Journal of Animal Research: v.5 n.4, p. 827-831. December 2015

DOI: 10.5958/2277-940X.2015.00137.0

Prenatal Development of the Lingual Intrinsic Skeletal Musculature, Lingual and Von Ebners Glands of the Tongue in Goat Foetii (*Capra hircus*)

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Received: 29 April, 2015 **Accepted:** 30 September, 2015

ABSTRACT

The present study conducted on the tongue of 18 goat foetii revealed that the differentiation of skeletal muscle was first noticed among the mesenchymal cells at 40 days of foetal age (CRL = 3. 40 cm). These were better differentiated at 62 days of gestational age (CRL=10.0cm) and showed continued gradual development with advancing foetal age. The typical cross striations in the lingual intrinsic skeletal muscles was first observed at 121days of foetal age (CRL = 27.50cm). The first appearance of lingual gland in the tongue of the goat foetii was observed at 62 days of gestation (CRL = 10.10 cm) and the first indication of appearance of Von- Ebner's gland was observed in the tongue of goat foetii at 120 days (CRL= 31.1 cm).

Keywords: Histomorphology, lingual muscles, Von Enber's glands, goat foetus

Tongue is the most important organ of prehension situated partly on the floor of the buccal cavity and partly in the anterior wall of the oral part of the pharynx. It is covered with mucous membrane and is important for mastication, swallowing of food and appreciation of taste. The dorsum of tongue is provided with projections of mucous membrane called papillae, disseminated on the lingual surface. These have two specific functions – gustatory and masticatory. The bulk of tongue is skeletal muscle, arranged in three layers all at right angles to each other (Sisson and Grossman, 1975; Reece, 2004) giving it a degree of flexibility for prehension and mastication of food (Getty, 1975; Dyce *et al*. 1996). Majority of tongue muscles are somatic in origin (Yamane, 2005). The presence of prominent torus linguae with a crescentic depression – fossa linguae was reported in the tongue of ox and sheep (Habel, 1975), goat (Qayyum and beg, 1975), buffalo (Dhingra and Barnwal, 1979; Prakash and Rao, 1980). The torus linguae probably compensates for the deficient masticatory mechanism caused by absence of incisors in the upper jaw (Labh and Mitra, 1969).

It has been observed that the morphogenesis and cytodifferentiation in developing vertebrate organs are controlled by the sequential and reciprocal interaction between the epithelial and mesenchymal tissues (Jitpukdeebodintra *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 must be 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 prenatal development of the lingual intrinsic muscles in goats prompted this study.

MATERIALS AND METHODS

The present study was conducted on the tongue of 18 goat foetii which were collected from the slaughter houses in and around Jammu city. These foetii were ranged from early pregnancy to near full term. Immediately after collection, the umbilical cords of these foetii were ligated properly and were cleaned with cotton soaked with water to remove the amniotic fluid. The weight of each foetii was recorded with the help of analytical balance. The approximate age of the foetii were calculated by putting the body weight values in the formula postulated by (Singh *et al.* 1979) for estimation of age in goat foetus as mentioned below.

Formula for estimation of foetal age in goat:

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

Where, W= body weight of foetus in gm.

t= age of the foetus in days.

The collected foetii were then divided into three groups based on their estimated ages viz.— Group I (below 50 days of gestation), Group II (between 50-100 days of gestation) and Group III (above 100 days of gestation to up to full term) containing 6 number of foetii in each group.

After estimation of age, the tongues were dissected out from the foetii. Tissue pieces from the tip, body, torus linguae and root of the tongue were fixed in 10% Neutral Buffered Formalin solution and processed for paraffin block preparation by alcohol-benzene schedule. Tissue sections of 5-6 mm were obtained from these blocks on clean glass slides with the help of rotary microtome (Luna, 1968). The sections were then subjected to various histological and histochemical methods *viz.* Haematoxylin and Eosin, Mallory's Stain, Hart´s Stain, Gomori's Stain and Bielschowsky's method for routine histology, collagen fibres, elastic fibres, reticular fibres and nerve fibres, respectively.

