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A Microscopic Study of lingual Papillae in Iranian Buffalo (*Bubalus bubalus*)

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Abstract: The morphology of lingual papillae of 10 healthy young adult Iranian buffaloes was studied by using light microscopy. It could be divided into three areas: the lingual apex, lingual body and lingual root. Filiform, conical, fungiform and lenticular papillae were considered as mechanical papillae but circumvallate papillae were considered as gustatory papillae. No foliate papillae were seen on the dorsal surface. Filiform papillae were distributed over the entire dorsal surface of the tongue, with the filiform papillae on torus linguae shaped as caudally directed pointed spines or conical shape. The convex surfaced fungiform papillae were raised above the lingual mucosa. The conical papillae are blunt pointed cone shape. Lenticular papillae were distributed on the torus linguae. The oval shape circumvallate papillae were located on the lateral and caudal part of torus linguae. A few taste buds were observed in the lateral epithelium of the papillae. The lingual papillae of the Iranian buffalo (*Bubalus bubalus*) exhibited some characteristics different from those of domestic ruminants.

Key words: Iranian buffalo, light microscopy, lingual papillae

INTRODUCTION

The lingual mucosa of domestic animals presents a highly differentiated papillary system with mechanical and gustatory functions (Konig and Liebich, 2007). The arrangement and structure of gustatory lingual papillae, responsible for the reception of gustatory sensation and mechanical lingual papillae, aiding the transfer of food, documented in vertebrates, constitute general traits typical of individual taxonomic units, for example, orders or families (Chamorro *et al.*, 1986; Ederunchaolu *et al.*, 2001; Kumar *et al.*, 1998; Emura *et al.*, 2000a,b). On the other hand, an important factor affecting the structure of lingual mucosa is the type of ingestion of food, the method of its grinding in the oral cavity, as well as the method of its passage to further segments of the alimentary tract. Thus, in comparative studies on morphological traits of the tongue conducted so far on manimals, the degree of adaptation of the animals to a given alimentary group, that is, carnivores, herbivores, or omnivores, is also investigated (Doran, 1975). Much work has been published on structures of the lingual surfaces in various animals. In the Carnivora, there have been many studies of the tongue of cat (Boshell *et al.*, 1982), dog (Kobayashi *et al.*, 1987), bush dog (Emura *et al.*, 2000a), lion (Emura *et al.*, 2003), tiger (Emura *et al.*, 2004), raccoon dog and fox (Emura *et al.*, 2006) and

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Japanese marten (Emura *et al.*, 2007). There have been microscopic studies of the tongue of cows (Kobayashi *et al.*, 2005; Steflik *et al.*, 1983), one-humped camel (Qayyum *et al.*, 1988), Bactrian camel (Ederunchaolu *et al.*, 2001), horse (Kobayashi *et al.*, 2005) buffalo (Scala *et al.*, 1993; Prakash and Rao, 1980), goat (Kobayashi *et al.*, 2005; Kumar *et al.*, 1998), lamb (Tadjalli and Pazhoomand, 2004) and Barbary sheep (Emura *et al.*, 2000b). The lingual papillae of cows were compared with those of horses by Chamorro *et al.* (1986) and De Paz Cabello *et al.* (1988). Such studies reveal variations in morphology and distribution of papillae on dorsal lingual surface among animal species. Therefore, the present study was performed to investigate the histological features differences of the tongue papillae in the Iranian buffalo (*Bubalus bubalus*) and to compare it to other animals.

MATERIALS AND METHODS

This research project was conducted from 20/09/2008 to 20/05/2009 in Ahvaz, Iran. Tongues were collected from ten healthy adult buffalo; immediately after slaughtering from Ahvaz slaughterhouse. After macroscopic observation, their length and width of the tongues were measured. Samples were collected from the dorsal surface of apex, body and torus linguae of the tongue. The papillae present on ventral surface of the apex were also collected. Samples were collected with maximum 0.5 cm thickness and were fixed in 10% formalin saline. Fixed samples were dehydrated in a graded series of alcohols, cleared in xylene, embedded in paraffin and cut with microtome at 5-6 μ m. Sections were mounted on glass slides, deparaffinized and stained by Haematoxylin and Eosin (H and E) (Bancroft and Gamble, 2002). The studies were observed under light microscope.

