



## ARAŞTIRMA

F.Ü.Sağ.Bil.Vet.Derg.  
2010: 24 (2): 99 - 102  
http://www.fusabil.org

### Study by Light and Scanning Electron Microscopy of the Fungiform Papillae on Tongue of the Porcupine (*Hystrix cristata*)

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The objective of this study was to determine the distribution and the structure of their taste buds and fungiform papillae on the porcupine's tongue by light and scanning electron microscopy.

The tongue of the porcupine had a slender anterior protrusion and the tip of the tongue was round. The fungiform papillae were mushroom in shape and covered squamous epithelium. The fungiform papillae were absent on the dorsal midline and apex of the tongue. They were scattered along both lateral edges of the dorsal surface in the middle region. The highest distribution of papillae was on the posterior one-thirds of the tongue. In tongues of the porcupine, 99% of all fungiform papillae contained taste bud. Almost every fungiform papillae typically had four or five taste buds. However, occasionally some had a taste bud at its center, and relatively few papillae were without taste buds.

**Key Words:** Porcupine, tongue, fungiform papillae.

#### Oklu Kirpi (*Hystrix cristata*) Dilindeki Papilla Fungiformis'lerin Işık ve Scanning Elektron Mikroskopuyla İncelenmesi

Bu çalışma, oklu kirpi dilindeki papilla fungiformis ve tat tomurcuklarının dağılımı, ışık ve elektron mikroskopik yapılarının belirlenmesi amacıyla yapılmıştır.

Oklu kirpinin dilinin ön kısmında ince uzun bir çıkıntı bulunmaktaydı ve dilin ucu yuvarlağı. Papilla fungiformis'ler mantar şeklindeydi ve squamöz epitel ile örtülüydü. Papilla fungiformis'ler üst orta çizgide ve dilin ucunda bulunmamaktaydı. Orta bölgede her iki yan kenar boyunca dağılmışlardı. Papillalar dilin en çok arka 1/3 ünde görülmekteydi. Oklu kirpinin dilindeki papilla fungiformis'lerin %99'u tat tomurcuğu içermekteydi. Hemen hemen her papilla 4 veya 5 tat tomurcuğu kapsamaktaydı. Bununla birlikte, bazıları bir tat tomurcuğuna sahipti ve nisbeten çok az papillada tat tomurcuğu bulunmamaktaydı.

**Anahtar Kelimeler:** Oklu kirpi, dil, papillae fungiformes.

#### Introduction

The rodents (rodentia) are the widest order of placental mammals and make up more than half of the mammals known at present. The porcupine belongs to the Hystricidae family that constitutes a small group of the order Rodentia (1,2).

Although structure of rodent fungiform papillae has been studied in rat (3-8), mouse (9,10), hamster (11-13), guinea pig (14), flying squirrel (15), opossum (16), squirrel monkey (17) and porcupine (*hystrix cristata*) (18). There is a only one report on details of the fungiform papillae of the porcupine. In this study fungiform papillae and their taste buds on the tongue of the porcupine were investigated by light and scanning electron microscopy.

#### Material and Methods

Five (three males and two females) adult porcupines (*Hystrix cristata*) were used in this study, without sexual distinction. They were hunted by villagers in Eastern Anatolia. Animals were sacrificed by an overdose of pentothal anesthetic. Tongues were removed immediately for histological examination. The tongue samples trimmed, were fixed for 24-48 h in 10 % neutral formalin, and embedded in paraffin.

SEM; For scanning electron microscopic examination tongue samples were placed into 3% glutaraldehyde with phosphate buffer (pH: 7.3). After rinsing in buffer, tissues were post-fixed in 1% osmium tetroxide (OsO<sub>4</sub>) at 37 °C for 1.5 hours. After post-

Geliş Tarihi : 09.03.2010  
Kabul Tarihi : 25.05.2010

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fixation tissues were placed in 3N HCl at 60 °C for 20 minutes to remove the extracellular musuc from the surface of the tissue. Tissue samples were passed alcohol and amyl acetate series and dried with critical-point-dryer. Specimens were coated with gold and observed a Jeol JSM 5600 SEM at 5-15 kv.

## Results

The tongue of the porcupine had a slender anterior protrusion and the tip of the tongue was round. It was about 6.7 cm long and about 1.6 cm wide. There was a profound fossa in the middle of dorsal surface of the tongue. The median sulcus was extended to area except for the posterior part. However, the median sulcus on the anterior part of the dorsal surface was clearer than those on the middle part of the tongue (Figure 1)



**Figure 1.** The tongue of the porcupine. Median sulcus (m), intermolar eminence (ie), fossa linguae (f), fungiform papillae (arrow).

The fungiform papillae were mushroom in shape and covered squamous epithelium. They had round or oval outlines. The fungiform papillae were absent on the dorsal midline and apex of the tongue. They were scattered along both lateral edges of the dorsal surface in the middle region. However they were common on the posterior one-thirds of the tongue and the highest density of papillae was located on this region.

