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Lingual Morphometrics and Dentition in Two Mammalian Species: A comparative Study

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Abstract

THIS study compared the macroscopic anatomical features of the tongue and its papillae between the herbivorous rabbit (*Oryctolagus cuniculus*) and the insectivorous hedgehog (*Hemiechinus auritus*). Six tongues from each species were examined under a stereomicroscope for gross morphology. The tongues' length, width, and thickness were measured in both species. In both, the dorsal surface of the tongue is divided into three areas: apex, corpus, and radix. The rabbit's tongue is medium-sized, muscular, light hazel-colored, with a rounded apex, while the hedgehog's tongue is smaller, thinner, and has a tapering apex. Both species have filiform papillae covering the dorsal surface and scattered fungiform papillae. The rabbit's tongue features a median groove in the apex and a torus lingua in the corpus, which are absent in the hedgehog. In the radix, the rabbit has two circumvallate papillae, while the hedgehog has three in a triangular shape. Both species have foliate papillae on the tongue's lateral regions. Statistically significant differences ($P < 0.05$) were observed in body weight, tongue weight, relative tongue weight, tongue length, and dentition between the species. The rabbit's tongue is significantly longer, broader, and thicker than the hedgehog's. Morphometric ratios of the tongue apex are significantly greater ($P < 0.01$) in the rabbit, while the tongue radix is wider and thicker in the hedgehog.

Keywords: *Oryctolagus cuniculus*, *Hemiechinus auritus*, Tongue, Apex, Corpus, Radix, Papillae, dentation.

Introduction

The morphological features of the mammalian tongues were significantly varying. These variations appeared to be connected to the types of food and environments and were significantly influenced by the environmental circumstances around them [1]. All the modifications perceived in the tongues of the premeditated animals explained the relationship between the adaptation of each animal to its feeding habit and habitat [2]. Animal species differ greatly in the structure and form of their tongues, which is indicative of the many roles that each tongue performs [3]. The tongue is mostly employed in the capture and movement of prey or food. However, the tongue seems to be specifically designed for chemoreceptive functions in other groups [4]. The tongues of many different animals have been studied for their effects on taste perception as well as their roles in food palatability, liquid food intake, chewing, suckling, swallowing, and speaking [5].

The rabbits served as models for a great deal of medical research and were heavily utilized in instructional settings. The lab rabbit (*Orycotolagus cuniculus*) was a member of the Order Lagomorpha and Family Leporidae. The rabbit was assigned a different order after being categorized as a rodent [6]. The long-eared hedgehog *(Hemiechinus auritus)* commonly known as the spiny hedgehog, is a member of Order: Insectivora and Family Erinaceidae [7]. It can be found in the Libyan and Egyptian deserts in the Middle East [8]. Native to the earth, hedgehogs are nocturnal mammals found in cultivated environments like gardens and farms. Small invertebrates and worms are the primary food source for the long-eared hedgehog [9]. Hedgehogs have a muscular tongue that takes up most of the mouth [10]. The mammalian's skull encloses and protects the brain and sense organs. Also, it gives the special shape of the head [11]**,** The lower jaw is formed of two mandibles which are articulated anteriorly by bony mandibular symphysis [12]. The dental formula of the African hedgehog is I 3/2, C 1/1, P 3/2, and M 3/3, for a total of 36 teeth [13]. There are a few other potential variants that provide the following dental formula: I 2-3/3, C 1/1, P 3-4/2-

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4, M 3/3 = 36-44 teeth total [14]. Furthermore, a crucial query remains: Is there a connection between the tongue's anatomical features and the types of food consumed? However, the papillae seen on the lingual surfaces of mammals have developed for specific purposes, and they provide information about the animal's food and habits [15-16].

The objective of this study was to investigate the tongue morphology in New Zealand white rabbits as herbivorous mammals and hedgehogs as insectivorous mammal. Also, it aimed to give a comparative analysis of macro- and microstructural organization of the two mammalian tongues to effectively regulate their disparate diets and adapt to morphological differences**.**

Material and Methods

The study included six New Zealand white rabbits (*Oryctolagus cuniculus*) weighing 2733 g on average, and six long-eared hedgehogs (*Hemiechinus auritus*) specimens weighing 1659g in average, of both sexes were used. The rabbits were obtained from farms in Desouk (Kafre El-Sheik Governorate, Egypt). Specimens of long-eared hedgehogs were obtained from farms in Abou Rewash (north of Giza, Egypt).

Specimens were slaughtered; dissections were performed using a stereo binocular microscope; tongues were extracted and inspected using a stereomicroscope. Six excised tongues of each species were examined for the gross morphological characteristics and then observed under a stereomicroscope (Olympus VM VMF 2x, Eyepiece 10x Stereomicroscope, Japan) to obtain magnified images of the tongue outline. Then, these morphological lingual features were photographed by a digital camera (Canon IXY 325, Japan) mounted on the eyepiece of the Stereomicroscope.