RESULTS

The tongue of Iranian buffalo was approximately 40.20 ± 1.524 cm length and 7.78 ± 1.471 cm width in body. It could be divided into three areas: the lingual apex, lingual body and lingual root (Fig. 1). The lingual body has a lingual prominence at the intermolar region half way along the dorsum of the tongue.

Five different forms of lingual papillae were identified, viz., filiform, conical, lenticular, circumvallate and fungiform. The numerous filiform papillae were distributed on the dorsal surface of the apex and to the body of the tongue, the free ends of which pointed towards

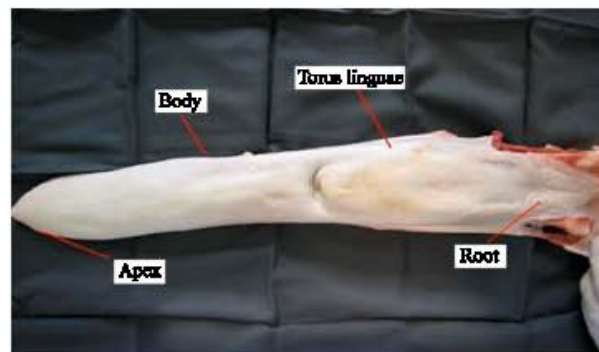


Fig. 1: Tongue of Iranian buffalo; It could be divided into three areas: the lingual apex, lingual body and lingual root

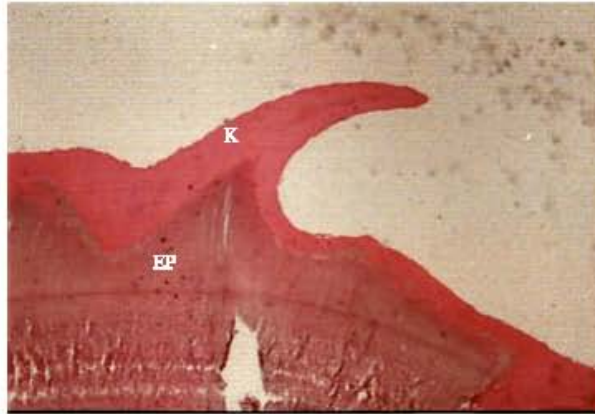


Fig. 2: Histological picture of filiform papillae of Iranian Buffalo (H and E, 4X): K: Corneum layer, EP: Epithelium

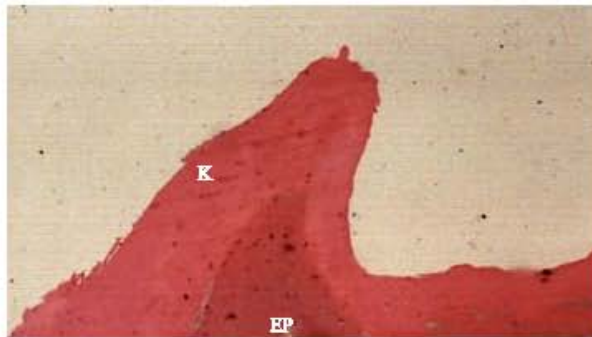


Fig. 3: Histological picture of filiform papillae of Iranian Buffalo (H and E, 20X): K: Corneum layer, EP: Epithelium

the root of the tongue (Fig. 2). The papillae appeared in conical shape with a sharp tip that was directed caudally (Fig. 3).

The conical papillae on torus linguae were elongated with a broad round base and a blunt tip (Fig. 4, 6). These papillae differed from filiform papillae in terms of their large height. The lenticular papillae were limited on the torus linguae. Lenticular papillae are as biconvex projection and elevated beyond the surface of tongue and were formed keratinized stratified squamous epithelium (Fig. 5, 6).

The circumvallates papillae were found on lateral and caudal part of torus linguae and contained many taste buds (Fig. 9, 10) on the lateral walls. They were round to oval in shape with minute elevation from the tongue surface (Fig. 7). The majority of the taste pores were positioned along the lateral surface of central papilla opening into the papillary groove (Fig. 8).