RESULTS AND DISCUSSON

In the present investigation, differentiation of skeletal muscle was first noticed among the mesenchymal cells at 40 days of foetal age (CRL=3.40cm). Long strands of skeletal muscles with large, elongated peripherally located nuclei were observed (Fig. 1). The lingual intrinsic muscle differentiation has been reported in mouse at E15 of gestation (Yamane, 2005) and at 44th day (Verma, 2008) and 79th day (Uppal *et al.* 2006) in buffalo foetii. Long strands of skeletal muscles with large, elongated nuclei were observed lying at the periphery of the muscle fibres. Yamane (2005) and (Mc Geady *et al.* 2006) reported that the development of tongue muscles proceed faster than those of other muscle in the foetal body.

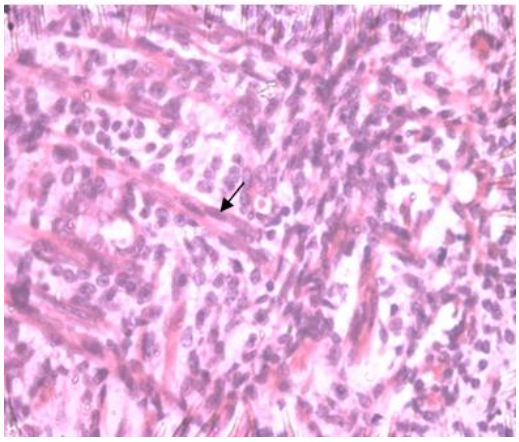

Fig. 1: Photomicrograph of tongue in 40 days old goat foetus showing long strands of skeletal muscles, H&E, 200X.

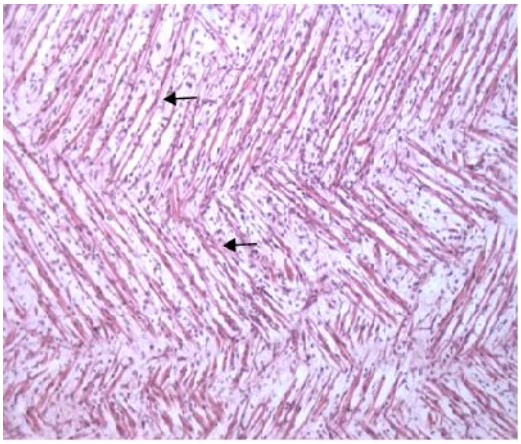

Fig. 2: Photomicrograph of 88 days old goat foetus showing differentiation of skeletal muscles, H&E, 100X.

The intrinsic lingual skeletal muscles were better differentiated at 62 days of gestational age (CRL=10.0cm) and they showed continued gradual development as the foetal age advanced (Fig. 2, 3) as reported earlier in goat foetii (Ramayya *et al.* 2000) The fast myogenesis and synaptogenesis in tongue musculature as compared to other muscles was linked to meet functional demands such as suckling and swallowing of milk immediately after birth (Yamane, 2005). Large nerve plexuses were observed between bundles of muscle cells. Bundles of muscle cells were first noticed at 93 days of foetal age (CRL=20.60 cm) which were separated by delicate

collagenous fibres (Fig. 4). The thickness of lingual muscle mass increased with advancing foetal age. In this study, the cross striation in the lingual intrinsic skeletal muscles was first observed at 121days of foetal age (CRL=27.50 cm) (Fig.5). On the contrary, initiation of cross striation in the lingual intrinsic muscle was first observed by 95th day (Uppal *et al.* 2006) and 77th day (Verma, 2008) in buffalo foetii. These variations in appearance of cross striations in lingual muscle might be due to species variations.

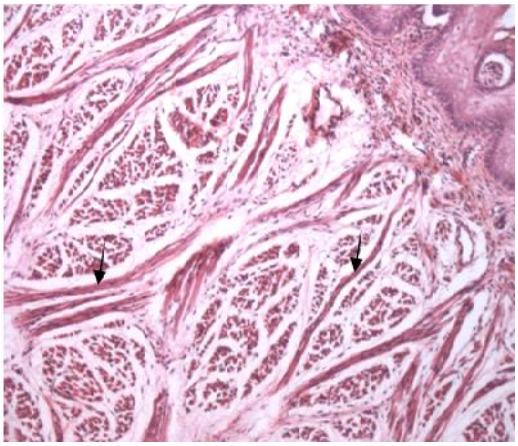

Fig. 3: Photomicrograph of tongue in 146 days old goat foetus showing differentiation of skeletal muscles, H&E, 100X.