The tongue morphometric measurements (length, width and thickness) of the studied mammalian animals were taken in micrometers using a Digital Vernier caliber. The averages of the tongue's length, width and thickness, as well as measurements of its three distinct areas (apex, corpus, and radix) were recorded. Then, morphometric measurements of apex, corpus and radix were expressed as percentages of the related total tongue measurements. In addition, tongue length and weight were given as percentages of total body length and weight data. The percentages of these relations were recorded for comparing the studied mammalian tongues. Statistical analysis (ANOVA test) of data was conducted by using Microsoft Excel under Windows programs. The heads of the two animals (*Orycotolagus cuniculus* and *Hemiechinus auritus*) were used to study the anatomical structure of the mandible in each animal to calculate their dental formula.

Results

Tongue anatomy and morphometric features

In both New Zealand white rabbits (*Oryctolagus cuniculus*) and long-eared hedgehogs (*Hemiechinus auritus*), the tongue occurs on the floor of the buccal cavity, and it is joined posteriorly via the frenulum linguae. Also, they have elongated, non-bifid tongues which occupy the majority of the oral cavity. Depending on the basis of different morphological features, the dorsal surface of the tongue in both species is distinguished into three areas: apex, corpus, and radix (Fig. 1).

The tongue of New Zealand white rabbit is typically a medium-sized a muscular organ, with a light hazel color and a rough surface that attracts food to its mouth. The tongue of the long-eared hedgehog is muscular organ, small in size and coated by microscopic papillae that allows it to hold and manipulate food. The tongue of *H. auritus* appears thinner than the tongue of *O. cuniculus* (Fig.1).

Apex area of the tongue:

The tongue of *O. cuniculus* has a rounded apex where the dorsal and ventral surfaces meet giving rounded lateral borders. The dorsal surface of the apex area is characterized by a median groove; which extends to the start of the lingual prominence of the corpus area. The apex is coated with condensed filiform papillae, giving its dorsal surface a rough look. The fungiform papillae are scarce and unevenly dispersed over the dorsum of the apex and its borders (Fig. 2A).

The tongue of *H. auritus* has a tapering lingual apex with semi-circular lateral borders. The apex of the hedgehog tongue lacks the median groove. On the surface of apex area, there are two types of papillae. The first type, filiform papillae, are smaller in size and sparser, while the second is fungiform, were the most common and found randomly over the dorsum of the apex and the tongue's edges. The latter papillae were clustered at the tongue's apex (Fig. 2B).

Corpus area of the tongue:

The dorsal surface of corpus in *O. cuniculus*, is characterized by the presence of the lingual prominence or torus lingua in its middle region. A unique type of filiform papillae covers this lingual prominence. These filiform papillae are the most common on corpus and resemble small cones; the fungiform papillae are very scarce and dispersed through the filiform papillae (Fig.2C).

In hedgehog, the lingual prominence is absent from the dorsal surface of the corpus area. The filiform papillae are slim and pointed; they cover the whole dorsal surface of the corpus. Various filiform papillae are found, with fungiform papillae dispersed

among them. Fungiform papillae are small mushroom-shaped structures (Fig. 2D).

Radix area of the tongue:

The radix area is the shortest part in the tongue of *O. cuniculus*. A pair of dome-like shapes and surrounded by deep depression (nominated by circumvallate papillae) is situated in the opposite directions of the tongue radix. These circumvallate papillae are large, rounded in shape and elevated from the dorsal surface of the tongue. Each of the two lateral regions of the tongue radix has a patch with well-developed foliate papillae. These papillae have an elongated-oval shape, with multiple folia or little ridges that can be separated by shallow grooves (Fig. 3 A, C & E).

While in *H. auritus,* three circumvallate papillae in triangular shape are present. These circumvallate papillae are large, rounded in shape and elevated from the dorsal surface of the tongue. Also, two well-developed foliate papillae are observed in the lateral regions of the tongue radix **(**Fig. 3 B, D & F**)**.

Morphometric measurements of the tongue and body weight

The results in Table **(**1**)** recorded the body weight and measurements of the tongue with its areas for both species. The current results showed that there was a significant difference in the tongue weight between the two mammals. The rabbit has their highest tongue weight (3.8±0.07g) than hedgehog (1.7±0.19g) and this is correlate with their body weight.

The tongue of *O. cuniculus* is statistically significantly longer, broader and thicker than that of *H. auritus*. The average total length of rabbit tongue was 49.6±0.52mm, while in hedgehog was 28.8 ±0.62mm. The average total width of *O. cuniculus* tongue was 12.0 ± 0.22 mm, while in *H. auritus* tongue was 7.2 ± 0.10 mm. The average total thickness of the rabbit tongue was 10.1±0.15 mm, while in the hedgehog was 7.4 ± 0.13 mm.

