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RESEARCH ARTICLE

Macroscopical and Microscopical Observations of the Tongue in the Iraqi Goat (*Capra hircus*)

Dr. Ammar Ismail Jabbar

Department of Anatomy and histology, College of Veterinary Medicine , Diyala University - Iraq

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Corresponding Author

Dr. Ammar Ismail Jabbar

Abstract

The current study conducted on 20 head of goat. The mean weights, length, width, and thickness of tongue in goat (*Capra hircus*) were recorded. The location, distributions and shape of lingual papillae as well as lingual glands were well described anatomically. Specimens from the tongue of goat selected for histological were processed and staining with: Hematoxylin and eosin and PAS. Grossly observations reveled, shallow median longitudinal groove notice on the dorsal surface of apex of tongue. torus linguae which limited rostrally by a shallow lingual fossa. Filiform, conical and lentiform papillae exert mechanical function whereas fungiform and vallate papillae have gustatory function. Histological examination of the tongue revealed abundant keratinized tissue of dorsal surface. Serous and mucous lingual salivary glands are present among the muscle bundls and submucosa. The purpose of the present study was to investigate the Macroscopical and microscopical structure of the tongue in the Iraqi goat.

INTRODUCTION

The Goats (*Capra hircus*) disseminated all over the world because their great adaptability to varying environmental conditions and the different nutritional regimes under which they were evolved .Diary goat is considered the cow of the poor, also the goat mainly kept it to produce meat or fibers(mohair) and (cashmere) (1) (2). Goat feed source is consider as a poor quality, and have efficient conversion of feed into edible and high-quality meat, milk, hide(skin) (3).Goat are able to survive and reproduce under a wide variety of environmental conditions (4).

The tongue is a movable musclomembranes organ. It has an attached root, body and free apex, capable of both vigorous and precise movements as in prehension, lapping, grooming and manipulation the food with in the mouth on the one hand and speech articulation on the other (5). The tongue mucosal surface is covered by a variety of papillae, filiform, conical, lenticular, fungiform, vallate and foliate. A few small salivary glands associated with this papillae. In domestic ruminants the transverse ridges on the hard palate and the projections on the tongue (papillae) help in the back ward movement of ingesta and prehension of food (5, 6).

There is no morphological and histological study of the tongue of the Iraqi goat, therefore the main first point of our aims of this study were to describe morphological structure of the tongue, and blood supply of the tongue in goat (Capra hircus), histological structure of the tongue ,the types and distribution of gustatory and mechanical lingual papillae of the tongue in goat. Also the type of lingual salivary glands of the tongue in goat.

Materials and methods:

Anatomical Stud:

Ten heads of healthy mature Goats of both sexes were collected from a local commercial market in Baquba city. Five were used for gross observations includes shape, location, and the distribution of tongue papillae. The samples were collected immediately after animal slaughter and separation of heads from the carcasses. Dissecting of tongues and remove of the extrinsic muscles (styloglossal, hypoglossal and genioglossal) from the tongue were done and

then used to study and record biometrical parameters. The weight was measured after removed the surrounding connective tissue and fat by using a sensitive electronic balance. The length, width and thick were measured with the help of electrical digital vernier and a centimeter scale. Five heads of goat were used of blood supply tongue after injecting of latex colored with red Carmen, the injection was done by syringe directly from the common carotid artery. After the setting of latex, the specimens were dissected carefully for the blood vessels and nerve supply the tongue. All data were analyzed using SPSS version 17 (SPSS Inc., Chicago, IL, USA) for Windows. One-way analysis of variance was used to detect age-related variations. The results are expressed as means ± SEM. The results were regarded as significant when $P < 0.05$.

Histological Stud:

Ten tongues of goats were used for histological study. The sample were collected as soon as possible from the regions of tongue Apex, Body, Root and fixed in 10% formalin for 48 hours, and processed routinely for paraffin embedding. Serial sections (transverse and longitudinal) were obtained at 6µ thickness from a rotary microtome and subjected to the Hematoxylin and Eosin (H&E) stains, also Periodic acid Schiff reagents (PAS)**.** According to (7) and (8). Photographs of examined slides were carried out with Olympus microscope supplied with digital camera (Win joe) with resolution of 2 mega pixel.

