Morphology of the Lingual Papillae of the Japanese lesser flying squirrel and four-toed hedgehog

By

Shoichi EMURA

Heisei College of Health Sciences, Gifu-shi, Gifu 501-1131, Japan

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Summary: Author examined the dorsal lingual surfaces of the adult Japanese lesser flying squirrel (Pteromys momonga) and four-toed hedgehog (Atelerix albiventris) by scanning electron microscopy. In the Japanese lesser flying squirrel, the filiform papilla of the lingual body consisted of a large conical papilla. The filiform papilla of the lingual prominence was spoon in shape. The fungiform papillae were round in shape and scattered among the filiform papillae. Many foliate papillae were observed on the posterolateral regions of the lingual body. The foliate papillae had some ridges separated by deep grooves. The vallate papilla was located between lingual body and root. Several long conical papillae derived from the posterolateral margin of the tongue. In the four-toed hedgehog, the filiform papilla of the lingual apex had a conical process. The filiform papilla of the lingual body had some processes. The fungiform papillae were round in shape. The foliate papillae were observed on the posterolateral regions of the lingual body. The papilla was separated from each other by a furrow. The vallate papilla consisted of a central papilla and an annular pad. These findings suggest that in the structure of the lingual papillae of the Japanese lesser flying squirrel there is similar to that of the sugar glider and the lingual papillae of the four-toed hedgehog is different from that of the Japanese lesser flying squirrel.

Materials and Methods

The tongues of the adult Japanese lesser flying squirrel (Pteromys momonga) of the family Sciurinae and four-toed hedgehog (Atelerix albiventris) of the family Erinaceidae were used in this study. The tongues were fixed in 10% formalin. Small blocks containing papillae were cut with a razor blade, post-fixed with 1% osmium tetroxide for 1 h. Thereafter, the specimens were dehydrated through a graded series of acetone and critical-point-dried. All specimens were sputtered with Pt-Pd before being examined under SEM (Hitachi S-3000N, Tokyo, Japan) at an accelerating voltage of 10 kV.

Results

Japanese lesser flying squirrel

Macroscopically, the tongue of the Japanese lesser flying squirrel was about 2.3 cm long and the lingual body had lingual prominence on the posterior part (Fig. 1). Three vallate papillae arranged in an inverted V-shape were observed on the dorsum.
The filiform papilla of the lingual body consisted of a large conical papilla (Fig. 2a). The filiform papilla of the lingual prominence was spoon in shape (Fig. 2b). The fungiform papillae were round in shape and scattered among the filiform papillae (Fig. 2a, b). Many foliate papillae were observed on the posterolateral regions of the lingual body (Fig. 3a). The foliate papillae had some ridges separated by deep grooves (Fig. 3a). The vallate papilla was located between lingual body and root (Fig. 3b). Several long conical papillae derived from the posterolateral margin of the tongue (Fig. 3b).
Macroscopically, the tongue of the four-toed hedgehog was about 3.5 cm long and the lingual body had no lingual prominence on the posterior part (Fig. 4). Three vallate papillae arranged in an inverted V-shape were observed on the dorsum (Fig. 4). The filiform papilla of the lingual apex had a conical process (Fig. 5a). The filiform papilla of the lingual body had some processes (Fig. 5b). The fungiform papillae were round in shape scattered among the filiform papillae (Fig. 5a, b). The foliate papillae were observed on the posterolateral regions of the lingual body (Fig. 6a). The papilla was separated from each other by a furrow (Fig. 6a). The vallate papilla consisted of a central papilla and an annular pad (Fig. 6b).

**Four-toed hedgehog**

Macroscopically, the tongue of the four-toed hedgehog was about 3.5 cm long and the lingual body had no lingual prominence on the posterior part (Fig. 4). Three vallate papillae arranged in an inverted V-shape were observed on the dorsum (Fig. 4). The filiform papilla of the lingual apex had a conical process (Fig. 5a). The filiform papilla of the lingual body had some processes (Fig. 5b). The fungiform papillae were round in shape scattered among the filiform papillae (Fig. 5a, b). The foliate papillae were observed on the posterolateral regions of the lingual body (Fig. 6a). The papilla was separated from each other by a furrow (Fig. 6a). The vallate papilla consisted of a central papilla and an annular pad (Fig. 6b).
Discussion

Many SEM studies of the lingual papillae have been carried out in the order rodentia. In lingual surface of the guinea pig, the filiform papillae consisted of a larger main papilla and two secondary papillae (Iwasaki and Miyata, 1985). In the flying squirrel (Emura et al., 1999), nutria (Emura et al., 2001) and capybara (Emura, 2008b), the secondary papillae like the filiform papillae of the guinea pig were not observed. The filiform papilla of the Patagonian cavy (Emura et al., 2011) was similar to those of the flying squirrel, nutria and capybara. The filiform papillae of the lingual body in the Japanese lesser flying squirrel consist of a large conical papilla. In the flying squirrel and nutria, the fungiform papillae were dome-shape and scattered among the filiform papillae (Emura et al., 1999; Emura et al., 2001). However, there were no fungiform papillae in the lingual dorsal surfaces of the Patagonian cavy and capybara, but were observed in both lateral sides of the tongues (Emura et al., 2011; Emura, 2008b). In this study, the fungiform papillae of the Japanese lesser flying squirrel are scattered among the filiform papillae of the lingual dorsal surface. Therefore, the distribution region of the fungiform is different from those of the Patagonian cavy and capybara. The foliate papillae are well developed in the order Rodentia. My observation in the Japanese lesser flying squirrel is well developed and shows the morphological characteristic for this type of papilla. In the bush-tailed rat kangaroo (Emura et al., 1999), several long conical papillae derived from the posterolateral margin of the tongue where the foliate papillae had been shown to be distributed in many other animal species. In this study, several long conical papillae derive from the posterolateral margin of the tongue. In the long-eared hedgehog, the filiform papilla covering the body of the tongue had an apparent fork-like appearance (Parchami et al., 2018). The foliate papillae were situated on both lateral root medial to the huge lateral lingual folds as three large obliquely situated parallel folds (Parchami et al., 2018). In the four-toed hedgehog, the filiform papilla of the lingual body has some processes. The foliate papillae are observed on the posterolateral regions of the lingual body and a papilla is separated from each other by a furrow. The structure of the foliate papillae in the four-toed hedgehog is different from those of the long-eared hedgehog and many other animal species in the order Rodentia.

The results show that the structure of the papillae in the Japanese lesser flying squirrel is different from those of the four-toed hedgehog.

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