



Lingual papillae of the buffalo fetus: an electron microscopic study

VARINDER UPPAL^{1*}, NEELAM BANSAL² and DEVENDRA PATHAK³

Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab 114001 India

Received: 1 September 2010 ; Accepted: 11 March 2011

Key words: Buffalo, Fetus, Lingual papillae, SEM

The lingual mucosa of domestic animals presents mechanical and gustatory papillae. Scanning electron microscopic studies of lingual papillae during postnatal life are reported in sheep (Kumar *et al.* 2003), goats (Kumar *et al.* 1998), camels (Qayyam *et al.* 1988), horse and ox (Chamorro *et al.* 1986). During fetal life, electron microscopic reports are available on development of lingual papillae in the mouse (Iwasaki *et al.* 1996) and rat (Iwasaki *et al.* 1997). In buffalo, histological studies are available (Scala *et al.* 1993, Verma *et al.* 2009) but no scanning electron microscopic studies are available in literature therefore the present work was conducted to study the characteristics of lingual papillae of the buffalo fetus and to compare their structural changes during postnatal life.

Buffalo foetii (6) were collected at the slaughterhouse. The curved-crown-rump length (CVR length) of the foetii was measured with an inelastic thread and age was calculated by using the formula:

$$Y = 73.544 + 2.256 X$$

(where Y is age in days and X is CVR length in cm) (Soliman 1975).

The tissue samples of 1 mm were collected from the dorsal surface of the tongue (apex, body, torus linguae and root) and from ventral aspect. The tissues were washed in 0.1 M chilled phosphate buffer and put in 2.5% glutaraldehyde and transported to laboratory. After 6 hrs of fixation the tissues were again washed with 0.1 M phosphate buffer (pH 7.4). Dehydration was done in a graded series of acetone (30%, 50%, 70%, 90%, 95% and dry acetone) for 15 min each at 4°C. After dehydration, the specimens were critical point dried (CPD) using CO₂ at 31.5°C and 1100 psi. Samples were mounted, gold ion sputter coated and examined under scanning electron microscope.

The age of the buffalo foetii ranged between 254–88 days with CVR length ranging between 80.0 – 95.0 cm. Five lingual papillae types, filiform, fungiform, lenticular, conical and circumvallate were demonstrated during fetal life.

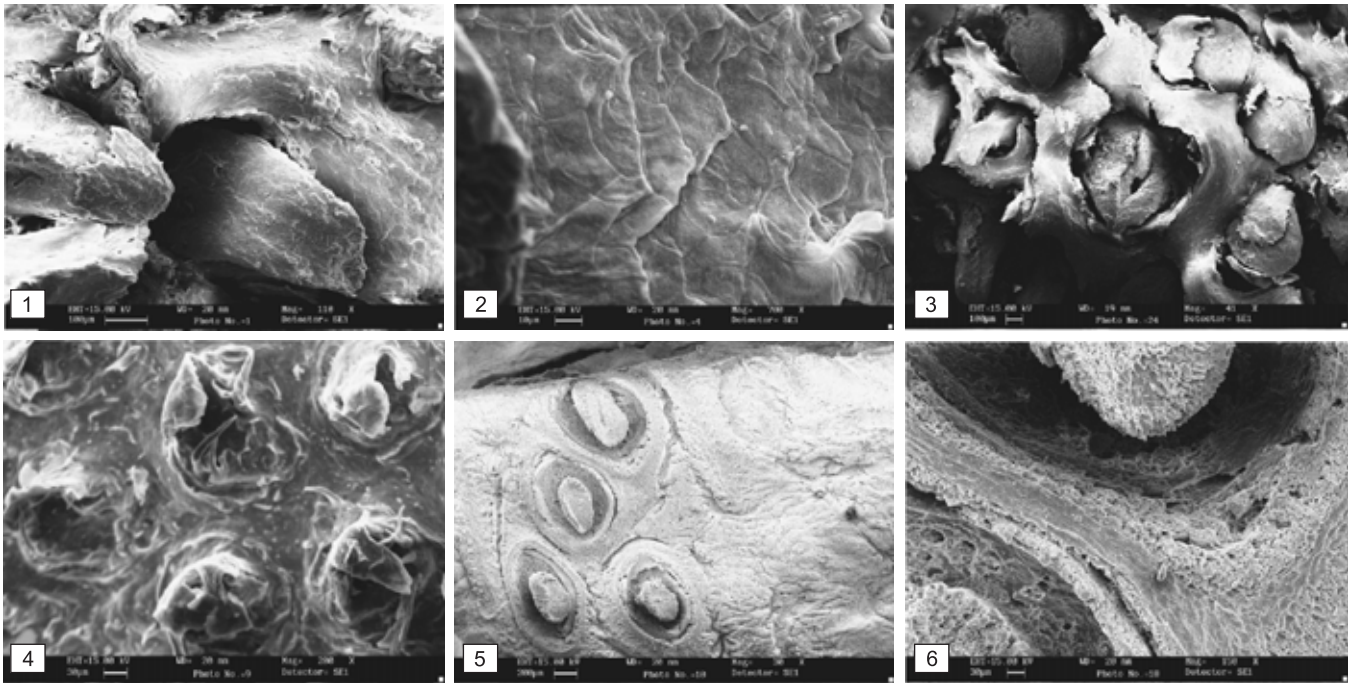
Present address: ¹Associate Professor (v.uppal@yahoo.com);

