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Histological study to the tongue for the guinea pig (*Cavia porcellus*) in Iraq

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Abstract

The tongue is one of the important organs of vertebrates, as it plays an important role in the process of food intake, absorption and swallowing, It varies the morphological according to the organism, the habitat, and the nature of the food for it. The aim of the study is to reveal the histologist structure of the tongue of the guinea pig (*Cavia porcellus*), where we took three samples of adult males, and crosses the tongue similar to rodents, except for some differences in terms of the epithelial layers, mucosa, the muscular layer, the number of tongue layers and the spread of papillae on the tongue, which is, differences due to adaptation to the habitat and their diet.

Keywords: Histological; Tongue; Guinea pig; Rodents; Papillae; Iraq

1. Introduction

The tongue is a highly mobile, muscular organ with two single surfaces. (5 and 1) The oral cavity of the epithelium of the mouth and the tongue consists of a group of appendages that include the teeth, the filiform papillae, the taste papillae, and the salivary glands. Functionally involved in the digestion of food, distinguishes the tongue of the vertebrates the true tongue has voluntary muscles that movable (2). Histologically; the surface of the tongue is characterized by a large number of lingual papillae, which differ in shape and size (such as filiform, fungiform, and circumvallate), which are found in all animals (3 and 4). The rodent tongue includes four types of lingual papillae propagated on the lingual surface: filiform, foliate, fungiform, and circumvallate (6). Filiform papillae have a conical shape and appear in different heights and thicknesses at different levels. The mycelium is round surrounded by strong filiform papillae. It can also be observed on the ventral surface. They had a pore taste on their surfaces. The Circumvallate papillae contained a primary groove and an annular plate. Its taste opens the pores of this groove (7). The Fungiform, circumvallate, and foliate papillae include taste buds known as linguistic taste papillae, which participate in the sensation of chemical stimuli and in the transmission of taste. The anterior dorsal surface of the tongue is attached to the Fungiform papillae, one of the papillae located in the midline is twisted at the back of the tongue in rodents (8,9). The aim of this study is to know the histological structure in the tongue of wild animals and to provide data for comparison with other rodents.

2. Material and methods

Histological samples were taken from 3 adult's male's tongues, of a guinea pig, and the sample was washed with saline solution and submerged with formalin diluted at 10% for a period of 48 hours. After fixing the sample, it was fixed by Bouin's solution for 15 hours. The sample was dried through a series of dilutions of the ethyl alcohol solution (70%,

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80%, 90%, and 100%) for two consecutive hours for each dilution and after other tissue procedures, the sample was stained procedures (HandE and verHoof stains) (10and11). and then the histological sections were photographed using a digital camera.

3. Results

The present study describes that the tongue consists of three regions: the apex, the body, and the root covered with a keratinized papilla, and it contains two types of papillae (filiform in the dorsal surface and circumvallate papillae) and revealed that the tongue was a thick musculature organ covered by thickened mucus membrane (Fig.1). The apex of the tongue was covered by slightly keratinized stratified squamous epithelium at the dorsal, lateral and ventral surfaces of the tongue showed no lingual papilla. (Fig.2). The stratified squamous epithelium on the dorsal surface of the tongue was the thickest, while the epithelium of ventral surfaces was the thinnest. The thickness of the dorsal epithelium was thicker than those of ventral and lateral surfaces.

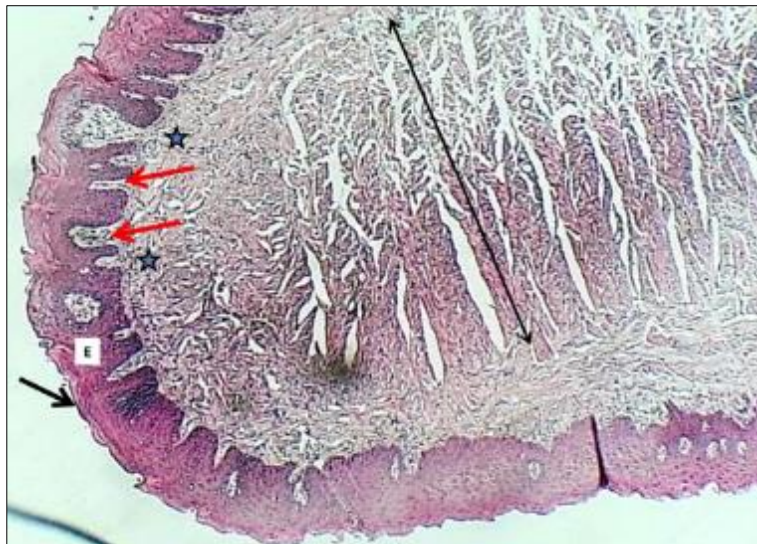


Figure 1 Longitudinal section through the apex of tongue shows: epithelium (E), keratin layer (Black arrow) dermal papilla (Red arrows) (2). Fibrous tissue of sub epithelium (Asterisks) and striated muscle (Double dead arrow). HandE stain 40X