Morphometric ratios of different tongue areas

The results showed that most of the morphometric ratios were statistically highly significant ($P < 0.01$) varied between the white rabbits and long-eared hedgehog; except the ratios of corpus width and tongue length which were non-significantly varied (table, 2).the ratio of tongue weight to the body weight was statistically highly significant thicker in *O. cuniculus* than *H. auritus*, with averages of 0.140±0.015% and 0.100±0.016%, respectively. The apex area represented the smaller part of the tongue; its average was 34.3 ± 0.44% and 19.4 ± 1.18% of tongue length in *O. cuniculus* and *H. auritus*, respectively. The tongue apex of hedgehog was statistically significantly smaller than that of the rabbits.

The corpus area represented the longer part of the tongue; its average was 48.3±0.53% and 54.8+0.84 % of tongue length in *O. cuniculus* and *H. auritus*, respectively. The tongue radix of hedgehog was statistically significantly wider than that of the rabbits. Its ratio average was 137.1±1.85% and 80.6±1.32% of the tongue width of hedgehog and white rabbit, respectively. Also, the ratio of radix thickness to the tongue thickness was statistically significantly thicker in *H. auritus* than *O. cuniculus*, with averages of 153.2±2.48 and 135.6±1.78%, respectively **(**Table 2**)**.

Dentation of two species

The results showed that rabbits have four maxillary incisors and two mandibular. which is distinguished by four upper incisors, with a second pair situated below the primary incisors, known as peg teeth which are long and sharp for slicing through plant material. Furthermore, like heterodonts, they have molars and premolars, which comprise the functional unit of chewing known as molariforms or cheek teeth. Rabbits lack canine teeth. Instead, they have cheek teeth (premolars and molars) that help with grinding and processing food. These cheek teeth don't touch when the jaw is at rest due to the mandible being narrower than the maxilla, there's a space called diastema. It's like a little dental gap where the dental formula for a rabbit is I2/1, C0/0, P3/2, and M3/3, totaling 28 teeth (Table 3).

While (*H. auritus*) has a distinctive dental structure that reflects its insectivorous diet. it Like other hedgehogs has heterodont dentition, meaning its teeth are specialized for different functions cutting, grinding, and tearing. Incisors: it has sharp and prominent incisors, especially the first upper pair, which helps in grasping and killing prey like insects. Canines: These are relatively small compared to carnivorous animals but still sharp, helping with gripping food. Premolars and Molars: The premolars and molars are adapted for crushing and grinding food. The first upper two molars are low and cursed, contributing to efficient food processing and the first two lower molars are sub rectangular. Cingulum that refers to a ridge at the base of the crowns of some teeth, often seen in the premolars, helps with additional surface area for grinding. Short incisors, canines, and prominently cusped molars grip and penetrate food, whereas the flattened crowns and multiple cusps of the molars crush the food. The upper incisors are separated by a wide gap into which the blunt, forward-projecting lower incisors fit. When a hedgehog bites down, the lower incisors scoop and lift the insect to the upper incisors, which impale the prey. The dental formula of the hedgehog is thus I3/2, C1/1, P3/2, M3/3, and the hedgehog has a total of 36 teeth (Table 3).

Discussion

The physical characteristics of the tongue in vertebrates are suited for a variety of functions, including suckling, grooming, food processing, water absorption, swallowing, and voice modulation [17-18-19]. Variations in the morphology of the tongue are intimately associated with food types, dietary specializations, and environmental adaptations [15]. A genus's distribution of distinct papillae on its surfaces is distinct from those of other species. One of the main variables affecting the form, distribution, and type of papillae is diet [20-21]. According to the current study, rabbits have long, non-protruding tongues with thin, spherical apexes that are specialized for eating from the ground as in rabbits [22] and Japanese badgers [23]. The current study found morphological differences in the tongues of O. cuniculus and *H. auritus*, two distinct species of vertebrates. The two species differ in the sizes and forms of their tongues, most likely as a result of changes in taxonomy and body size. In both species, the tongue's dorsal surface is divided into three sections: the apex, corpus and radix. This pattern was also present in most vertebrate species [24-25-26-27-28]. Whereas *H. auritus*'s tongue lacks a dorsal median groove and lingual prominence in the caudal portion of their tongue, *O. cuniculus*'s features included a clear, deep groove that splits the tongue's rostral half into two symmetrical halves. The median groove on the rostral region of the tongue is a common feature in some previously studied small mammals, which validates our findings, albeit its length can be considered a species-specific feature. The groove, however, is absent in the guinea pig [29] and Egyptian fruit bat [21], as well as the Balady and Bouscate rabbits, as observed by [30]. Moreover, in young albino mice, the median sulcus appeared to extend from the tip to the middle of the back of the tongue [31]. The lingual prominence in the caudal portion of the tongue is widespread in grass-eating artiodactyls like cattle, sheep, and goats [32], but it is missing in carnivorous and omnivorous species like pigs [33]. [34] found prominent intermolar tubercle in common European bats. Furthermore, [35] observed that molossid bats have a pronounced mid-dorsal lobe. Although some studies concluded that all bats lack an intermolar tubercles [36-37]