²Associate Professor cum Head, ³Assistant Scientist, Department of Anatomy and Histology.

Filiform papilla were distributed numerously on the dorsal surface of the apex and body of the tongue. The papillae were also present on the ventral surface but were fewer. The basal part of the papillae emerged from a well-developed groove. All the papillae were directed caudally towards the root of the tongue as reported earlier in buffalo fetus (Verma *et al.* 2009) but their tips did not exhibit any secondary projections whereas earlier 3–6 secondary projections have been reported in adult ox (Paz Cabello *et al.* 1988) and goat (Kumar *et al.* 1998). The free ends of the papillae were conical but with blunt and rounded tips and the filiform papillae at this stage did not exhibit any secondary projections (Figs 1, 2). Earlier, the transformation of round head of filiform to pointed has been reported at seventh postnatal day in mouse (Iwasaki *et al.* 1996). The characteristics of pointed tips of filiform papillae along with the secondary projections is suggestive of their role in prehension of food fragments (Chamorro *et al.* 1986), so may be that these features appear after the birth when the calf starts taking the fodder. The papillae were covered by stratified squamous epithelium which gave the surface a rough appearance and displayed a characteristic ridge like folds in a labyrinthine pattern called as microridges or microplicae and the depressions in between them as micropits whereas during adult life absence of microplicae was reported in cow mainly attributed due to erosion by friction derived from an intense mechanical activity (Paz Cabello *et al.* 1988). The desquamation of the cells was also seen.

Fungiform papillae (*Papilla fungiformis*) were scattered among the filiform papillae on the dorsal and lateral surfaces. They were more densely packed on the apex. These papillae were round, convex and covered by desquamated epithelial cells. Fungiform papillae were separated from the filiform papillae by a shallow groove as reported earlier in ox, horse (Chamorro *et al.* 1986), camel (Qayyam *et al.* 1988) and goat (Kumar *et al.* 1998). As most of the fungiform papillae were covered by the adjacent epithelial cells so only a few taste pores were observed (Fig.3) as reported in ox (Scala *et al.* 1993)

Lenticular papillae were leaf like, having many secondary



Figs 1–6. Scanning electron micrographs of buffalo fetus tongue showing **1.** Filiform papillae, **2.** rough surface of filiform papillae due to squamous epithelium, **3.** fungiform papillae, **4.** lenticular and conical papillae, **5.** circumvallate papillae, **6.** microplacae, micropits and taste pores in the vallate papillae.

projections (Fig.4) and directed downwards as reported earlier in goat (Kumar *et al.* 1998). The surface of these projections presented the microplacae system. The surface was rough due to desquamation of the squamous epithelial cells. In the present study the surface was rough and scaly but no channeled tracts were observed whereas earlier Paz Cabello *et al.* (1988) had reported a channeled tract and a scaly surface of lenticular papillae in ox.

Conical papillae were distributed in between the lenticular on the torus lingua. These papillae were of two types i.e. large and small. The papillae had pointed tips and an irregular surface. Secondary projections were also observed in these papillae. Conical papillae were of two types i.e. large and small. These papillae presented a pointed tip whereas Kumar *et al.* (1998) reported blunt tips of the conical papillae in goat.