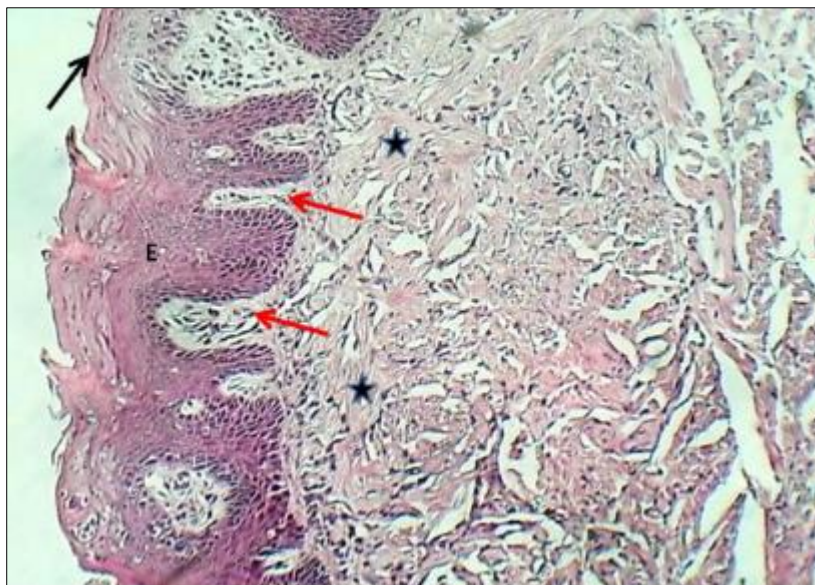


Figure 2 Longitudinal section through the apex of tongue shows: epithelium (E), keratin layer (Black arrow) dermal papilla (Red arrows) (2) and fibrous tissue of sub epithelium (Asterisks). HandE stain 100X



Figure 3 Longitudinal section through the body of tongue shows: thick epithelium displayed numerous filiform papilla (Black arrow), thin longitudinal striated muscles (Red double arrow head) and thick transverse striated muscle bundles (Red double arrow head). HandE stain 100x

The corpus lingua (Body) was covered by a very thick keratinized stratified squamous epithelium. While the ventral surface revealed an absence of the stratum corneum the epithelium was non keratinized stratified squamous epithelium. The subepithelial fibrous tissue was a thin layer and supported by marked longitudinal layers of striated muscle (Fig.3). The ventral surface of the body was similar to that of the apex (Fig.4). At the apex and body, the core of the tongue was built up by longitudinal and transverse bundles of the striated muscle of the tongue. The body of tongue shows: thick epithelium displayed numerous filiform papilla cylindrical shape, thin longitudinal striated muscles and thick transverse striated muscle bundles. (Fig.3)