The fungiform papillae in Iranian buffalo in the sections were as a mound with a connective tissue core. The form of the fungiform papillae was round and convex, i.e., mushroom-like and these papillae were scattered among the filiform papillae. No taste buds nor pores were recognizable on the free surface of the papillae (Fig. 11).

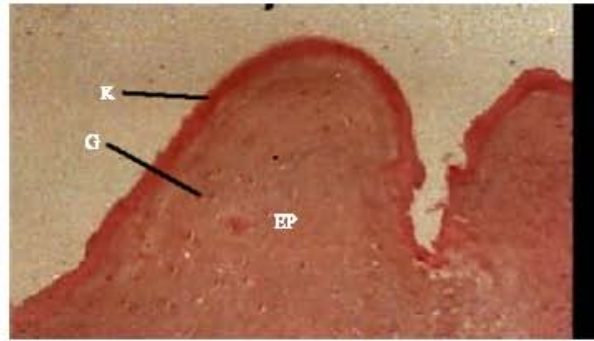


Fig. 4: Histological picture of conical papillae of Iranian Buffalo (H and E, 20X): K: Corneum layer; EP: Epithelium; G: Granular layer

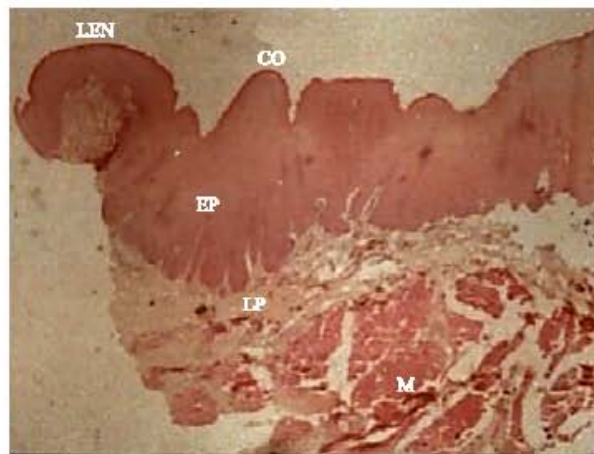


Fig. 5: Histological picture of tongue of Iranian Buffalo (H and E, 4X): LEN: Lenticular papillae; CO: Conical papillae; EP: Epithelium; LP: lamina propria; M: Muscular layer

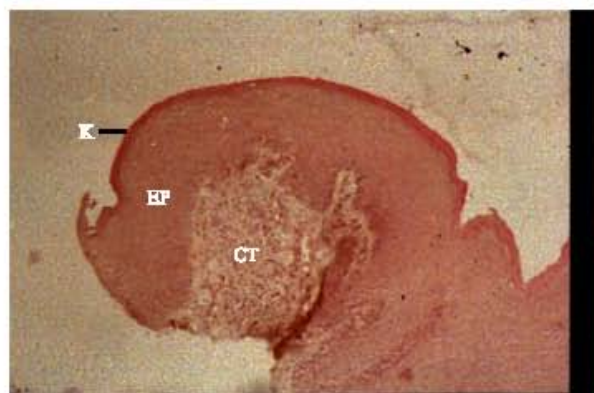


Fig. 6: Histological picture of lentiform papillae of Iranian Buffalo (H and E, 10X): K: Corneum layer; EP: Epithelium; CT: Connective tissue

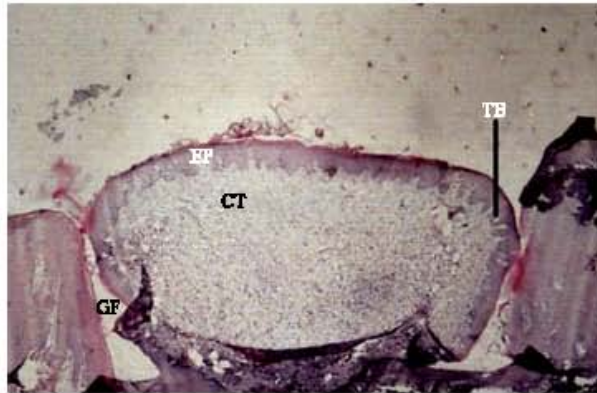


Fig. 7: Histological picture of circumvallate papillae of Iranian Buffalo (H and E, 4X):
CT: Connective tissue; EP: Epithelium; TB: Taste Bud

