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Light and scanning microscopic structure of filiform papillae in mice

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ABSTRACT

The aim of this study was to investigate the light and scanning electron microscopic structure of filiform papillae in adult mice. Light microscopic examination revealed that the papillae were covered with stratified squamous epithelium and had a core of connective tissue. Filiform papillae were observed on the dorsal surface of the tongue, located between the apex of the tongue and the vallate papillae. Three different types of filiform papillae were observed in three different areas: cylindrical in the anterior part of the tongue, large conical on the intermolar eminence, and small conical in front of the vallate papilla in the posterior part of the tongue. In scanning electron microscopic examination, epithelial cell-margin thickening was recognizable. Micropits and microridges were observed on the surface of the epithelial cells of the filiform papillae.

Key words: mouse, filiform papillae, scanning electron microscope

Introduction

There have been several light and scanning electron microscopic studies on the structure of filiform papillae in rats (IIDA et al., 1985; KULLAA-MIKKONEN et al., 1987; IWASAKI et al., 1997, 1999), mice (IWASAKI et al., 1987b; MEISEL et al., 1987; IWASAKI et al., 1996), hamsters (FERNANDEZ et al., 1978), guinea pigs (KOBAYASHI, 1990), porcupines (KUBOTA et al., 1966) and flying squirrels (EMURA et al., 1999) belonging to the order rodentia.

Scanning electron microscopic studies on the development of filiform papillae in rats (IWASAKI et al., 1997, 1999) and mice (MEISEL et al., 1987; IWASAKI et al., 1996) have been presented. However, information about the light or scanning electron microscopic structure of filiform papillae in adult mice is somewhat limited.

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The purpose of this study was to examine, with light and scanning electron microscopy, the distribution pattern and form of the filiform papillae on the adult mice tongue, in order to compare the results with those previous reports in other rodentia.

Materials and methods

Tongues from 12 adult mice of both sexes, mass of approximately 40 g (Mice of the BALB/c strain, obtained from Veterinary Control and Research Institute, Elazığ, Turkey) were used for the study. Animals were anaesthetized with ether and euthanized. Tongues were removed immediately and put into 10% neutral formaldehyde for histological examination. After routine processing 5-7 μ m sections were cut and stained with hematoxylin-eosin.

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 (OsO₄) at 37 °C for 1.5 h. Afterwards, post-fixation tissues were placed in 3 N HCl at 60 °C for 20 min. to remove extracellular mucus from the surface of the tissue (IWASAKI et al., 1996, 1997). Tissue samples were passed through alcohol and amyl acetate series and dried with critical-point-dryer. Specimens were coated with gold and observed under a Jeol JSM 5600 scanning electron microscope at 5-15 kV.

Results

Light microscopy. Filiform papillae were covered with stratified squamous epithelium and had a core of connective tissue. Connective tissue formed microscopic or dermal papilla. Although prominent keratinization was observed in the anterior surface of the papillae, keratinization at the posterior surface was less distinguished (Fig. 1).

Scanning electron microscopy. Three distinct types of filiform papillae were observed in three different parts of the tongue. These papillae were located between the apex of the tongue and the vallate papillae in the posterior. Cylindrical-shaped filiform papillae were observed between the apex of the tongue and the intermolar eminence. These papillae were directed towards the root of the tongue. The papillae that were close to the median sulcus were slightly directed towards the sulcus (Fig. 2). Higher magnification of the cells from the surface of these papillae revealed that the borders of the cells, especially in the anterior edge, were thickened. These cells were mainly located at the middle and basal parts of the papillae. At the surface of these epithelial cells, micropits and microridges were detected (Fig. 3).

Large, conical shaped filiform papillae were observed on the intermolar eminence in concentric circles. Parts of the papillae facing the centre were the anterior side, and the opposite parts were the posterior side of the papillae. The tip of each papilla was divided

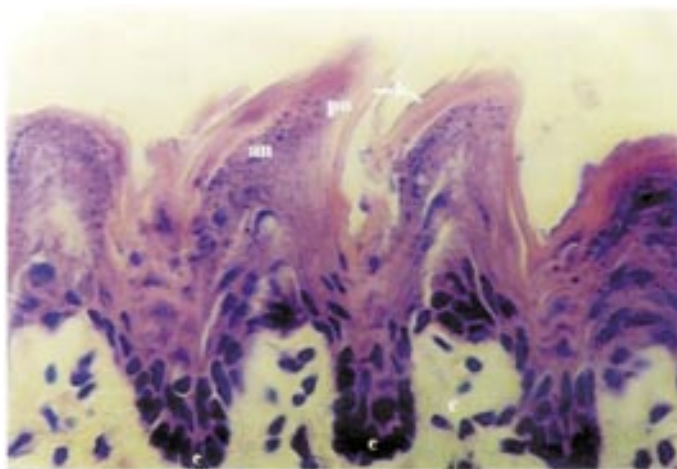


Fig. 1. Light microscopic photograph of filiform papillae. Stratified squamous epithelium (e), anterior surface of filiform papillae (an), posterior surface of filiform papillae (po), connective tissue (c) and keratinised layer (k). H&E, $\times 40$.