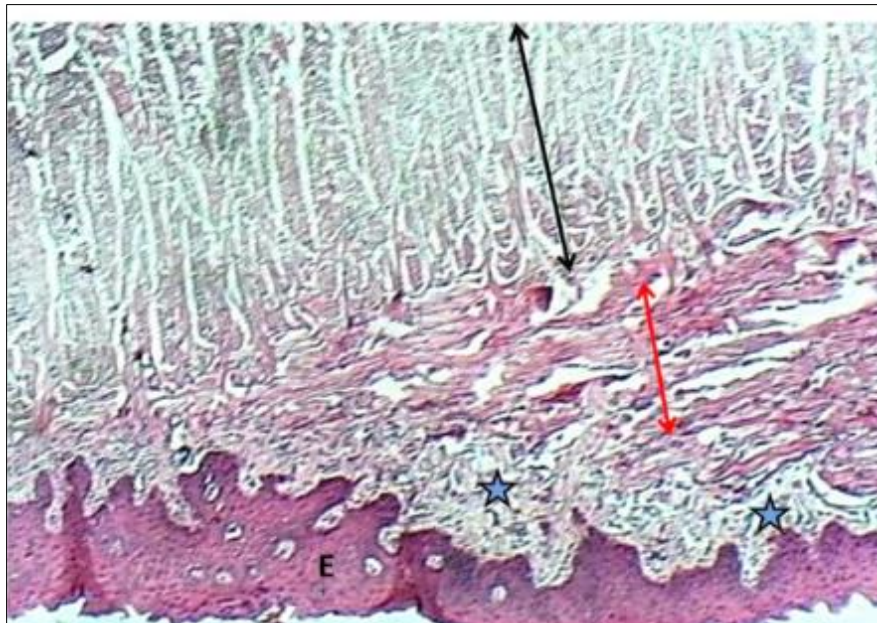


Figure 4 Longitudinal section through the body of tongue (Ventral surface) shows: non keratinized epithelium (Black arrow), longitudinal striated muscles (Red double arrow head) and transverse striated muscle bundles (Black double arrow head). HandE stain 100x

At the root of the tongue, the dorsal surface was smooth showed no filiform papilla, and displayed a very thick keratin layer showed circumvallate papilla (fig.5). The circumvallate papillae were the large had circumscribed shape and surrounded by a deep circular groove that located on both sides of the dorsal surface of the root, the papillae entirely covered by a moderately cornified stratified squamous epithelium which was thicker on the dorsal surface than the thin side, the connective tissue core of these papillae had profuse arterioles, venules, and capillaries and composed of a dense irregular connective tissue, von Ebner's glands were seen at the lamina propria of circumvallate papillae(Fig.6 and7). The core of the root was occupied by compound tubular serous and mucous glands and strands of striated muscles. The serous glands were predominated the mucous gland (fig. 8).

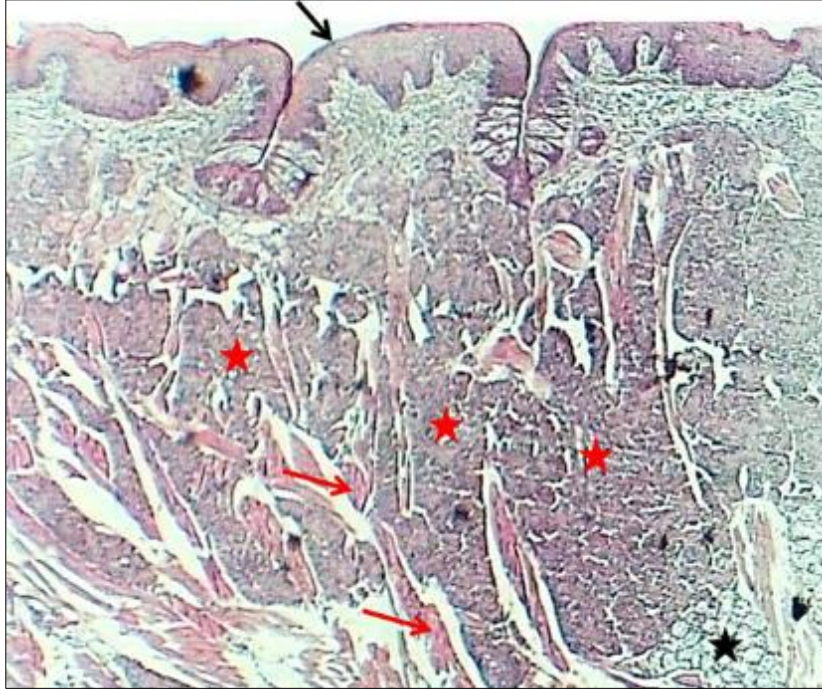


Figure 5 Longitudinal section through the root of tongue (Dorsal surface) shows: thick keratinized epithelium (Black arrow), compound tubular serous glands (Red asterisks), compound mucous tubular glands (Black asterisks) and striated muscles (Red arrows). HandE stain 40x