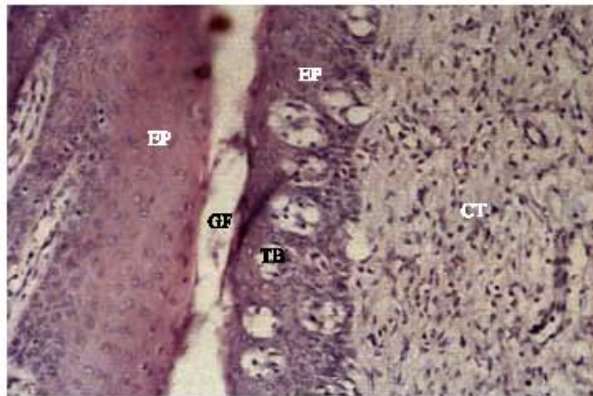


Fig. 8: Histological picture of circumvallate papillae of Iranian Buffalo (H and E, 20X):
CT: Connective tissue; EP: Epithelium; TB: Taste bud; GF: Gustatory sulcus

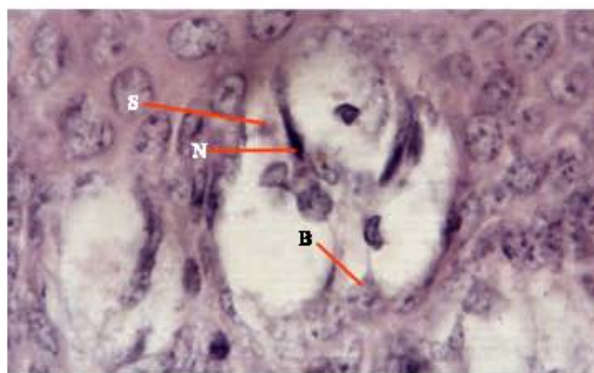


Fig. 9: Histological picture of taste bud of circumvallate papillae of Iranian Buffalo
(H and E, 100X): S: Supportive cell; N: Neuroepithelial; B: Basal cell

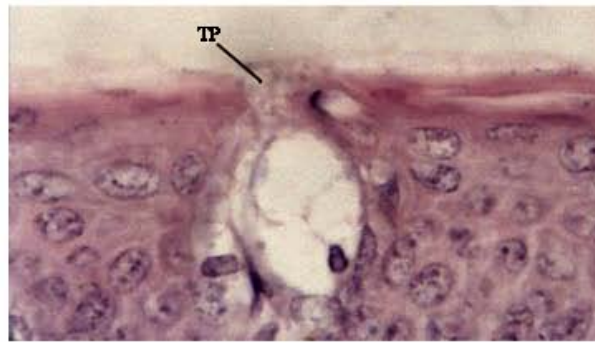


Fig. 10: Histological picture of taste bud of circumvallate papillae in Iranian buffalo (H and E, 100X): TP: Taste pore

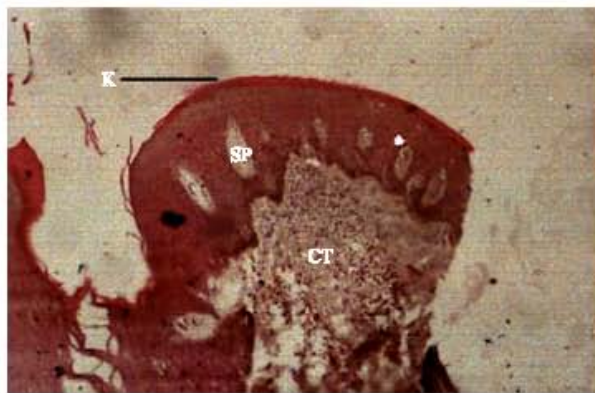


Fig. 11: Histological picture of fungiform of Iranian Buffalo (H and E, 4X): K: Corneum layer; SP: Secondary papillae; CT: Connective tissue

