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HISTOMORPHOLOGICAL DEVELOPMENT OF LINGUAL TASTE BUDS IN GOAT (*Capra hircus*)

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ABSTRACT

The present study was conducted on the tongue of 18 goat foeti, divided into 3 prenatal age groups *viz.*, group 1 (<50 days of gestation), group 2 (50-100 days of gestation) and group 3 (>100 days of gestation) containing 6 foeti in each group, to assess sequential events in the development of taste buds. The first appearance of primitive taste buds was observed on the apical surface of circumvallate and fungiform papillae in 93 days old goat foetus (CRL = 20.6 cm). The fungiform papillae located on the apex and body region of tongue were devoid of any taste buds. At 120 days of gestation (CRL = 31.1 cm), the taste buds were ovoid in shape and contained elongated or spindle shaped cells. The taste pores were apparent in taste buds at 146 days of gestation (CRL = 35.5 cm). The mean number of taste buds in circumvallate papillae in this group was 2.0±0.36. The mean number of taste buds in fungiform and circumvallate papillae in tongue of goat foeti in group III was 1.83±0.3 and 5.5±1.08, respectively. A significant increase in the number of taste buds was observed in circumvallate papillae between group II and III.

Key words: Circumvallate papillae, fungiform papillae, taste buds, tongue

INTRODUCTION

Many studies have analyzed the morpho-functional characteristics of mammalian tongue to evaluate and define the factors that form basis of various alimentary habits and gustatory functions (Iwasaki and Asami, 2002). Many works have been reported on tongue with respect to the postnatal life in buffalo (Singh, 2001), pig (Sarma *et al.*, 2002), sheep (Kumar *et al.*, 2003) and bovine (Tabata *et al.*, 2006). Reports are available on morphogenesis of circumvallate papillae and differentiation of taste buds in pig prenatal life (Tichy, 1991), embryonic origin of amphibian taste buds (Barlow and Northcutt, 1995), scanning electron microscopy of morphogenesis of lingual papilla in mouse (Iwasaki *et al*., 1996), scanning electron microscopical studies of developing gustatory papillae in human (Witt and Reutter, 1997) and morphogenesis of tongue in pig foeti (Sarma *et al*., 2003).

The morphogenesis and cyto-differentiation in developing vertebrate organs is controlled by sequential and reciprocal interaction between epithelial and mesenchymal tissues (Jitpukdeebo-dintra *et al.*, 2002). Development of different papillae occurs prenatally and in a very specific spatial and temporal pattern. Although each type is morphologically distinct, the initial events in the development in all mammals are histologically similar (Mistretta, 1991) and later on there appears

to be some progressive differentiation to acquire the papillary epithelial taste progenitor cell and finally taste cell within the papillary apex (Mistretta and Liu, 2006). Paucity of literature on the development of lingual taste buds in goats prompted this present study.

MATERIALS AND METHODS

The present study was conducted on the tongue of 18 goat foeti collected from the slaughter houses in and around the Jammu city in the year 2013. The weight of each foeti was recorded with the help of analytical balance. The approximate age of foeti was calculated by putting the body weight values in following formula given by Singh *et al*. (1979) for the estimation of age in goat foetus:

$$W^{1/3} = 0.096\ (t\text{-}30).$$

Where, W = Body weight of foetus (g); t = Age of foetus (days)

The collected foeti were divided into 3 groups based on their estimated ages *viz.*, group I (<50 days of gestation), group II (50-100 days of gestation) and group III (>100 days of gestation upto full term) containing 6 foeti in each group. After age estimation, the tongues were dissected out from the foeti. Tissue pieces from tip, body, torus linguae and root of tongue were fixed in 10% neutral buffered formalin solution and processed for paraffin block preparation by alcohol-benzene schedule. Tissue sections (5-6 μm thick) were obtained from these blocks on clean glass slides with the help of rotary microtome (Luna, 1968). The sections were subjected to haematoxylin and eosin staining and micrometry was done with the help of ocular micrometer duly calibrated with stage micrometer. The data was subject to standard statistical analysis (Snedecor and Cochran, 1994) to find out Student's 't' test using 16.0 version of SPSS software.

RESULTS AND DISCUSSION

The first indication of papillae placodes with respect to fungiform and circumvallate papillae was observed in goat foeti of group I, but at that stage no taste buds were seen in developing papillae. The first appearance of primitive taste buds was observed on apical surfaces of circumvallate and fungiform papillae in 93 days old goat foetus (CRL = 20.6 cm). The fungiform papillae located on the apex and body region of tongue were devoid of any taste buds. Taste bud differentiation in foeti began at E16.5 in mouse (Krimm, 2007), at 23rd week in human (Sawaf *et al*., 1991), at 50th day of gestation in sheep (Hill and Mistretta, 1990), at 30th day of gestation in rabbit (Fujimoto *et al*., 1993) and at 175 days of gestation in buffalo (Verma, 2008).

