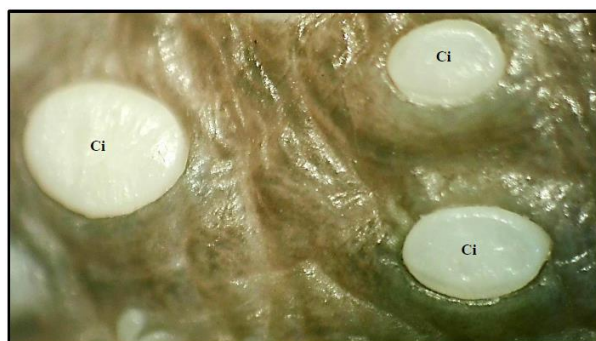


Fig. 13: Photograph of the gross anatomy of the dorsal surface of the tongue root in gazelle shows: Ci- Circumvallate papillae (Dissecting microscope 4X).

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