DISCUSSION

In mammals, in general, light microscopy has identified some degree of structural variation on the dorsal surface of the tongue, especially in shape of lingual papillae. The morphology of the tongue of Iranian buffalo is similar to goats (Kumar *et al.*, 1998), ox (De Paz Cabello *et al.*, 1988; Chamorro *et al.*, 1986), buffalo (Scala *et al.*, 1993) and Barbary sheep (Emura *et al.*, 2000a), but different from one-humped camel (Qayyum *et al.*, 1988), horse (Chamorro *et al.*, 1986; De Paz Cabello *et al.*, 1988) and Bactrian camel (Eerdunchaolu *et al.*, 2001). The present study has demonstrated the existence of filiform, fungiform, conical, lenticular and circumvallate papillae as reported in goat (Kumar *et al.*, 1998), ox (De Paz Cabello *et al.*, 1988; Chamorro *et al.*, 1986) and buffalo (Scala *et al.*, 1993). However, conical papillae were absent in one-humped camel (Qayyum *et al.*, 1988) and Bactrian camel (Eerdunchaolu *et al.*, 2001), but special type (wart-like) papillae have been reported in one-humped camel (Qayyum *et al.*, 1988). The conical-shaped filiform papillae in Iranian buffalo were directed caudally as reported in goats (Kumar *et al.*, 1998).

The morphology of conical papillae in Iranian buffalo was similar to that in goats (Kumar *et al.*, 1998) and ox (De Paz Cabello *et al.*, 1988), but these papillae showed a clear groove surrounding their base in goats and ox.

The lenticular papillae in goat (Kumar *et al.*, 1998), ox (De Paz Cabello *et al.*, 1998), lamb (Tadjalli and Pazhoomand, 2004) and Bactrian camel (Eerdunchaolu *et al.*, 2001) were on the surface of torus linguae that could serve as a complementary protection of the tongue surface.

The circumvallate papilla in the Iranian buffalo had a papillary groove as reported in the goat (Kumar *et al.*, 1998), ox (Chamorro *et al.*, 1986), lamb (Tadjalli and Pazhoomand, 2004), one-humped camel (Qayyum *et al.*, 1988), bactrian camel (Eerdunchaolu *et al.*, 2001) and buffalo (Scala *et al.*, 1993). The taste pores in the Iranian buffalo opened laterally close to the papillary groove as in goat (Kumar *et al.*, 1998) and bovines (Chamorro *et al.*, 1986; Davies *et al.*, 1979; Dellmann and Eurell, 1998).

The mushroom-shaped fungiform papillae of Iranian buffalo being separated from the filiform papillae by groove was similarly reported in the goat (Kumar *et al.*, 1998), lamb (Tadjalli and Pazhoomand, 2004), ox, horse (Chamorro *et al.*, 1986), one-humped camel (Qayyum *et al.*, 1988) and Bactrian camel (Eerdunchaolu *et al.*, 2001). The fungiform papillae in Iranian buffalo in the sections were as a mound with a connective tissue core that is similar to horse and bovines (Chamorro *et al.*, 1986). We didn't observe taste buds or pores were recognizable on the free surface of the papillae. However, a few taste pores have been reported in the ox and horse (Chamorro *et al.*, 1986; Davies *et al.*, 1979). The fungiform papillae in the buffalo have a shape that corresponds to their name, while in the horse; they almost do not emerge from the surface of the tongue (Chamorro *et al.*, 1986).

In conclusion, the important morphologic characteristics of the lingual papillae studied in the Iranian buffalo showed that the buffalo was better endowed with mechanical papillae both by variety and morphological features and less with gustatory papillae; therefore, the Iranian buffalo tongue has a major mechanical capacity but a poorer gustatory sensitivity. The characteristics of lingual papillae in the Iranian buffalo make the papillary morphology of the tongue of this animal similar to that of other domestic ruminants such as goat, ox, lamb and barbary sheep.

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