The filiform papillae are the rabbit's major mechanical papillae that carry and swallow food [38]. Filiform papillae are caudally oriented, as seen in hedgehogs by [39] and rats by [28]. Filiform papillae are thought to be present and distributed identically in all species. [40] found that filiform papillae benefit in mastication and swallowing due to their structural variation and bending direction. They hypothesized that the opposing bending of filiform papillae was done to hold the meal until it was eaten, while in our study the filiform papillae of long-eared hedgehogs was the most common across the entire dorsal surface of tongue's apex and body. The appearance and proportions of the filiform papillae are determined by their physical position on the tongue, with filiform papillae covering the body of the tongue being longer and wider than those on the apex and resembling forks. Filiform papillae, which are highly keratinized mechanical papillae, aid in food passage in the alimentary canal [15].

The present study on New Zealand white rabbits confirmed that the presence of a lingual prominence is considered a characteristic feature of herbivores, and this muscle-rich prominence with filiform papillae allows herbivores to grind food by crushing it between the tongue and the upper palate, whereas the filiform papillae in *H. auritus* are primarily used to aid in food capture. Our findings are consistent with previous research in grass-eating artiodactyls like cattle, sheep, and goats [32], which suggest that filiform papillae change in morphology to serve a range of tasks; for example, filiform papillae are simple in rodents but complicated in artiodactyls such as cattle. *O. cuniculus* had enormous, cylindrical filiform papillae in the center of the tongue that gradually decreased toward the lateral surface. Cornification of the lingual surface and ridge development mirrored herbivore feeding habits.

The current study showed that the overall morphological features of the tongue are very similar to the structure of the tongue in the rodent species studied; however, there is a distinct species-specific feature in the tongue's morphology and the stereomicroscopic structure of the lingual papillae. The morphological characteristics of the tongue in the long-eared hedgehog are similar to those of other little animals studied previously. The length of the long-eared hedgehog tongue (28.8mm) is consistent with [7] estimate of the Iraqi hedgehog's tongue (27.5 mm) and [41] and [42] estimates of the long-eared hedgehog's tongue (24.50 mm) and (19.75 mm) respectively. The long-eared hedgehog tongue is a small-sized muscular organ that is elongated and rounded at the apex, becoming larger caudally toward the base. It appears thinner than the tongue of *O. cuniculus***.** The dorsal surface of the tongue is also divided into three separate areas. These regions are similarly covered in lingual papillae, giving the dorsal surface a velvety texture. The ventral surface of the tongue is free of lingual papillae. Unlike rodents, lagomorphs and ruminants, the recent study observed that the long-eared hedgehog tongue lacks an intermolar lingual prominence and median sulcus on the dorsal surface [43-44-45-7]

The long-eared hedgehog's tongue features two enormous caudolateral lingual folds. These two folds may help to prevent saliva from collecting in the oral cavity and flowing into the alimentary canal. Further research may be required to confirm this statement. In contrast, rabbits possessed two circumvallate papillae located in the posterior part of the tongue's body,

immediately behind the lingual prominence. Thus, circumvallate papillae resembled cows, horses [46], squirrel monkeys [47], guinea pigs [29] and water buffalo [48].

This study also recorded three types of gustatory papillae in the tongue of both species: numerous fungiform papillae scattered across the lingual surface, foliate papillae on the caudolateral margins of the tongue, O. cuniculus has two circumvallate papillae on the root of its tongue, but *H. auritus* has three huge papillae on the tongue radix.

Fungiform papillae are uniformly distributed throughout the dorsal surface of the tongue's apex and body, between filiform papillae, and are absent from the radix. The distribution of fungiform papillae varies among vertebrates in the guinea pig, fungiform papillae are only found on the apex of the tongue and the lateral borders of the corpus, and the dorsal surface is completely devoid of these gustatory papillae [29]. In the gerbil, fungiform papillae can be seen on both the corpus and the radix of the organ. In rats, mice, and nutria, fungiform papillae are densely distributed on the lingual apex and decrease in frequency as one proceeds deeper into the organ [49].