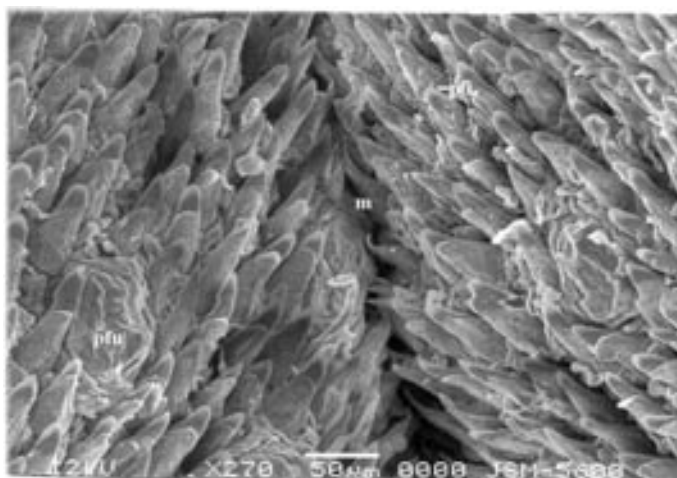


Fig. 2. Scanning electron micrograph of cylindrical-shaped filiform papillae of the anterior part of tongue. Filiform papilla (pfi), fungiform papilla (pfu), median sulcus (m). SEM, $\times 270$

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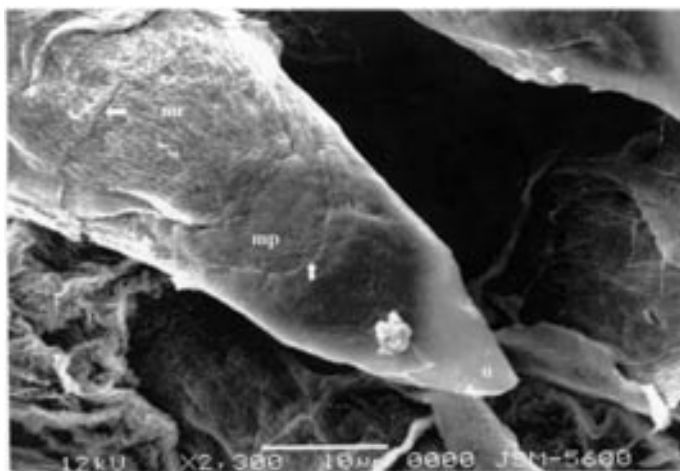


Fig. 3. Higher magnification of filiform papilla. Micropits (mp), microridges (mr), cell-margin-thickening (arrows), tip of papilla (u). SEM, $\times 2300$.

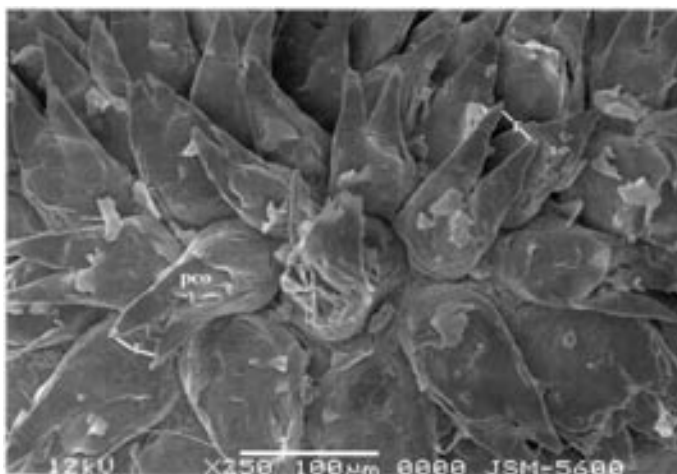


Fig. 4. Large conical shaped filiform papillae arranged in concentric circles on the intermolar eminence. Large conical-shaped filiform papilla (pco), terminal processes of papilla tips (r). SEM, $\times 250$.

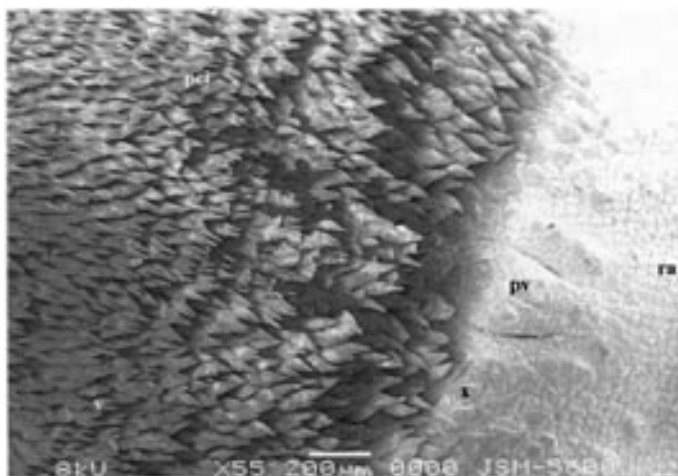


Fig. 5. Lower magnification view of small conical-shaped filiform papillae on the posterior part of tongue. Small conical-shaped filiform papillae (pci), vallate papilla (pv), root of the tongue (ra), terminal processes of papilla tips (v), no terminal processes of papilla tips (x). SEM, $\times 55$.

into two or three terminal processes (Fig. 4). Higher magnification of the surface epithelium revealed thickened cell borders, as well as surface micropits and microridges.