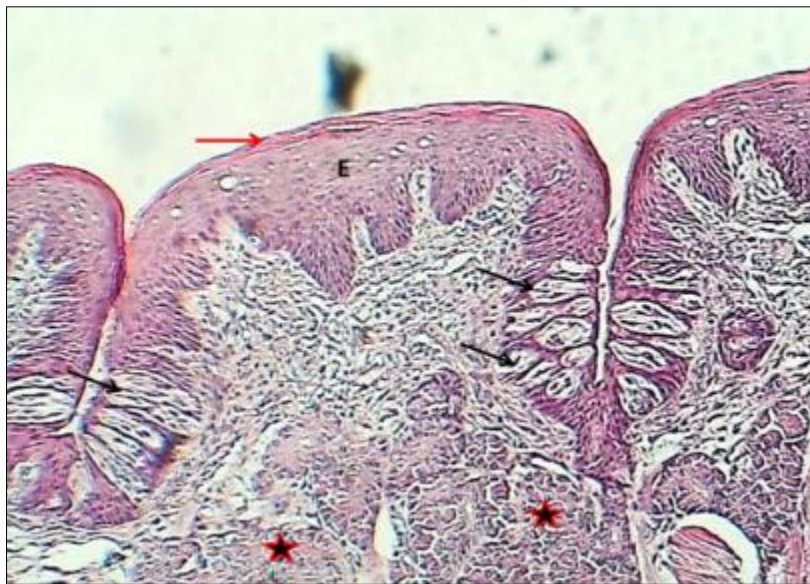


Figure 6 Section of the circumvallate papilla shows: thick keratinized epithelium (Red arrow), Von Ebnor (serous glands) (Asterisks), taste buds (Black arrows). HandE stain 100x

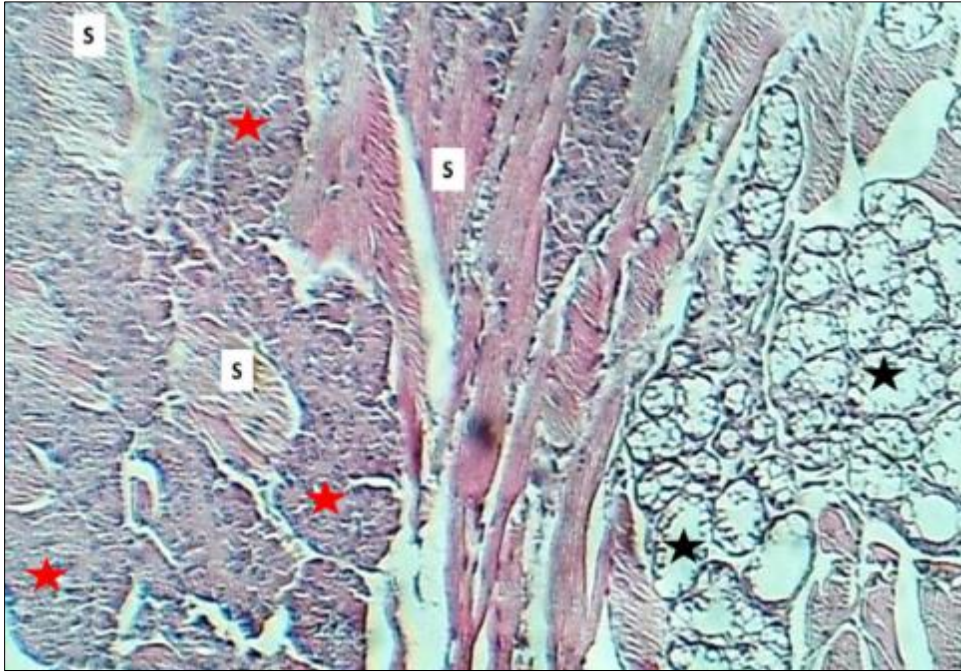


Figure 7 Section through the lingual salivary glands shows: small size serous acini (Red asterisks), large size mucous alveoli (Black asterisks) and striated muscles (S). HandE stain 100x