Circumvallate papilla (*papilla vallata*) were oval to round in shape having a central vallum and were present on both sides of the torus lingua. Papillae were separated from annular pad by a papillary groove as reported in buffalo (Scala *et al.* 1993), goat (Kumar *et al.* 1998) and sheep (Kumar *et al.* 2003). The papillae were arranged in 2–3 lines on each side of the tongue. The taste pores were present at the lateral surface of the papilla and opening in the papillary groove as observed in bovine (Chamorro *et al.* 1986), goat (Kumar *et al.* 1998) and sheep (Kumar *et al.* 2003). The dorsal surface of the circumvallate papillae presented a dense meshwork of microplacae system along with microvilli as reported in sheep (Kumar *et al.* 2003). The papillary groove also presented a rough appearance due to presence of microplacae

and micropits. The interpapillary area presented desquamated squamous cells (Figs 5, 6).

From the study it was inferred that all the lingual papillae had been fully differentiated at the end of the fetal life. The taste pores could be well appreciated in the gustatory papillae. The differentiation pattern and development of lingual papillae was better on the caudal part of the tongue as compared to the cranial one suggestive of caudo cranial differentiation of the lingual papillae.

SUMMARY

An electron microscopic study was conducted on the lingual papillae of the buffalo fetus during late gestation. The age of the buffalo foetii ranged between 254–88 days. The study revealed that all papillae were differentiated by this age. The filiform papillae had round tips instead of pointed one. The conical and lenticular papillae were also differentiated. The fungiform papillae were round and covered by desquamated epithelial cells. The circumvallate papillae were surrounded by a papillary groove with taste pores present on the lateral surface of the papillae. The study demonstrated a caudocranial (from root to apex of the tongue) development of the lingual papillae with caudal papillae better developed than cranial one at a time.

ACKNOWLEDGEMENTS

The electron microscopic studies were carried out at the Sophisticated instrument facility for electron microscopy (supported by the Department of Science and technology,

Government of India) at All India Institute of Medical Sciences, New Delhi.

REFERENCES

- Chamorro C A, Cabello P Paz, Sandoval J and Fernandez F. 1986. Comparative scanning electron microscopic study of the lingual papillae in two species of domestic mammals (*Equus caballus* and *Bos taurus*). 1, Gustatory papillae. *Acta Anatomica* **125**: 83–87.
- Iwasaki S, Yoshizawa H and Kawahara I. 1996. Study by scanning electron microscopy of the morphogenesis of three types of lingual papillae in the mouse. *Acta Anatomica* **157**: 41–52.
- Iwasaki S, Yoshizawa H and Kawahara I. 1997. Study by scanning electron microscopy of the morphogenesis of three types of lingual papillae in the rat. *Anatomical Record* **247**: 528–41.
- Kumar P, Saggar D, Ganganaik S, Jain R K and Gupta A N. 2003. Scanning electron microscopic studies on the tongue papillae of sheep. *Indian Journal of Animal Sciences* **73** (4): 488–90.
- Kumar P, Kumar S and Singh Y. 1998. Tongue Papillae in goat: a scanning electron microscopic study. *Anatomia Histologia Embryologia* **27**: 355–57.
- Paz Cabello P, Chamorro C A, Sandoval J and Fernandez F. 1988. Comparative scanning electron microscopic study of the lingual papillae in two species of domestic mammals (*Equus caballus* and *Bos taurus*). 1, Mechanical papillae. *Acta Anatomica* **132**: 120–23.
- Qayyum M A, Fatani J A and Mohajir A M. 1988. Scanning electron microscopic study of the lingual papillae of one humped camel (*Camelus dromedaries*). *Journal of Anatomy* **160**: 21–26.
- Scala G, Pelagalli G V, Vittoria A and Girolamo P. 1993. Etude morpho-structurale des papilles linguales linguales chez le buffle (*Bubalus bubalis*). *Anatomia Histologia Embryologia* **22**: 264–72.
- Soliman M K. 1975. Studies on the physiological chemistry of the allantoic and amniotic fluid of buffaloes at various periods of pregnancy. *Indian Veterinary Journal* **52**: 111–17.
- Verma D, Uppal V and Bansal N. 2009. Histogenesis of filiform papillae in buffalo during prenatal life. *Indian Journal of Animal Sciences* **79** (7): 791–93.