Small, conical-shaped filiform papillae were observed on the posterior part of the tongue and the anterior and side parts of the vallate papillae. The tips of these papillae were composed of two processes. These papillae lost their branches and resembled cylindrical papilla in the proximity of vallate papillae (Fig. 5). Higher magnification of the surface epithelium revealed cell-margin-thickening. Micropits and microridges were seen on epithelial cell surfaces.

Discussion

FERNANDEZ et al. (1978), IIDA et al. (1985) and KULLAA-MIKKONEN et al. (1987) reported that conical-shaped filiform papillae are found in large numbers in the anterior part of the dorsal surface of the tongue and are directed towards the posterior of the tongue in hamsters and rats, respectively. IWASAKI et al. (1987 a, b) reported that in rats and mice three distinct types of filiform papillae are found in three different parts of the tongue, in particular: simple cylindrical in the anterior; large, conical on the intermolar eminence, and small conical in the posterior. KOBAYASHI (1990) noted large numbers of cylindrical

shaped filiform papillae that were directed to the posterior, in the anterior of the guinea pig tongue. EMURA et al. (1999) observed filiform papillae all over the tongue in flying squirrel, whereby the papillae close to papilla vallata and radix lingua were larger and conical shaped. KUBOTA et al. (1966) reported that in porcupine these papillae were located on the anterior, dorsal surface of the tongue and were at, callous plates. In this study, filiform papillae were reported to have a similar structure and localization as those of rats and mice reported by IWASAKI et al. (1987a, b).

The finding that filiform papillae were covered with stratified squamous epithelium and had a core of connective tissue (AGUNGPRİYONO et al., 1995) and that connective tissue supports filiform papillae as microscopic or dermal papilla (TANYOLAC, 1993), are in accordance with previous studies.

KULLAA-MIKKONEN et al. (1987) and IWASAKI et al. (1999) reported that in rats filiform papillae had anterior and posterior surfaces. The anterior surface contained keratohyalin granules, whereas no such granules were present in the posterior surface. In this study we found a rather strong keratinization in the anterior surface, while an undistinguished keratinization was observed in the posterior surface.

Studies performed in mice (IWASAKI et al., 1987 b; IWASAKI et al., 1996), rats (IWASAKI et al., 1987 a; IWASAKI et al., 1997) and *Calomys callosus* mouse (UTIYAMA et al., 1995) revealed that the surface cells of the papillae had prominent cell-margin-thickening. Similarly, this study revealed that the middle and basal parts of the papilla had prominent cell-margin-thickening.

IWASAKI et al. (1987b) and IWASAKI et al. (1996, 1997) observed micropits and microridges on the surface of epithelium of the papillae in mice and rats. IIDA et al. (1985) found that microridges were distributed in small numbers in the tips of the filiform papillae, whereas high numbers were observed in the body and basal parts of the papillae. IWASAKI et al. (1988) observed micropits, but no microridges, on the surface of filiform papillae in squirrel monkey. Our findings are in accordance with the literature, except with that of IWASAKI et al. (1988).

In conclusion, the present study reveals the localization, structure and distribution of filiform papillae in adult mice in light and scanning electron microscopic level.

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SAŽETAK

Cilj istraživanja bio je istražiti svjetlosnu i »skening» elektronsku mikroskopsku strukturu nitastih bradavica u odrasla miša. Svjetlosnom mikroskopijom utvrđeno je da su bradavice prekrivene višeslojnim pločastim epitelom

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te da osnovu čini vezivno tkivo. Nitaste bradavice nalaze se na dorzalnoj strani jezika, na području od vrha do optočenih bradavica. Utvrđena su tri različita tipa nitastih bradavica, i to u tri različita područja. Valjkasti tip nalazi se u prednjem dijelu jezika. Velike stožaste bradavice nalaze se na srednjem dijelu jezika. Male stožaste bradavice nalaze se ispred optočenih bradavica na stražnjem dijelu jezika. »Skening» elektronskom mikroskopijom primijećeno je zadebljanje epitelnoga ruba. Udubljenja i zadebljanja utvrđena su na površini epitelnih stanica nitastih bradavica.

Ključne riječi: miš, nitaste bradavice, »skening» elektronska mikroskopija