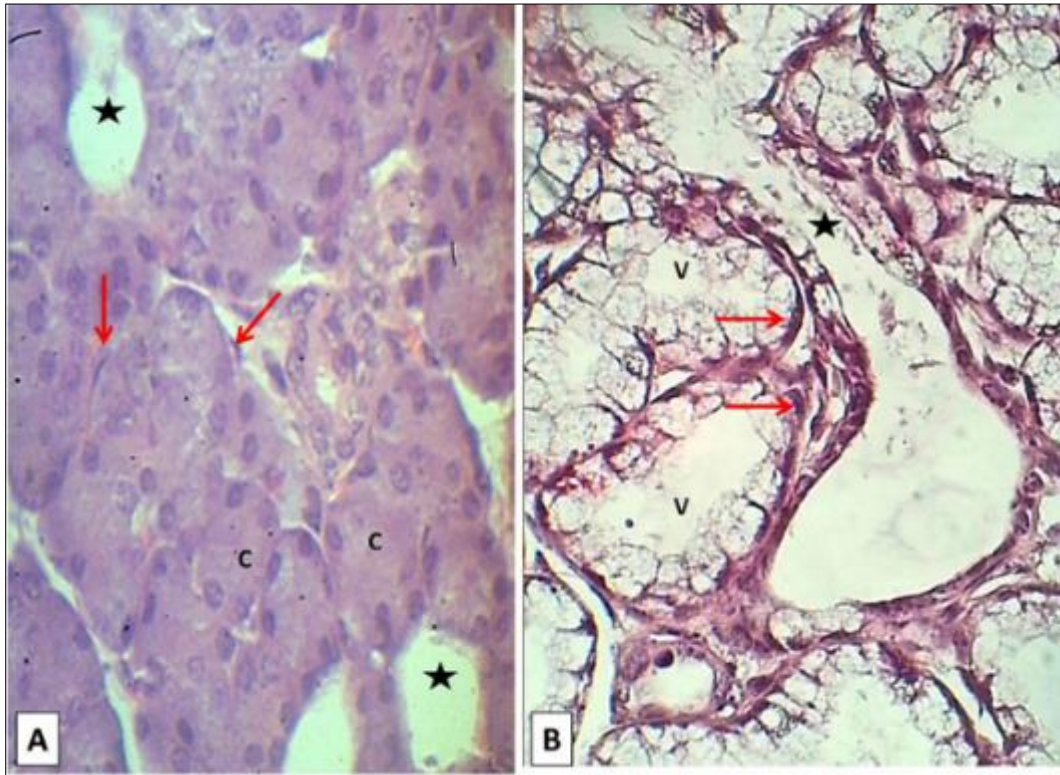


Figure 8 Section of the lingual salivary glands, section (A) compound serous glands and section (B) shows myoepithelial cells (Arrows), mucous alveoli (V), serous acini (C.), intercalated duct (Asterisks). HandE stain 100x

The core of the tongue was composed of two types; subepithelial dense irregular collagenous connective tissue and muscular tissue the connective tissue showed no elastic fibers(fig.9).

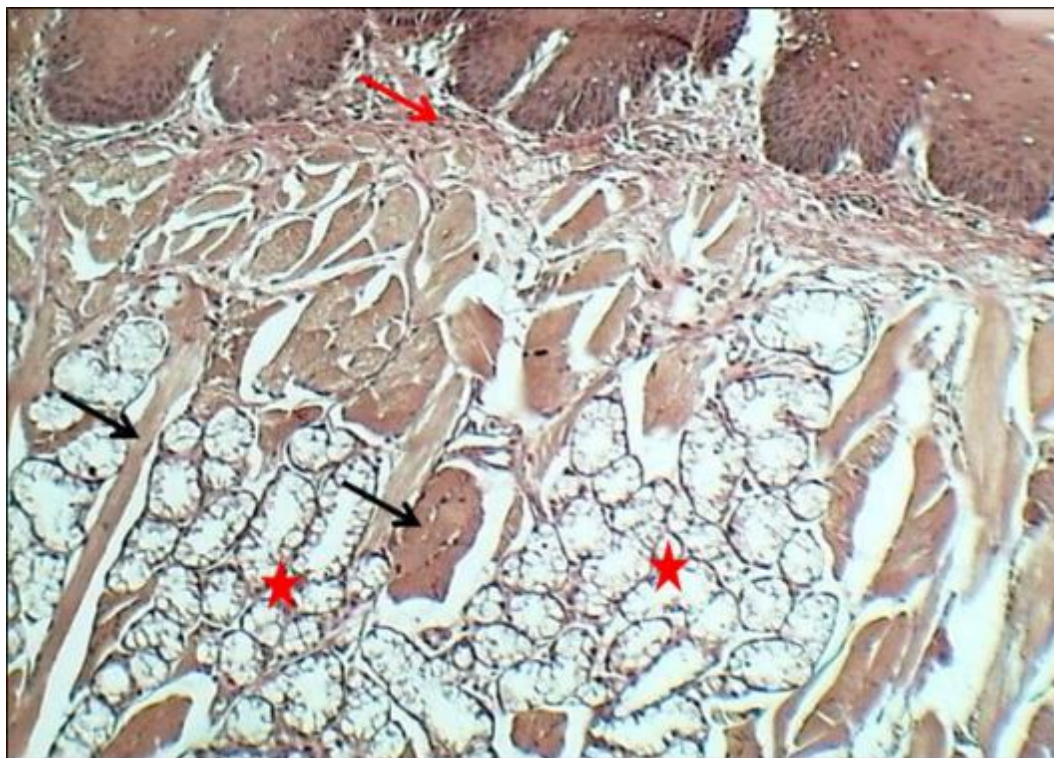


Figure 9 Section of the tongue at root shows subepithelial dense collagenous connective tissue (Red arrow) and striated muscle (Black arrows) and mucous alveoli (Asterisks). Verhoeff stain 100x

