The histogenesis of fungiform papillae in *Camelus dromedaries*

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Abstract

This study was carried out to investigate the histological observations of fungiform papillae in camelus dromedaries embryos. A total of 25 foetuses of the camelus dromedaries embryos were used. Evidence of thickening of the epithelium in to 4-6 layer was observed as early as 6-7 week. In foetuses of about 11 week, mesenchymal tissue and blood vessels was observed under the epithelium. Rudiments of fungiform papillae were observed at this time. In 12-13 week old foetuses, papillary differentiation were evident with connective tissue and lamina propria underlying them and further differentiation of the epithelium which continued to mature until in foetuses of about 15 week, early rudiments of taste buds were observed. And in 17-18 week, taste buds were developed well and taste buds cell were recognizable.

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Introduction
The surface anatomy and histology of the adult tongue of domestic animals and its papillae is described in numerous textbooks of Histology (Bloom & Fawcett, 1994; Dellman, 2006). The tongue in mammals is an extremely muscular organ within whose substance there are a number of smaller salivary glands and any number of motor and sensory nerve fibers (Sisson and Grossman, 1975; Dyce et al., 1996). The tongue is extensible and this muscular organ has a primary role in feeding, namely, in the stage of prehension, chewing and the swallowing of food. Although, they differ in characteristics, existence and distribution among animal species, lingual papillae are classified as gustatory and mechanical papillae. Gustatory papillae with taste buds are fungiform papillae, circumvallate papillae and foliate papillae. (Eurell et al., 2006). Taste sensation initiated within some papillae found in all vertebrate animal is however, difficult to quantify and is thought to be directed more towards selecting taste that are harmless or harmful to them than to enjoy or dislike compared to the humans (J.C. Shawulu et al., 2012). Numerous research studies investigated morphogenesis of lingual papillae in various animal species (Ahpin et al., 1989; Tichy, 1992; Fujimoto et al., 1993; Iwasaki et al., 1996a; Kulawik, 2005a, 2005b) and human (Witt & Reutter, 1997). The available reports were entirely concerned with adult structures of the tongue but much less has been written about the prenatal development of the chemical papillae in camel. This study is aimed at studying the prenatal development changes of the tongue fungiform papillae at the foetal stage in the one-humped camel (Camelus dromedaries), an important breed of camel in Iran.

Material and method
A total of 25 fetal tongue sample of both sexes of the Camelus dromedaries in Yazd were used in this study. (5 specimen from each month). Camel uteruses were gathered from slaughter house in Yazd province, Meybod town. After dissecting the uteruses, the age of foetuses were meaggered by crl formula (using crown to rump length), (age of foetus) = \[ \text{crl} + 23.9 \]
\[ \frac{336}{9.23} \]
according to Mcgeody (2006). After physical examination, the tongue tissues were fixed in Bouin’s fluid, dehydrated in graded series of ethanol, cleared in xylene and embedded in paraffin wax. The blocks of tissues of tongue from apex, middle and root of the tongue were sectioned in transverse and longitudinal planes of the dorsum of the tongue. The slides were stained with hematoxylin and eosin (H&E). Staining method as described by Luna (1968). Selected sections were photographed with photomicroscope. The morphological features were noted.

Results
Some of the tongues of the foetuses of about 6-7 week old showed epithelial thickenings on the dorsum and in the apex of the tongue, the highest concentration being at the apex of the tongue. These thickenings probably were early rudiments of some lingual papillae. The sections taken from the dorsum of the apex and the body of tongue was covered by 4-6 layers of epithelial cells. The cells at the basal layer have large oval or round nuclei, while the apical cells consisted of lower cells, their nuclei being flattened. A well defined basement membrane was apparent. Underlying it is the mesenchymal tissue with cells having oval nuclei and some amount of cytoplasm (Fig. 1). In the foetuses of about 11 week old, there was further maturation of the epithelium. The dorsum of the apex, the body and root of the tongue showed rudiments of fungiform papillae which was quite apparent.