Results and discussion:

Anatomical study:

The tongue of the goat is long consisting from three parts: apex, body and root. The total length of the tongue in goat is (13.48 ± 0.24 cm). The width and thickness of the apex is (31.36 ±1.04 mm), and (9.63 ± 0.28 mm) respectively, while the widest and thickest part of the body in the middle of the torus linguae was (34.21 ± 0.57 mm), and (20.7 ± 0.55 mm) respectively whereas in the root, the width was (30.93 ± 0.55 mm) and thickness was (18.6 ± 0.24 mm) in first part of root (Table 1) (Fig. 1). This results is similar to the results of (9) and disagree with the result of (10) in lesser mouse deer this may be due to the difference in animals size and type of grassing.

The apex of the tongue was nearly rounded in shape which formed by meeting of the dorsal and the ventral surfaces, with rounded margin, shallow median longitudinal groove length (3.75 ± 0.260 cm) notice on the dorsal surface of apex which across for short distance in ventral surface cranially. This observation is in agreement with the observations of (10), and disagree with (11) in zavot cattle, in Yak (12). The apex of the tongue of the goat has not notched in center disagree with (13) in Indian goat. The apex increased gradually in width, thickness and then narrowest in the beginning of the body. The body was the largest and the longer part of the tongue located between the apex and root, quadrilateral shape, has four surfaces ventral, dorsal, two lateral surfaces. It has elliptical dorsal prominence, called torus linguae which limited rostrally by a shallow transverse depression called lingual fossa (Fig.1). This result is coincided with results of (14) in Sambar deer, Rocky mountain goats(15), Reeves muntjac deer (16) this may be due to similarity with this animals as a grass eating artiodactylas and in contrast to (10) in lesser mouse deer ,this lingual prominence plays an important role when animals masticate food in the mouth ,pressing it between the palate and the lingual prominence they also stated that this prominence is characteristic for mammals eating fibrous vegetation such as grass .

The body begins narrow and gradually increased in width and thickness until reach to the beginning of root, then return narrow (Table 1). The root was the last and the shorter part of the tongue lies caudally to body of the tongue and slopes ventrally and caudally toward the base of the epiglottis, and has papillae on the dorsal surface (Fig. 1). This result disagree with the result of (9) in ram who mention that the dorsal surface of root devoid from papillae. The width and thickness of the root nearly of that of apex (Table 1).

Gross anatomical studies revealed that five types of papillae were present on the tongue of goat included mechanical and gustatory papillae, filiform , fungiform, conical, lenticular and circumvallate papillae (Fig. 1).The filiform papillae were soft horny thread like structure, inclined toward the posterior of the tongue smallest in size and the most numerous of all lingual papillae which distributed on dorsal surface, ventral surface and rarely extend caudally at level of circumvallate papillae. Filiform papillae which found on lateral margin and at tip of tongue were highly cornified Fig.(2).This resent result is in agreement with the result of (10, 11, 12, 14, 17).

Fungiform papillae were round, convex, mushroom-like papillae distributed among filiform papillae and are more concentrated around the tip of the tongue and on lateral cranial edges Fig.(2).This result is agree with the results of (10, 14, 18) in sambar deer, lesser mouse deer and in Akkaraman sheep. And disagree with the results of (9) in adult ram and(19) in camel, whom the reported that the distribution of the fungiform papillae is extended to the ventral surface of the tip of tongue. The fungiform papillae in this study extend to the transverse fossa of the torus linguae but don't extend to the torus linguae this in contrast with the result of (16) in Reeves muntjac deer.

The conical papillae were elongated, conical in shape and found in several sizes (small, middle, and large) conical papillae, observed rostral to the torus lingua which are very large and continuous caudally on dorsolateral to the torus lingua with decreased in number, also on both side of tongue root can be observed Fig.(3).This result in disagreement with the results of (11) who mentioned that the distribution of the conical papillae started from the root of the tongue and extended caudally In zavot cattle, and disagree with the (10) in lesser mouse deer which were absent. And in agreement with (17) cow, this difference due to the species different and due to differ in eating habit.
The lenticular papillae is convex lens in shape, It is largest mechanical papillae, few and different in size, located as a zone of papillae on the middle part of the torus lingua Fig.(3) This result agrees with (14) in sambar deer.