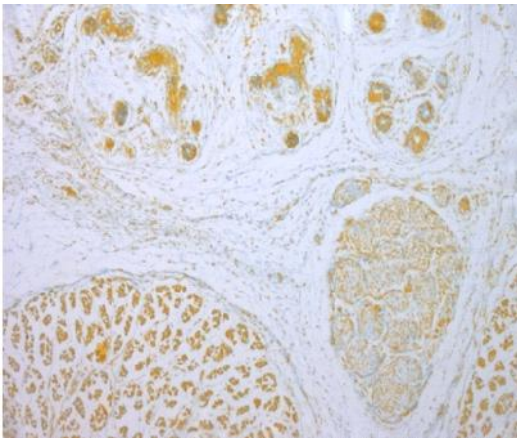

Fig. 4. Photomicrograph of tongue in 93 days old goat foetus showing muscle bundles separated by delicate collagenous fibres (arrow), Mallory's stain, 100X.

In the present investigation the first appearance of lingual gland in the tongue of the goat foeti was observed at 62 days of gestation (CRL= 10.10cm). In contrast, these glands were appeared in the foetal tongue at 110 days of gestation in sheep (Mistretta and Bradley, 1983). These were distributed in the submucosa as well as in between the skeletal muscle bundles, as reported earlier in buffalo by Singh (2001), in domestic animals (Dellmann, 1993), in goat (Ramayya *et al.* 2000), in rat by E19-E20 (Hamosh, 1983) in mouse by E18 (Jitpukdeebodintra *et al.* 2002). Their amount and distribution increased with advancing gestational age (Figures 6, 7, 8, 9). These glandular acini had mainly serous cells with mucous cells. These glands were branched tubulo-acinar (Fig. 7) as reported in buffalo (Prakash and Rao, 1980; Singh, 2001), in domestic animals (Dellmann, 1993) and goat (Ramayya *et al.* 2000).

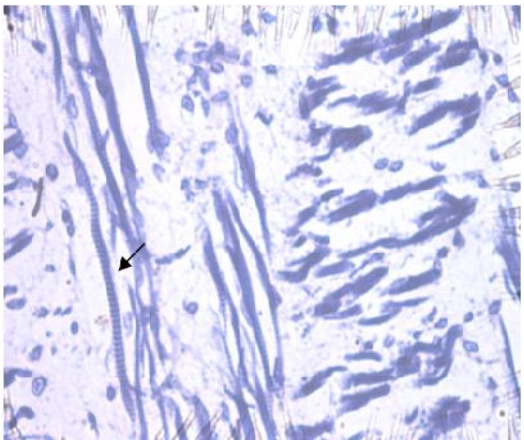

Fig. 5: Photomicrograph of tongue in 121 days old goat foetus showing cross striation in the lingual intrinsic skeletal muscles (arrow), MPTH, 100X.

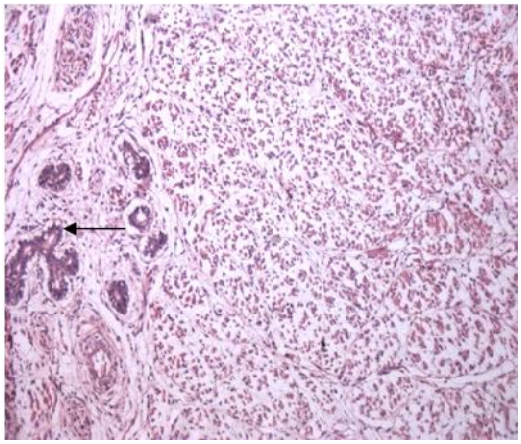

Fig. 6: Photomicrograph of tongue in 88 days old goat foetus showing lingual glands (arrow), H&E, 100X.

The first indication of appearance of Von Ebner's glands was observed at 120 days (CRL= 31.1 cm) in the tongue of goat foetii (Fig. 10). These glandular acini appeared by 116 days (Uppal *et al.* 2006) and 122 days (Verma *et al.* 2010) in the tongue of buffalo foetii which had characteristics of serous cells.