Fig. 1. H&E. X 6-7 week, epithelial thickening (Ep), mesenchyme (MM).
The lamina propria of the mucous membrane formed protrusions, constituting the connective tissue core of the developing lingual papillae. In the foetuses of about 12-13 week old, there was further maturation of the papillae; primordial fungiform papillae were very apparent. There were marked differences from the previous age group. Collagenous fibres and blood vessels were present in the lamina propria (Fig. 3). In the 15 week old foetuses, the lingual papilla looked continued to mature with some rudiments of taste buds apparent on the fungiform papillae (Figs. 4). In 17-18 week old foetuses there was further maturation of the papillae and it showed fungiform papillae, with the lamina propria showing full differentiation. Taste buds were well developed and showed basal cell, supporting cell and neuroepithelial cell (Fig. 5).

**Discussion**

The dorsal surface of the tongue in camellus dramedaries embryos was examined by light microscopy. These observations made it possible to following the developmental changes in the mucous membrane of the tongue from week 6-7 to 17-18 week prenatal life in camel. The study focused on the development and histogenesis of primordial fungiform papillae. The observations were made in sections of specimen in median, transverse and dorsal planes. It was observed that at 6-7 week old foetal life, the epithelium covering the dorsum of the examined apex, body and root the tongue have about 4-6 layers of the epithelium, showing thickening of the epithelium. Rudimentary evidence of future papillae formation was observed at this age. This observation corresponds to the finding of J.C. Shawulu et al (2012) in sahel goat of similar age of gestation. The mesenchymal tissue was located under the epithelium, which is found on a well-defined basement membrane. The lamina propria of the mucosa was scant at this time, that is in agreement to the report by Tichy (1992) in ovine foetuses of the same age.
The 11 to 15-week-old foetuses showed apparent primordial of different papillae, with additional thickening of the epithelium. The observed thickenings represent the first forms of primordial of fungiform papillae. Descriptions of the development of lingual papillae of mouse, rat and human has shown that early developmental stage of dome shaped structures found in the surface of the tongue were primordial of fungiform papillae (Iwasaki et al., 1996b, 1997; Witt & Reutter). Skeletal muscles fibers, blood vessels and some serious gustatory glands were well developed in 11-week-old foetuses. The observations of Cho et al. (2005) in foetuses and neonates of Korean native goat (Capra hircus) shows that skeletal muscle and some serious gustatory glands were fully developed in 90-day-old. In this study the development of fungiform papillae apparently started about 15 weeks of foetal life. The presence of taste buds on the free surface of fungiform papillae was observed in camelus dromedaries similar to cattle (Chammorro et al. 1986), the bacterian camel (Eerdunchaolu et al., 2001), Akkaraman sheep (Unsal et al., 2003), lesser mouse deer (Agungpriyono et al., 1995) and mutjac deer (Zheng and Kobayashi, 2006), however in the Egyptian camel (Korany and Bachir, 2004), jamunapari goat (Kumar et al., 1998) and Saanen goat (Kurtul and Atalgin, 2008) fungiform papillae were without taste buds. Barone (1976), suggested that because of the absence of taste buds in fungiform papillae, these papillae have only a mechanical function in some animal species. Therefore, the taste buds present in fungiform papillae in the camellus dromedaries tongue have gustatory function. The studies of Iwasaki et al. (1997) showed that different factors affect the histogenesis of rudiments of lingual papillae. Thus agents such as growth factors and hormones should be examined for the role in different stages before and after birth to clarify the mechanism of histogenesis of lingual papillae and differentiation of cells. Jainudeen and Hafez (1993) showed that developmental changes are influenced by both genetic factors as well as environmental factors. The tongue is found in all vertebrates except fishes and some amphibians and the undulation as of the dorsal lingual surface are recognizable as a common feature of the tongues of most animals from amphibian to mammals (Iwasaki & Kamakura, 1994; Iwasaki et al., 1996a, 1996b, 1997). According to (Farbman, 1991; salehi. E et al, 2010) there is an intimate relationship between the feeding habits and the development of the lingual papillae. Our finding showed this relationship.

**Conclusion**

This study has described the selected stages of morphogenesis of fungiform papillae in camelus dromedaries foetuses. Much attention was given to differentiate the lingual mucosa and the formation of gustatory pores in fungiform papillae. It is important to note that there are significant but complex changes that occur in the differentiation of the mucous membrane of the tongue during the period from 6-18 weeks of prenatal development of the fetus in camellus dromedaries, which is continued in the postnatal life.

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