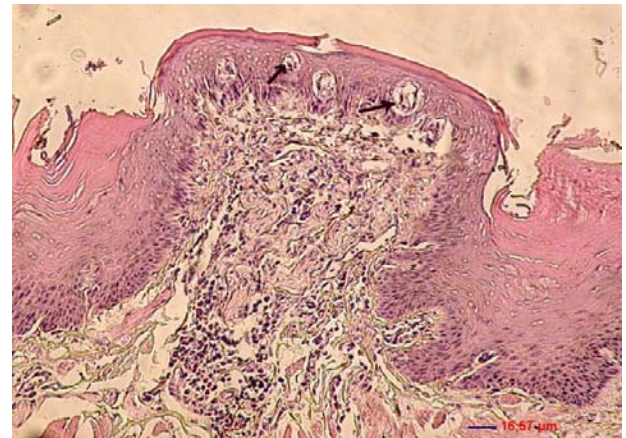
The fungiform papillae were sparsely distributed 4-5 numbers on the middle one-thirds of the tongue and 9-10 numbers on the posterior one-thirds of the tongue. A mean total number of 14-15 fungiform papillae per tongue were found which were about equally divided between the two lateral halves of the tongue. The

papillae were distributed as follows: 33% (4-5 numbers) on the anterior half of the tongue and 66% on the posterior half of the tongue (9-10 numbers).

Average lengths of papillae were 1625 micrometers and average diameters of papillae were 1187 micrometers.

In tongues of the porcupine, 99% of all fungiform papillae contained taste bud. Almost every fungiform papillae typically had four or five taste buds (Figure 2a) However, occasionally some had a taste bud at its center, and relatively few papillae were without taste buds (Figure 2b). A consistent feature of the taste buds was it's location at the apex of a small hill-shaped epithelial protrusion of the central papillary surface.

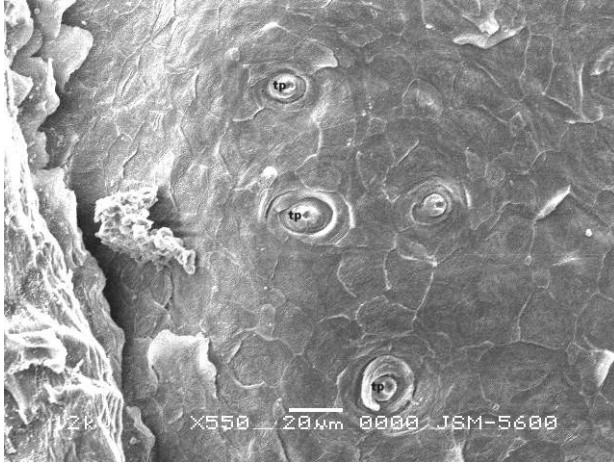
There was taste pores on the fungiform papilla (Figure 3a). It was seen very small micropit and microridge in the boundary of epithelial cells (Figure 3b).



**Figure 2a.** Light microscope photograph of fungiform papillae. Arrow: taste buds of fungiform papilla. H.E.



**Figure 2b.** Light microscope photograph of fungiform papillae. H.E.



**Figure 3a.** Scanning electron micrograph of fungiform papillae (fu). X.



**Figure 3b.** Scanning electron micrograph of fungiform papillae (fu) X.

## Discussion

It was reported that the median sulcus was present in the anterior part of the dorsal surface of the tongue in the rat (4) and Mouse (10). The present results indicated that

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the median sulcus was present both anterior and middle part of the tongue.

The investigators have pointed out that the fungiform papillae of guinea pig (14), rat (3,5-8) mouse (9,10) and flying squirrel (15) were densely located in the tongue tip and they were absent on the dorsal midline. In the opossum they were concentrated around the edges of the tongue. In the present study the fungiform papillae were absent both on the midline and on the tongue tip. They were scattered along both lateral edges of the dorsal surface in the middle one-thirds and they were common on the posterior one-thirds of the tongue. The pattern of distribution of fungiform papilla in the porcupine was different from that guinea pig, rat, mouse, flying squirrel and opossum.

Suggested that over 50% of the total number of fungiform papillae were located on the tongue tip (anterior quarter) in the rat (5). The results of the present study indicated that 33% of fungiform papillae were found on the anterior half of the tongue

In rat (4,8), mouse (10) and hamster (13) each fungiform papillae had only a taste bud. In the opossum (16) and porcupine (18). They had no taste bud. In the present study, fungiform papillae generally had four or five taste buds.

Mistretta and Baum was found about 116 (6 months), 113 (twenty-four months) papillae per tongue in rats. On the other hand Miller and Preslar was found about 187 papillae per tongue in rats (93 papillae on the right sides and 95 on the left sides). While, Dinç et al. was found 115 (10 days) (59 papillae on the right sides and 56 papillae on the left sides), Mistretta and Oakley was found 119 (60 days) (61 papillae right sides and 58 papilla on the left sides) papillae per tongue identified 53 to 93 fungiform papillae per tongue in rats. These results were significantly different with present study.

The morphology of the fungiform papillae observed in this study was the different from that observed in other rodents.

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