The circumvallate papillae were located on dorso-lateral surface of caudal part of the torus lingua, arranged in two rows on both side of tongue in (V) shape similar with other small ruminant (13, 16, 20) and disagree with (10, 21). Their number on the left side (13.6 ± 0.24) while on the right side (13.0 ± 0.32). The circumvallate papillae were round to oval in shape, with minute elevation from the lingual surface. It was surrounded by deep papillary groove. the outer row was more in number than inner row, also the number of this papillae in the left side more than that at right side (Table 2). Fig.(3) . This result in agreement with the results of (9) in adult ram.
The foliate papillae disappear in the tongue of goat at this study, this result in agree with most ruminant, and disagree with (15) in horse (22) in Hippopotamus, raccoon(23) In chinchilla(24) and agouti (25).

Blood supply and innervation:

The study of blood supply of tongue in goat has been revealed that the common carotid artery terminated by dividing into external carotid artery and occipital artery, the external carotid artery give transverse facial artery and continuous deeply as a lingual artery which supplied the tongue Fig.(4). The goat tongue is innervation by cranial nerves hypoglossal and glossopharengeal nerves Fig. (5).This result is in agreement with (26)

Histological Results:

The epithelium of mucosa of tongue is, thick dorsally, rough and cornified, stratified squamous whereas the mucosa of the ventral and lateral surfaces was thin and delicate. This result is in agree with the result of (27) an (14), and disagree with (10).The degree of keratinization in different animals may be influenced by the type of food. The mucous membrane of the dorsum tongue presented highly papillated such as filiform, fungiform, lenticular, conical, and vallate papillae Fig. (6), while the ventral surface of the tongue apex has numerous filiform and fungiform papillae, Fig (7).

The histological study reveled two type of filiform papillae, the epithelium of the first type tapered into curved spine –like process and connective tissue core is scarce while the second type blunt curved variety and connective tissue core penetrated the general epithelial surface. The caudally directed, pointed filiform papillae were distributed throughout the dorsum, showed heavy keratinization, Fig. (6). This result is in agree with result of (28) in Red Sokoto Goats .There are two type of filliform papillae large chief papilla and secondary papilla. This result in agreement with the result of (12) in yak,(29) in barbary sheep and (24) in chinchilla and disagree with the results of (16) In Reeves muntjac deers, (30) in Big horn sheep.

The conical papillae of the goat tongue are distributed on the dorsal surface of the torus lingua but the central type is larger than the peripheral type, and the surface of the papilla showed heavy keratinized epithelial cells Fig. (8). like the result of (12) and (31).

The lenticular papillae which located on the middle part of the torus lingua, are round to oval and larger than this located peripherally. The dorsal surface of the papilla is slightly convex, and covered by moderately keratin layer Fig. (9).this result in agree with (12) , (31) and (32) and disagree with (11) who mention that this papillae were covered with a thick layer of keratin.

In the present study, the fungiform papillae are more densely distributed on the dorsal and ventral surface of lingual apex. The fungiform papilla is dome shape has numerous taste bud in the epithelium of dorsal and lateral of papilla. This results in agreement with the result of (10, 16). The top of the papilla is covered by thin keratinized epithelium .This result is coincided with the result of (12) in yak and (19) in camel and in contrast with the result of (33) Iraqi seep The ducts of lingual gland is present in the lamina propria, Fig. (10).

The circumvallate papillae are similar to that in other Ruminants, they were large flattened circumscribed –shape papillae surrounding by deep trenches and covered by a slightly cornified layer, this result disagree with the result of (21) In opossum, the epithelium containing taste buds on lateral wall similar to that in (10, 31, 35) connective tissue core revealed a dense irregular connective tissue with profuse blood vessels and different cells, also the ducts of lingual gland are present opened to the groove which surrounded this papillae Fig. (11) .

Both serous and mucous (PAS+) lingual salivary gland are present among muscle bundles and also in the submucosa. The presence of mixed gland may be due to consuming mixed food. The duct of this gland are seen opened into the area of vallum of papillae Fig.(12).This result in agreement with (12) in Yak, (10) in lesser mouse

deer. The skeletal muscle bundles arranged in different direction to give this organ highly motility Fig.(10) This appearance like in most animals (10, 14, 16, 20, 30) .