At 120 days of gestation (CRL = 31.1 cm), the taste buds were ovoid in shape and contained elongated or spindle shaped cells (Fig. 1). The taste buds reportedly are oval in cows and sheep, irregular oval in goat, spindle-shaped in pigs, melon-shaped in horses and circular in dogs (Swedenson and Reece, 1996). Ramayya *et al*. (2000) reported irregularly oval taste buds in goats. In this study, the taste pore were apparent in taste buds at 146 days of gestation (CRL = 35.5 cm) (Fig. 2 and 3). The first primitive taste pores were observed in human foetus at around 10th week (Witt and Reutter, 1997) and in sheep foetii at 100th day of gestation (Mistretta and Haus, 1996). However, the taste pore was formed in both rat and mouse after birth (Kossel *et al*., 1997; Krimm, 2007). In newborn lambs the taste buds lack microvilli at the apical parts of cells composing of taste pore (Tichy, 1992). The taste buds comprised of three cell types namely neuroepithelial cells, basal cells and sustentacular or supporting cells. Similar observations have been reported in the tongue of neonatal buffalo by Singh (2001) and in buffalo foetii (Verma, 2008). Tabata *et al*. (2006) have

Table 1: Number of taste buds in fungiform and circumvallate papillae in different age groups of goat foeti

Groups (gestation period) / Lingual papillae	< 50 days	50-100 days	>100 days
Taste buds in fungiform papillae	*	*	1.83±0.30
Taste buds in circumvallate papillae	*	2.0^{a}±0.36	5.5^{b}±1.08

*Taste buds not yet formed;
Mean with common super script do not differ (P<0.05) significantly

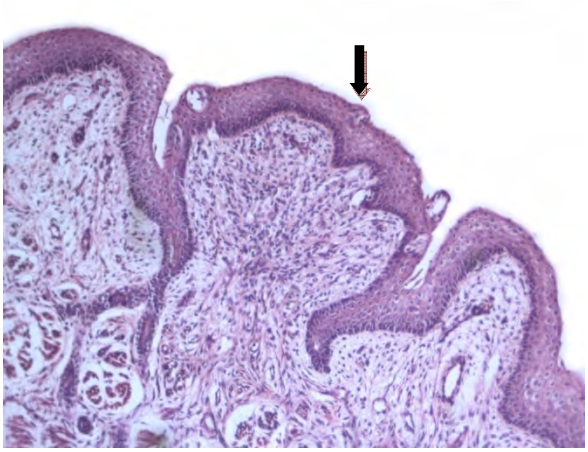

Fig. 1: Photomicrograph of tongue in 120 days old goat foetus showing appearance of taste buds (arrow), H&E 100X

reported 2 types of taste cells in bovine fungiform papillae *viz*. type I and type II cells. They reported that type I cells have thin cyto-plasm and elongated nucleus; and cytoplasm of perinuclear region was more electron dense than type II cells. Type I contained thick long cytoplasmic processes protruding to the taste pore. On the other hand, type II cells have a thick cytoplasm and ovoid nucleus. The mean values with respect to the number of taste buds in fungiform and circumvallate papillae could not be determined in foetal tongues of group I because taste buds were not formed at that period. Similarly, taste buds were undifferentiated in fungiform papillae in foeti of group II. However, the mean number of taste buds in circumvallate papillae was 2.0±0.36 in this group. The mean numbers of taste buds in fungiform and circumvallate papillae in tongue of goat foeti of group III were 1.83±0.30 and 5.5±1.08, respectively (Table 1).

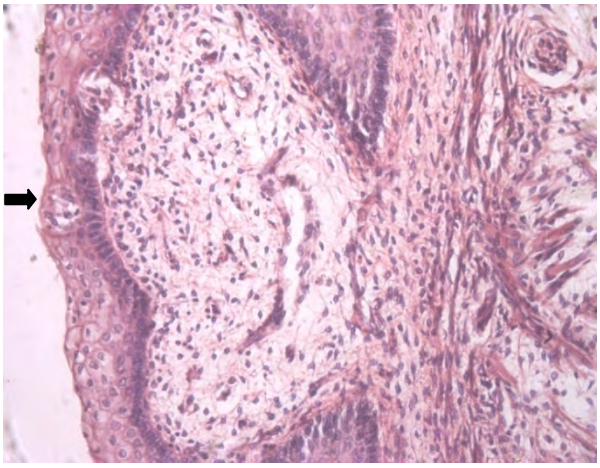

Fig. 2: Photomicrograph of tongue in 134 days old goat foetus revealing taste buds on the apical surface of circumvallate papillae (➡) 200X

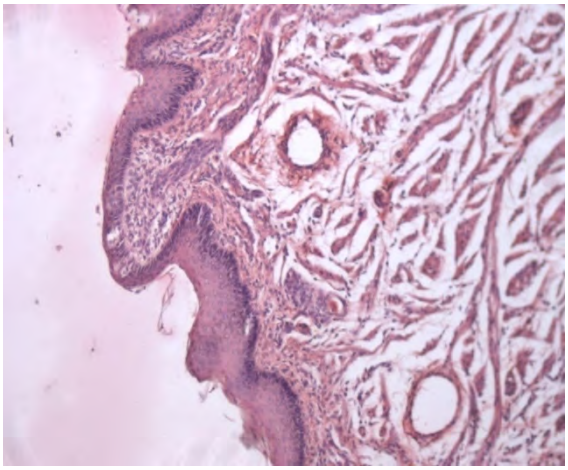

Fig. 3: Photomicrograph of tongue in 134 days old goat foetus showing taste bud in fungiform papillae, H&E, 100X

There was a significant ($P_{0.05}$) increase in the number of taste buds in circumvallate papillae between groups II and III. In contrast to our observations, Singh (2001) reported 6.8-8.9 bud per papillae in adult bovine tongue and 18.20±1.20 taste buds in neonatal buffaloes, respectively, which might be due to species variation. Similar to our findings numerical evaluation on taste buds in the tongue of buffalo foeti revealed that the circumvallate papillae contained more number of taste buds than fungiform in pigs (Mack *et al*., 1997).

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