

GROSS AND MICROANATOMICAL OBSERVATIONS ON THE TONGUE OF GUINEA PIG

THOKCHOM SHITARJIT SINGH¹, S. USHA KUMARY*¹ and O.R. SATHYAMOORTHY²
¹Department of Veterinary Anatomy, Madras Veterinary College, ²Department of Veterinary Anatomy,
 Veterinary College and Research Institute, Theni-625602
 Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai-600007, India

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SUMMARY

This study was carried out to describe the gross and microanatomical characteristic features of the tongue of guinea pig. Tongue of guinea pig was elongated in shape and was 3.3 ± 0.10 cm in length. Four types of papillae viz. filiform, fungiform, foliate and vallate papillae were observed on the surface of the tongue. Filiform papillae were distributed throughout the entire dorsal surface of the tongue and showed different shapes. The fungiform papillae exhibited a dome-shaped, and few taste buds were observed on the top of the dorsal surface of the epithelium. Two well-developed vallate papillae were noticed in the caudal region which was close to the root. Foliate papillae were formed by folds of epithelial projections and were limited by deep parallel grooves.

Keywords: Filiform, foliate, fungiform, guinea pig, vallate

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Guinea pigs (*Cavia porcellus*) are small laboratory animals that belong to rodent species of family Caviidae and the genus *Cavia*. There are different strains of guinea pigs but mostly only five strains of guinea pigs are often used as a model organism for biological experimentation (Clemons and Seeman, 2011). This study aimed to describe the gross and microanatomical characteristic features of the tongue of guinea pigs.

Six adult guinea pigs were collected from the Department of Laboratory Animal Medicine, Madhavaram Milk Colony, Chennai after getting approval from the Institutional animal ethics committee (IAEC), TANUVAS for research purposes.

After recording the gross anatomical observations, the tongue was dissected from the oral cavity and fixed in 10% neutral buffered formalin and processed for routine paraffin embedding and sectioning. Sections of 5-6 μ m thickness were cut with microtome and stained with haematoxylin and eosin for routine histological observations (Luna, 1968). Special staining techniques employed were Masson's Trichrome and Picrosirius red staining methods for collagen fibers (Luna, 1968), Gomori's silver stain for reticular fibers (Gomori, 1937) and Weigert's method for elastic fibres (Luna, 1968).

The tongue of guinea pig was attached to the floor of oral cavity by a fold of mucous membrane, frenulum linguae. Sulcus linguae was not observed. The tongue was elongated in shape and had three parts viz. apex, body and root (Fig. 1). The average length of tongue of guinea pig was 3.3 ± 0.10 cm. The length of tongue of agouti was reported as 4.5 cm (Ciena *et al.*, 2013). There was a elevation,

the lingual prominence near the caudal region of body adjacent to the molar teeth similar to that of torus linguae in ruminants. In guinea pig tongue, four types of papillae were present namely, filiform, fungiform, vallate and foliate. As in nutria *Myocastor coypus* (Emura *et al.*, 2001) and Patagonian cavy (Emura *et al.*, 2011).

The dorsal surface of the tongue was lined by keratinized stratified squamous epithelium. However, the keratinization was less on the ventral surface of tongue similar to observations of Ciena *et al.* (2013) in agouti and Lopes *et al.* (2009) in rat. The lamina propria and submucosa was composed of loose connective tissue along with blood vessels and nerves as recorded in persian squirrel Sadeghinezhad *et al.* (2016). The core of the tongue was composed of striated muscle fibers in various directions crossing one another, fat, nerve fibers, blood vessels and lingual glands.

The filiform papillae were distributed on dorsal surface of the tongue and were lined by keratinized stratified squamous epithelium. similar to observation made by Ciena *et al.* (2017) in guinea pig, Ciena *et al.* (2013) in agouti and Sadeghinezhad *et al.* (2016) in Persian squirrel. These papillae were of different shapes: long papillae, short papillae, trifold (branched) papillae and large papillae (Fig. 2) as recorded by Kobayashi (1990); Ciena *et al.* (2017) in guinea pig and Sadeghinezhad *et al.* (2016) in Persian squirrel. The lamina propria was highly vascularized, without lingual glands and it remained in contact throughout the epithelium.