Table (1) showing the parameters of Tongue in goat.		
Tongue weight		154.2 ± 2.1 gm
Tongue length		13.48 ± 0.24 cm
Median groove length		3.1 ± 0.18 cm
Tongue width	Apex	31.36 ±1.04 mm
	Body	34.21 ± 0.57 mm
	Root	30.93 ± 0.55 mm
Tongue thickness	Apex	9.63 ± 0.28 mm
	Body	20.7 ± 0.55 mm
	Root	18.6 ± 0.24 mm
Number of circumvallate papillae	Left	13.6 ± 0.24
	Right	13.0 ± 0.32

Values represent mean ± S.E (P≤0.05)

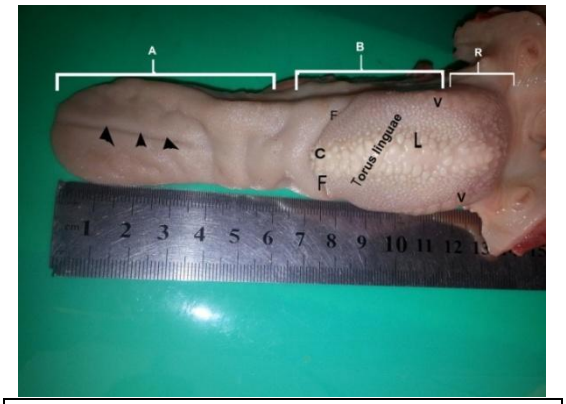

Fig.1: Photograph of dorsal surface of the tongue in the goat, shows: A –Apex B-Body R -Root torus linguae, F- lingual fossa, arrow head- median groove, V- vallate papillae, L-lenticular papillae , C-conical papillae .

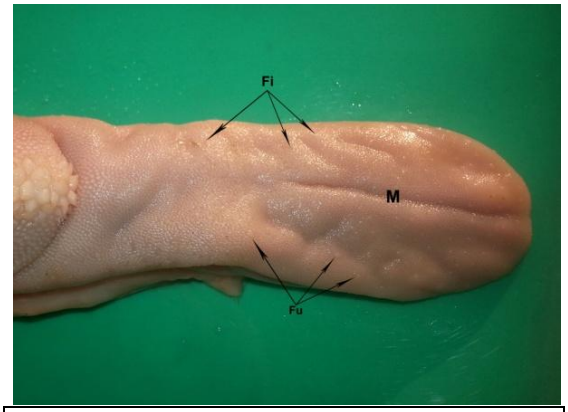

Fig.2: Photograph of dorsal surface of the tongue in the goat, show: A –Apex B-Body M-median groove ,Fu- fungiform papillae, Fi-filiform papillae .

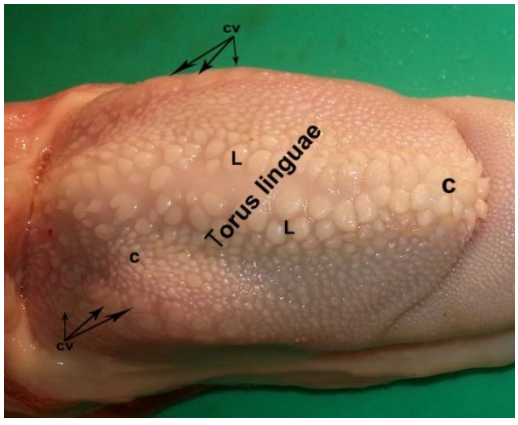

Fig.3: Photograph of dorsal surface of the tongue in the goat, show: Torus linguae CV-vallate papillae, L-lenticular papillae , C-conical papillae.

Fig.4: Photograph of head of the goat, illustrated the blood and nerve supply of the tongue: C-common carotid artery, E-External carotid artery, La- Lingual artery, H- Hypoglossal nerve, G- glossopharangeal nerve, T- Tongue

Fig.5: Photograph of head of the goat, illustrated the nerve supply of the tongue: T- tongue H- Hypoglossal nerve, G- glossopharangeal nerve,

Fig.6: Photomicrograph of dorsal surface of tongue of the goat, illustrated k-thick keratinized stratified squamous epithelium, Fi-1: type one filiform papillae, Fi-2: type two filiform papillae, , (H&E stain X40).

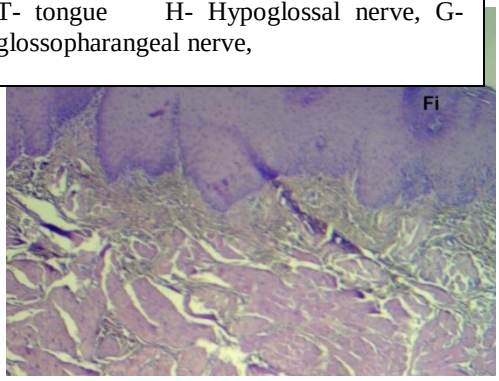

Fig.7: Photomicrograph of ventral surface of tongue of the goat, illustrated presence of Fi-filiform papillae, (H&E stain X40).