For dentition pattern, the two mammals show a similar number of molars (M3/3) and premolars on each side, while hedgehog has equals number and arrangement of canine (C1/1) which is like those of carnivores. But the rabbit has a typical teeth pattern of herbivores; it lacks canines which is like the space called diastema in herbivores [50-51]. However, the total number of teeth is significantly different with that of hedgehog highest (36) and rabbit the lowest (28). These findings correlate with the reports of [52-53]**,** and [50] that the shape, size and arrangement of teeth depend on dietary consumption. Hedgehogs have a very similar dental structure to humans (**36**). They have four different types of teeth that most mammals also have, incisors, canines, premolars, and molars. pattern is quite little different in the number of incisors (I).

Conclusion

Accordingly, it is worthy to conclude that the lingual morphometric assessment in the two mammalian species under the study has a functional consequence in respect to their respective diets.

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Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical of approval

This study follows the ethics guidelines of Institutional Animal Care and Use Committee (ARC-IACUC) Agricultural Research Center

(ethics approval number**,** ARC-AZU-120-24).

TABLE 1. Measurements of the tongue parts and body in O. *cuniculus* and *H. auritus*

Character	*O. cuniculus*		*H. auritus*.	
	Range	Mean± SD	Range	Mean± SD
Body weight (g)	2300-3200	2733.3±314.1	1480-1780	1659±131.5**
Tongue weight (g)	3.75-3.87	3.8±0.07	1.4-1.9	1.7±0.19**
Body length (mm)	275-380	325.7±42.2	168-190	180.3±9.52**
Tongue length (TL) (mm)	49.0-50.3	49.6 ± 0.52**	28.0-29.8	28.8 ± 0.62**
Apex length (AL)	16.8-17.2	17.1 ± 0.15	5.1-06.1	5.6 ± 0.41
Corpus length (CL)	23.8-24.1	24.0 ± 0.15	15.6-16.1	15.8 ± 0.19
Radix length (RL	7.9-09.1	8.6 ± 0.45	7.1-07.9	7.5 ± 0.27
Tongue width (TW)	11.8-12.4	12.0 ± 0.22**	7.1-07.4	7.2 ± 0.10**
Apex width (AW)	13.4-13.7	13.5 ± 0.10	4.1-04.3	4.2 ± 0.08
Corpus width (CW)	12.5-12.9	12.7 ± 0.15	7.4-07.7	7.5 ± 0.12
Radix width (RW)	9.6-09.8	9.7 ± 0.08	9.8-10.0	9.9± 0.08
Tongue thickness (TTh)	9.9-10.3	10.1 ± 0.15**	7.1-07.5	7.4 ± 0.13**
Apex thickness (ATh)	6.9-07.3	7.1 ± 0.14	3.6-03.9	3.8 ± 0.10
Corpus thickness (CTh)	9.4-09.8	9.6 ± 0.14	7.1-07.3	7.2 ± 0.08
Radix thickness (RTh)	13.5-13.9	13.7 ± 0.14	11.1-11.4	11.3 ± 0.12

: **There is a highly significant variance (P = <0.01)

TABLE 2. Morphometric ratios of the different tongue regions and body (%) in *O. cuniculus* and *H. auratus*

Ratios	*O. cuniculus*		*H. auritus*	
	Range	**Mean± SD**	**Range**	**Mean± SD**
T Wt/BWt (%)	0.119-0.160	0.140±0.015	0.085-0.128	0.100±0.016**
TL /B L (%)	13.0-17.9	15.5±2.01	15.0-17.1	16.03±1.03 NS
AL / TL (%)	33.6-34.8	34.3 ± 0.44	18.0-21.2	19.4 ± 1.18**
CL / TL (%)	47.7-49.1	48.3 ± 0.53	54.0-56.0	54.8 ± 0.84**
RL / TL (%)	16.1-18.1	17.4 ± 0.74	24.7-26.5	25.8 ± 0.63**
AW / TW (%)	110.5-114.4	112.8 ± 1.30	55.4-60.0	57.8 ± 1.51**
CW /TW (%)	103.2-106.9	105.6 ± 1.41	101.4-107.4	104.3 ± 1.97 NS
RW / TW (%)	78.2-82.1	80.6 ± 1.32	133.8-138.8	137.1± 1.85**
ATh / TTh (%)	69.6-71.3	70.4 ± 0.78	48.9-52.2	51.0 ± 1.32**
CTh / TTh (%)	92.2-96.1	94.3 ± 1.47*	95.1-100.0	97.5 ± 1.87 *
RTh / TTh (%)	134.3-139.4	135.6 ± 1.78	150.7-157.7	153.2 ± 2.48**

*: There is a significant variance (P = <0.05); **: There is a highly significant variance (P = <0.01)
TWt: Tongue weight; **BWt**: Body weight; **BL**: Body length; **AL**: Apex length; **ATh**: Apex thickness; **AW**: Apex width; **CL**: Corpus length; **CTh**: Corpus thickness; **CW**: Corpus width; **RL**: Radix length; **RTh**: Radix thickness; **RW**: Radix width; **TL**: Tongue length; **TTh**: Tongue thickness; **TW**: Tongue width; **NS**: Non-significant.