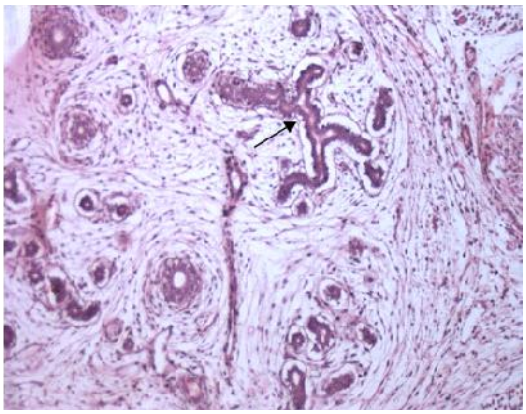

Fig. 7: Photomicrograph of 93 days old goat foetus showing lingual glands (arrow), H&E, 100X.

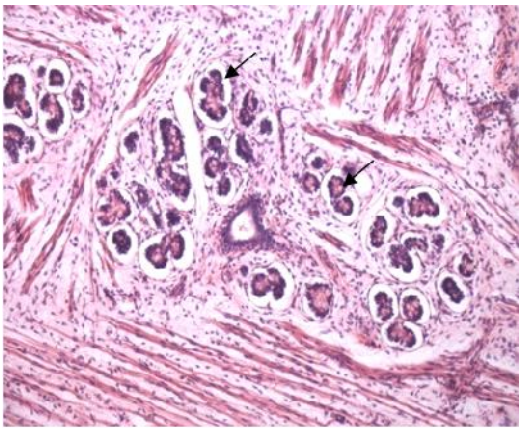

Fig. 8: Photomicrograph of tongue in 108 days old goat foetus showing lingual glands, H&E, 100X.

These glands continued to grow by investigation of the epithelium of the circumvallate with further development of foetal age.

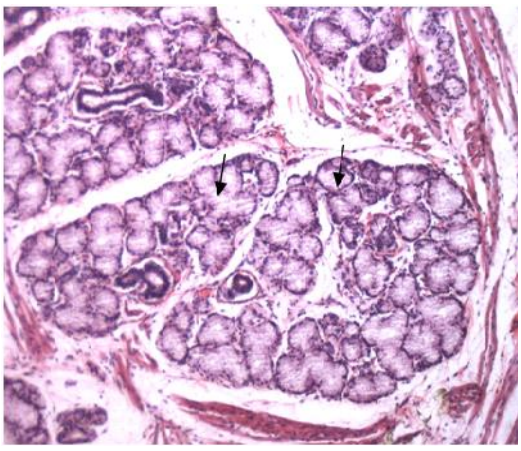

Fig. 9: Photomicrograph of tongue in 134 days old goat foetus showing lingual glands, H&E, 100X.

These Von Ebner's gland showed gradual development with increase in gestational age of the goat foetii as also reported earlier in domestic animals (Friendson, 1981; Dellmann, 1993), in goats (Narasimhan *et al*. 1999; Ramaya *et al*. 2000) and in buffalo (Gadre and Singatairi, 2006).

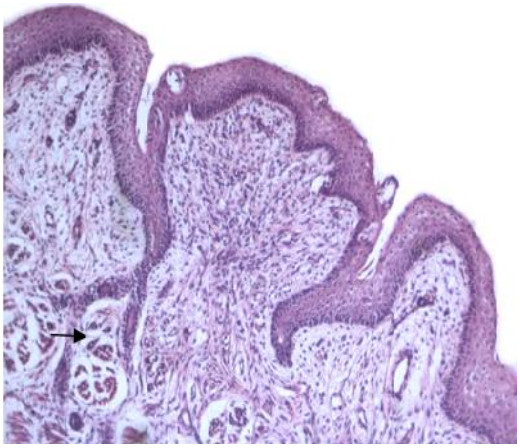

Fig. 10: Photomicrograph of tongue in 120 days old goat foetus showing appearance of Von Ebner's glands (arrow), H&E 100X.

CONCLUSION

The intrinsic lingual skeletal muscles were better differentiated at 62 days of gestational age CRL =10.0 cm) and they showed continued gradual development as the foetal age advanced. The amount and distribution of lingual and Von- Ebner's gland increased with advancing gestational age.

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