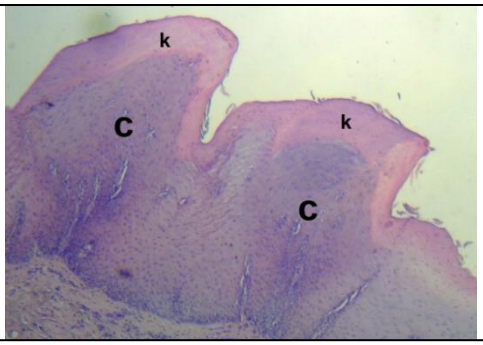

Fig.8: Photomicrograph of dorsal surface of tongue of the goat, illustrated k-heavy keratinized stratified squamous epithelium, C- conical papillae, (H&E stain X40).

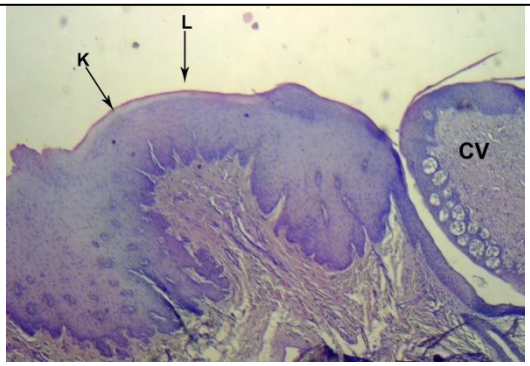

Fig.9: Photomicrograph of dorsal surface of tongue of the goat, illustrated, k-keratinized stratified squamous epithelium, L-lenticular papilla, CV- Circumvallate papilla. (H&E stain X40).

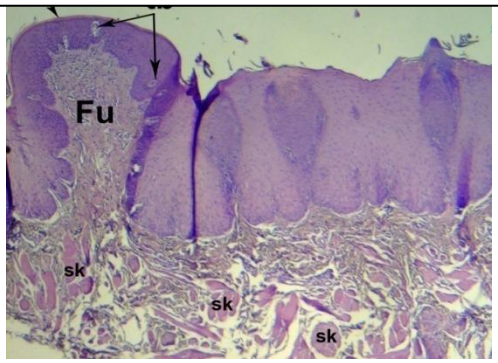

Fig.10: Photomicrograph of dorsal surface of tongue of the goat, illustrated, k-keratinized stratified squamous epithelium, Fu-Fungiform, tb- taste buds, sk- skeletal muscle bundles. (H&E stain X40).

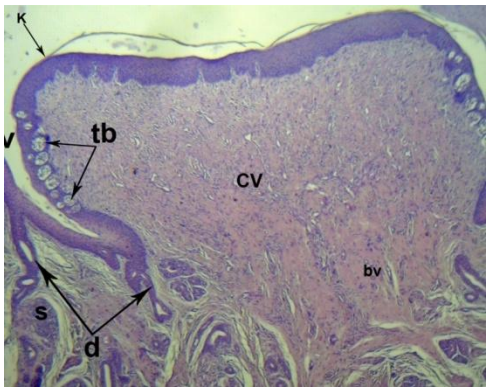

Fig.11: Photomicrograph of dorsal surface of tongue of the goat, illustrated, k-keratinized stratified squamous epithelium, L-lenticular papilla, CV- Circumvallate papilla. (H&E stain X40).

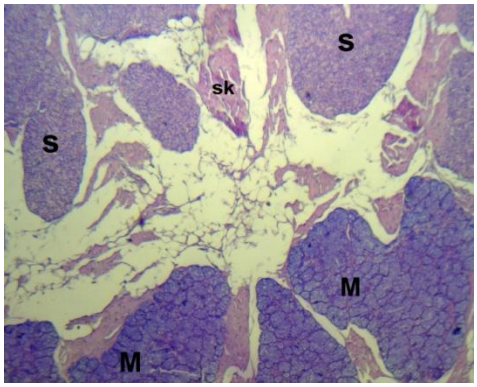

Fig.12: Photomicrograph of cross section in the tongue of the goat, illustrated, sk- skeletal muscle bundles, S-Serous lingual salivary gland, mucous salivary gland among muscle bundles. (PAS X40).

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