TABLE 3. Dentation of the two species

Species	Dental formula	Total teeth
O. cuniculus	2(I 2/1, C 0/0, PM 3/2, M 3/3)	28
H. auritus	2 (I 3/3, C 1/1, PM 3/2, M3/3)	36

NOTE: **I**: incisors; **C**: Canine; **PM**: premolar; **M**: molar

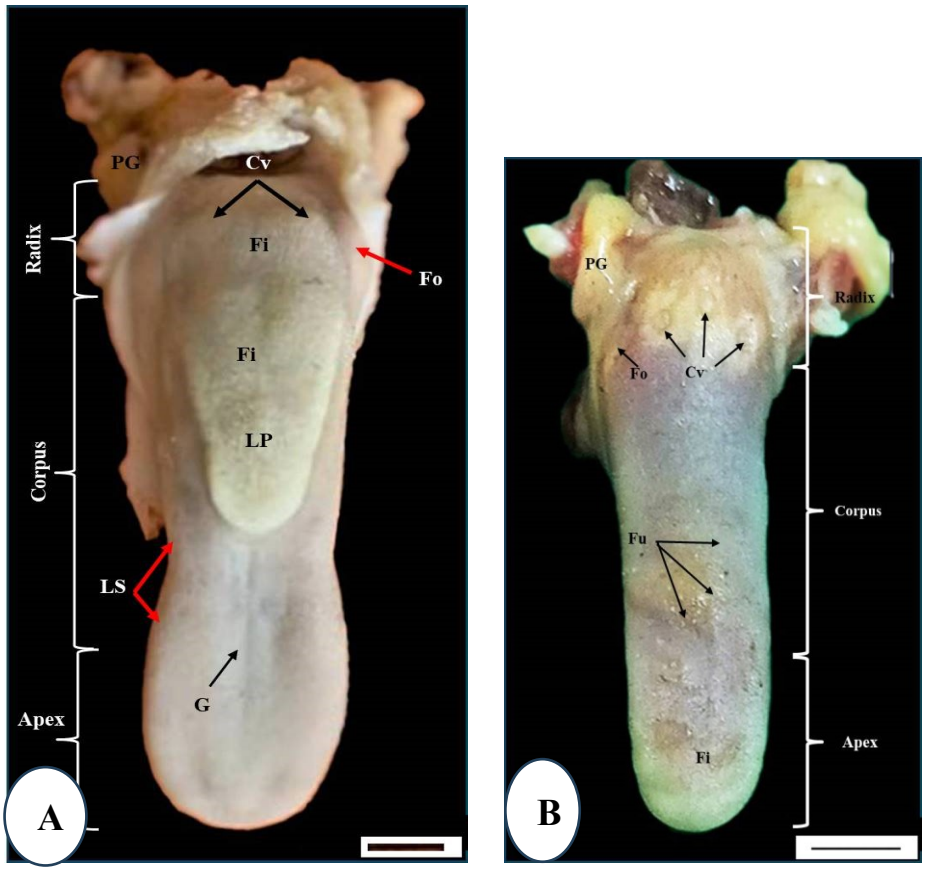

Fig. 1. Photographs showing the dorsal view in the tongue of ***O. cuniculus*** (**A**) and ***H. auritus*** **tongue** (**B**). **Cv:** Circumvallate papillae in the radix region of tongue; **Fi**: Filiform papillae; **Fo:** Foliate papillae in the lateral region of radix tongue; **Fu:** Fungiform papillae; **G**: Median groove in apex tongue; **LP**: Intermolar lingual prominence in the corpus tongue; **LS**: lateral side of tongue; **PG:** Palate glossal folds. (Scale bar = 5 mm)