Two well-developed vallate papillae were noticed in the caudal region of the tongue similar to observation of

*Corresponding author: ushaacademic@gmail.com

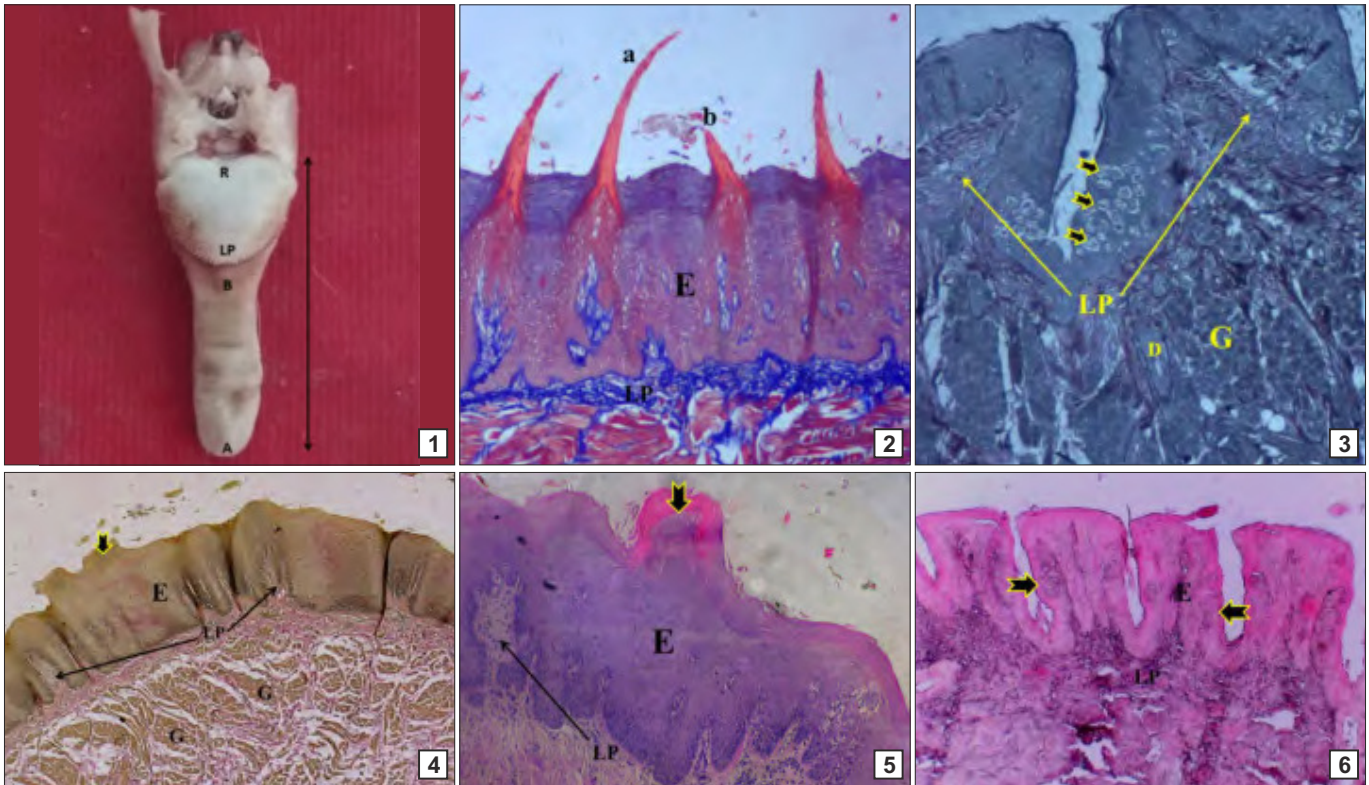


Fig. 1-6. (1) Photograph of the dorsal surface of the tongue of adult guinea pig showing apex (a), body (b), lingual prominence (p) and root (r). (2) Photomicrograph of the filiform papillae showing different shapes. a- Long papillae, b- Short papillae E- Epithelium LP-Lamina propria (Picrosirius red staining x400); (3) Photomicrograph of the vallate papilla in the tongue of guinea pig showing taste buds (arrow). LP- Lamina propria D- Ducts of salivary glands (Gomori's x400); (4) Photomicrograph of the fungiform papillae showing thin epithelium (E) adjacent to the lamina propria (LP), taste buds at the top (arrows) and salivary glands (G). (Gomori's x400); (5) Photomicrograph of the fungiform papilla showing taste buds (arrows). (H&E x400); (6) Photomicrograph showing the foliate papillae. E-Epithelium Arrow head-Taste buds LP-Lamina propria (H&E x100)

Ciena *et al.* (2017) in guinea pig. But there was a single vallate papilla in rats (Lino and Kobayashi, 1988; Ciena, 2013). However, two vallate papillae were reported in nutria (Emura *et al.*, 2001) and rabbits (Silva *et al.*, 2002). But, three or four vallate papillae were noticed in flying squirrels (Emura *et al.*, 1999) and in agouti (Ciena *et al.*, 2013). In the present study, circumvallate papillae were lined by a thick keratinized stratified squamous epithelium as in Persian squirrel (Sadeghinezhad *et al.*, 2016) and guinea pig (Ciena *et al.*, 2017). Taste buds were seen on the lower third of the lateral walls of papillae (Fig. 3). The serous lingual glands (Von Ebner glands) and their respective ducts were noted in the lamina propria. This was similar to the observation in Persian squirrel (Sadeghinezhad *et al.*, 2016) and guinea pig (Ciena *et al.*, 2017).

The fungiform papillae were dome-shaped and were densely distributed among the filiform papillae on the apex and margin of the tongue and evenly scattered on the body and also the root of the tongue (Fig. 4). These observations are similar to findings in the tongue of other rodents such as the mice (Qin *et al.*, 2010), blind mole rat (Kilinc *et al.*, 2010) and agouti (Ciena *et al.*, 2013). These papillae were