4. Discussion

The tongue is a muscular mobile organ consisting of three regions: a root, a body, and a tip. The dorsal side is relatively thick compared to the current study, and it contains a protrusion as a torus lingual (12). The papillae found on the dorsal surface of the tongue and their distribution is a specialty and feature that differs according to different races and species, according to the habitats and foods consumed by that species, as these features greatly affect the papillae, their type, distribution, and morphology of papillae (13) (22). The presence of papillae on the surface of the tongue enhances the process of absorption, transport, and swallowing of food by increasing the surface area of the tongue (14). Histological features of rodents In general, keratinization of the epithelium is observed over the entire dorsal region, including the filamentous papillae as well (15 and 16). This keratinization occurred because she was a greedy eater (16) Note that the filiform papillae are comparable in structure in almost all mammals. The papillae are directed towards the root to facilitate the storage of food on the dorsal surface of the tongue. Studies have shown that the tongue is muscular and consists of a top, a body, and an end or base (root) that changes in thickness as we move towards the pharynx. The papillae are divided into two types in all the mechanical and gustatory papillae with different numbers compared with the current study. The tongue of Egyptian fruit bats is divided into three regions: the anterior part is not distinguished by papillae, the middle part contains lingual papillae heading back towards the pharynx with filiform papillae in the current study have filiform papillae in the dorsal surface (body region) of the tongue and Egyptian fruit bats filiform papillae distributed on the anterior, middle, and posterior part and are pink in color in addition to the transitional and conical papillae, while the fungiform papillae spread on the top of the tongue and on the sides of the tongue are arranged in a triangular shape in the current study has no transitional and conical papillae but present the circumvallate papilla (17) The dorsal surface of the tongue of the Egyptian rat revealed the presence of different subtypes of filiform papillae, while they were not found in the tongue of the guinea pig (18).

In the Persian squirrel, filiform papillae were observed covering the entire surface of the tongue and increasing in number and size as we moved towards the root in like this study. The fungal buds were scattered on the tongue surrounded by the groove of each one with the presence of taste buds on the lateral walls. foliate papillae are scattered on both sides of the tongue with a large number of taste buds. The core of the tongue is made up of language glands, skeletal muscles, and connective tissue like this current study. The glands are located in an area between the body and the root of the tongue. The front part contains serous, mucous, and serous cells. (19) Studies have shown that the fungiform papillae have different shapes in the mammary glands. In mice, they were cylindrical and bats were cone-

shaped, while in hedgehogs they were similar to hemp and were all scattered. Consciousness was consistent with all studies of different sizes and shapes, while it did not appear in the tongue of the guinea pig (20 and 21). When comparing the white rat albino rat (*R. norvegicus*) tongue with that of the guinea pig, it is clear that the filiform papillae have a conical shape extending on the surface of the tongue, while the tongue of the guinea pig is concentrated in the lingual body, of the dorsal surface and the absence of fungiform papillae in the current study, various the white rat (22 and 23).

The tongue of the Pebbly Fish is covered with a squamous layer with a number of lymphoid cells with the soft tissue of fat cells with a layer of skeletal muscle that was thin in the submucosal layer. The muscle layer separates the epithelial cells from the submucosal layer and the tongue contains a cartilaginous part of which the tongue is believed to be composed compared with the current search (24, 25).

The tongue of the hedgehog contained filiform, thorn-like papillae, not divided into secondary sections, while the current study showed the presence of the filiform conical papillae in the lingual body of the surface of the tongue, and the fungiform papillae appeared in the form of assemblies in the lingual body, while the current study was free of them similar to the tongue of the hedgehog with the tongue of the guinea pig. The presence of the circumvallate papillae at the end of the tongue and the absence of the foliate papillae (26, 27).

5. Conclusion

Histological studies of the tongue of vertebrates in general and rodents in particular manifest that the division of the tongue and the distribution of the papillae on the dorsal surface of the tongue varies according to the difference of sex and gender due to the different nature of habitats and food and the adaptation of the organism to it and based on these differences came in the current study.

Compliance with ethical standards

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Disclosure of conflict of interest

There was no conflict of interest in this study.

Statement of ethical approval

All operations and conclusions were executed under the knowledge and supervision of the laboratories of the Iraq Natural History Research Center and Museum \ University of Baghdad.

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