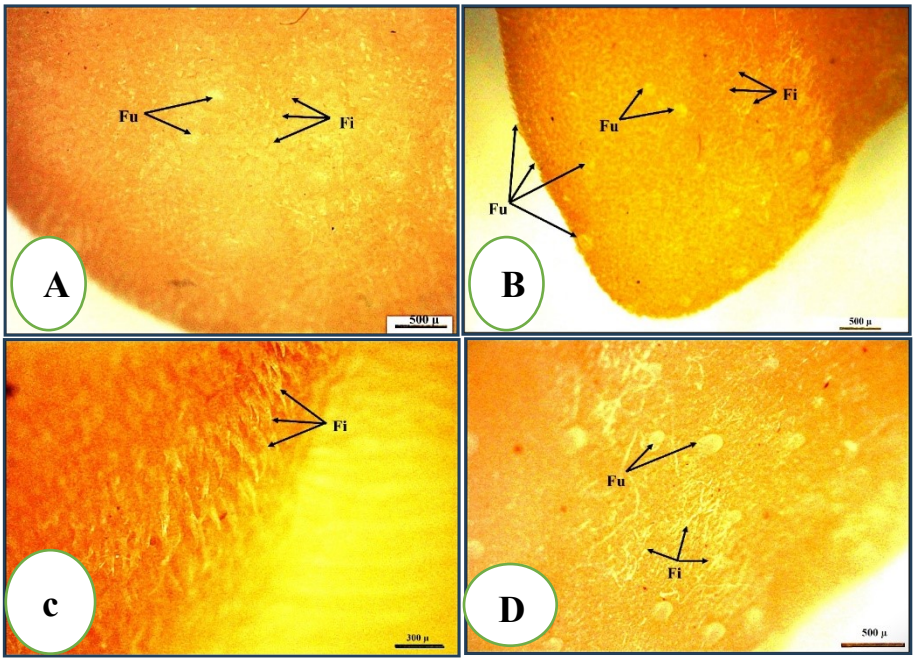

Fig. 2. Microphotographs showing the rounded lingual apex with two circular lateral borders in ***O. cuniculus*** tongue (**A**) and a tapering lingual apex with two circular lateral borders in the tongue of ***H. auritus*** tongue (**B**). There are two types of lingual papillae: filiform (**Fi**) and fungiform (**Fu**). The most abundant filiform papillae (**Fi**) in corpus tongue in ***O. cuniculus*** (**c**), and filiform papillae **(Fi)** cover the whole dorsal surface of the tongue corpus with fungiform papillae (**Fu**) dispersed among the filiform papillae in tongue of ***H. auritus*** tongue (**D**).