somewhat keratinized, and very few taste buds were observed on the top of the dorsal surface of the epithelium (Fig. 5) However, Persian squirrel possessed one to four intraepithelial taste buds on the top surface (Abumandour and El-Bakary, 2013). However, no taste buds were found in porcupines (Kubota *et al.*, 1966) and 1 to 10 taste buds were present in rabbits (Nonaka *et al.*, 2008).

In the present study, the foliate papillae placed bilaterally, on the caudal region of tongue of guinea pig. These papillae were formed by folds of epithelial projection limited by deep parallel grooves. This is similar to the observation recorded by Ciena *et al.* (2017) in guinea pig. According to Emura *et al.* (2011) and Ciena *et al.* (2013), foliate papillae were well developed in some animals of the order Rodentia. Epithelial lining of this papillae was stratified squamous keratinized epithelium but it was thin in the present study. Taste buds were deeply embedded on their lateral wall of the papillae (Fig. 6). The papillae were restricted by deep vertical groove into which serous units open as recorded in guinea pig (Ciena *et al.*, 2017) and in Persian squirrel (Sadeghinezhad *et al.*, 2016).

Lingual salivary glands were arranged in the body

and root of the tongue in which the serous von Ebner's glands were located anteriorly and Weber's glands were placed posteriorly (Fig. 8 & 9) similar to reports of Ciena *et al.* (2017) in guinea pig and Sadeghinezhad *et al.* (2016) in Persian squirrel. However, mammals may show three types of lingual salivary glands including the glands of Blandin-Nuhn, von Ebner's glands and Weber's glands (Tandler *et al.*, 1994). The Weber's glands are said to aid in swallowing dry food and facilitates the tongue movement (Nagato *et al.*, 1997). The von Ebner's glands are said to be involved in taste perception (Li and Snyder, 1995).

CONCLUSION

The results from this study showed the detailed description of the gross and micromorphological features of tongue of guinea pig including various lingual papillae along with lingual salivary glands.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with the manuscript.

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