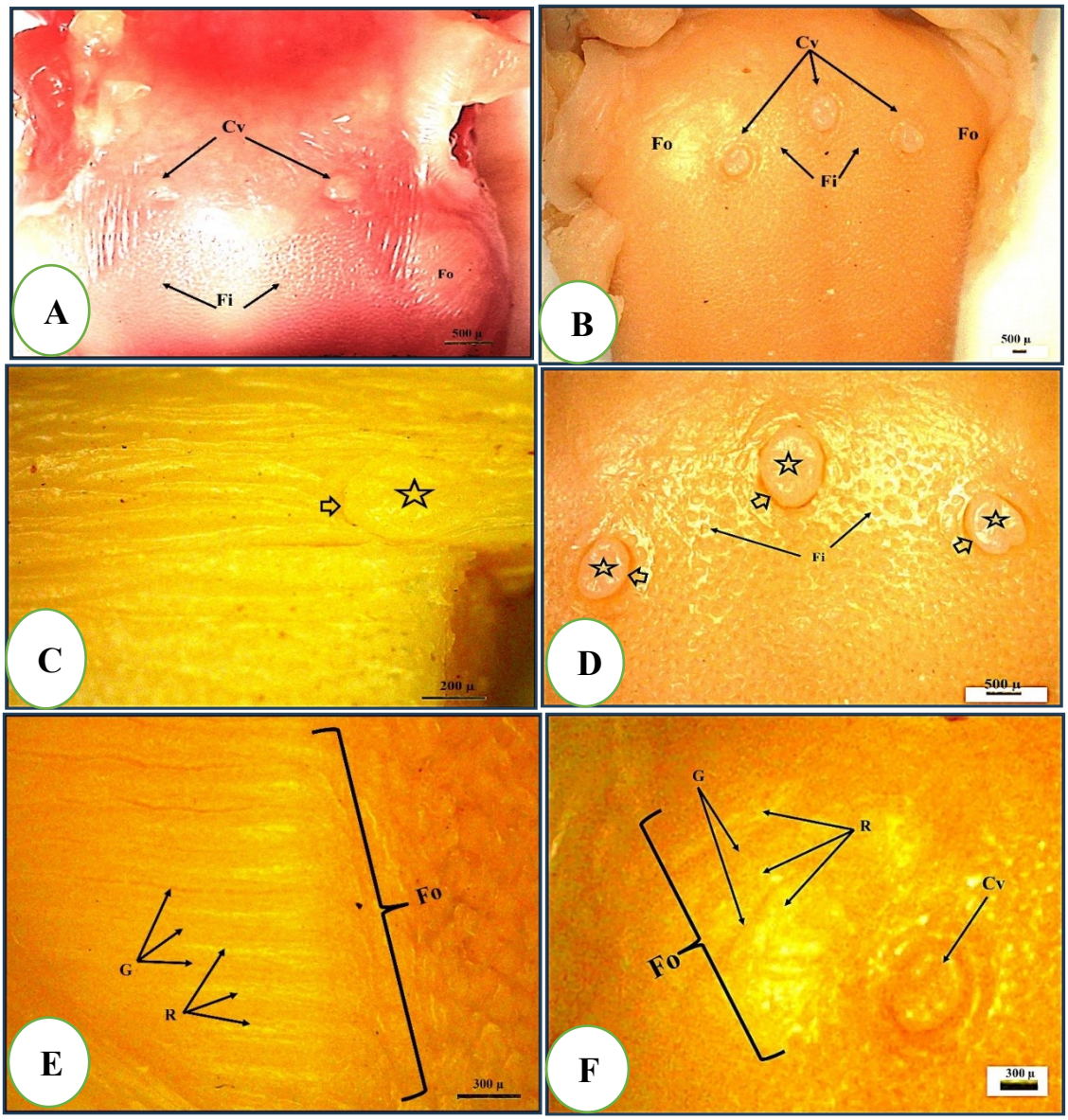

Fig. 3. Microphotographs in the dorsal surface of radix tongue of ***O. cuniculus*** **(A, C & E)** and ***H. auritus*** **(B, D & F)**. These figures showed presence of two circumvallate papillae **(Cv)** in radix tongue of ***O. cuniculus*** (**A**) and three circumvallate papillae **(Cv)** in tongue radix of ***H. auritus*** **(B)** as well as filliform (**Fi**) papillae were observed in both species. The circumvallate papilla (**asterisk**) has a continuous deep depression (**arrowhead**) in ***O. cuniculus*** **(C)** and in ***H. auritus*** **(D)**. Also, there is pair of a patch of well-developed foliate papilla **(Fo)** with multiple parallel ridges **(R)** separated by shallow grooves **(G)** in ***O. cuniculus*** **(E)** and in ***H. auritus*** **(F)**.

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دراسة مقارنة القياسات المورفولوجية (الظاهرية) للسان والاسنان في نوعين من الثدييات

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الملخص

هدفت هذه الدراسة إلى مقارنة السمات التشريحية العيانية للسان وحليماته بين الأرنب الأبيض النيوزيلندي العاشب (Oryctolagus cuniculus) والقنفذ طويل الأذنين آكل للحشرات (Hemiechinus auritus). تم فحص ستة ألسنة مأخوذة من كل نوع تحت المجهر المجسم للخصائص المورفولوجية الإجمالية وتصويرها بواسطة كاميرا رقمية. تم قياس طول وعرض وسمك اللسان ومساحاته المختلفة في كلا النوعين المدروسين. في كلا النوعين ، يتميز السطح الظهري للسان إلى ثلاث مناطق: القمة والجسم والجذور. عادة ما يكون لسان الارنب الابيض عضوا عضليا متوسط الحجم ، بلون عسلي فاتح وسطح خشن. لديها قمة مستديرة. بينما في القنفد طويل الاذنين يبدو أصغر وأرق وله قمة مستدقة. يحتوي السطح الظهري للسان في كلا النوعين على حليمات خيطية تغطي السطح بأكمله ، وحليمات فطرية الشكل منتشرة في جميع الأنحاء. يتميز السطح الظهري لسان الارنب بوجود أخدود متوسط في القمة وبروز لساني في المنطقه المتوسطه للسان (الجسم). هذه الميزات المورفولوجية غائبة في لسان القنفذ. اما في منطقة الجذر لوحظ زوج من الحليمات العديسية في لسان الأرنب بينما توجد ثلاث حليمات من هذ النوع في شكل مثلث في لسان القنفذ. تحتوي كل منطقة جانبية من جذر اللسان على رقعة بها حليمات ورقية متطورة في كلا النوعين. أشارت الدراسة الحالية إلى وجود فروق ذات دلالة إحصائية بين النوعين في وزن الجسم ووزن اللسان ووزن اللسان النسبي وطول اللسان والأسنان. وجد ان لسان الارنب أطول إحصائيا وأوسع وأكثر سمكا من لسان القنفذ. أيضا كانت معظم النسب المورفومترية لقمة اللسان ذات دلالة إحصائية عالية أكبر في الأرنب الابيض من القنفذ طويل الأذنين. في المقابل ، يبدو جذر اللسان أوسع وأكثر سمكا في القنفذ طويل الأذن من الأرنب الأبيض. وبناء على ذلك، تجدر الإشارة إلى أن التقييم المورفومتري القياسى للسان في نوعي الثدييات قيد الدراسة له نتيجة وظيفية فيما يتعلق بالنظام الغذائي لكل منهما.

الكلمات الدالة: . Oryctolagus cuniculus ، Hemiechinus auritus، اللسان ، القمة ، الجسم ، الجذر، الحليمات، الأسنان.