COMPARATIVE HISTOLOGICAL STUDY OF TONGUE IN TWO SPECIES OF RAT
(RATTUS NORVEGICUS & RATTUS WISTAR)

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ABSTRACT
This study was carried out to compare the anatomical structure of tongue in two species of Rattus. For this purpose, the tongue of Rattus norvegicus (8 adult male) and Rattus wistar (8 adult male) was dissected from the root. Macroscopic features of tongue as weight, length and width were measured by calliper. Then, they were fixed in formalin (10%) and prepared by tissue processing. The sections (5 μ) were prepared and subjected to Haematoxylin and Eosin stain. Morphometric analyses were performed by light microscopy and progress capture soft ware. The comparative observation in these species were showed that the keratinized stratified squamous epithelium covered dorsal of tongue especially on apex and the lingual torus was on the posterior third. The layers and arrangement of them were similar together but and different in thickness. Nnumerous filiform papillae as mechanical papillae and a few fungiform and one circumvallate papillae as gustatory papillae were observed on dorsum of tongue. Distribution and density of filliform and fungiform papillae were different. Lingual glands were found spatially on posterior of ventral surface. According to these results, the structure of tongue in both species is somewhat similar and differences due to adaptations for verity of diet.

Keywords: Papillae, Taste bud, Diet

INTRODUCTION
Rattus norvegicus and Rattus wistar are the important species of genus Rattus (Fragaszy et al., 2003). Although they adapt to life in most any habitat specially wherever that is an abundance of food but their diet is different. In other hands, food taking in animals related to the structure of their tongue (Cizek et al., 2011). In this study, the tongue of two species of rat is compared and relation of histological structure of them and their diet is investigated.

The structure of the tongue were surveyed in other rodents as Rat (Kilinc et al., 2010), mouse (Iwasaki et al., 1996), hystrix (Karan et al., 2010), rabbit (Silva et al., 2002; Nonaka et al., 2008) and wistar rat (Aiwa et al., 2007; Nasr et al., 2012) using light and electron microscopy.

The tongue of mammals is muscular organ with three layers including mucosa, submocosa and muscularis. Mucosa is covered by psudostratified squamous epithelium with variation in the keratiniation. Six types of the lingual papillae with different density and distribution were known in mammals (Jackowiak and Godynicki, 2007). These papillae are divided to mechanical (filiform,P, fugiform,P, conical,P) and gustatory papillae (vallate,P, foliate,P, lentiform,P).

Although filiform papillae are needle shape in most of vertebrate but three distinct types of them were known. Type I which are needle like and covered with thin keratinized stratified squamous epithelium and they were located on apex and anterior of body (Jwasakis, 2002). The bifid or trifled filiform papillae (type II, III) were shorter and thicker than type I, and placed on posterior area (Nasr et al., 2012).

Light and scanning electron microscopic study of the dorsal lingual papillae of the rat Arvicanthis niloticus indicated keratinization of the dorsal surface of the tongue with variable degrees (Naser et al., 2012).

The tongue in rodents is elongated and the dorsal surface of it has many papillaes which frequently show species-specific traits in structure, location and density. Its epithelium was covered by keratin which is thinner on the ventral surface (Jwasakis, 2002).
MATERIALS AND METHODS
The tongue of 8 adult male rats ( *norvegicus* ) and 8 adult male rats ( *wistar* ) were dissected from the root. Their weight, length and wide in apex, body and root, were measured. Then, they were fixed in neutral buffered formalin (10%) for 48 hours and prepared by tissue processing by tissue processor automatically as follow:

They were dehydrated respectively with alcohol 70–100%, cleared by xylol and paraffin impregnation. The serial sections (5 μm) were obtained by microtome and subjected to Haematoxylin and Eosin stains. The morphometric features of tongue were studied by light microscope and progress capture soft ware.

RESULTS AND DISCUSSION
The tongue was elongated (table.1), three parts (apex, body and root) were distinguished and lingual torus was on the posterior third in both species (Figure 1).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>R. norvegicus (8 N)</th>
<th>R. wistar (8 N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean± S.E of length</td>
<td>2.85±0.16 Cm</td>
<td>2.67±0.14 Cm</td>
</tr>
<tr>
<td>Mean± S.E of width(Apex)</td>
<td>0.42±0.12 Cm</td>
<td>0.58±0.11 Cm</td>
</tr>
<tr>
<td>Mean± S.E of width(Body)</td>
<td>0.60±0.10 Cm</td>
<td>0.66±0.00 Cm</td>
</tr>
<tr>
<td>Mean± S.E of width(Root)</td>
<td>1.15±0.02 Cm</td>
<td>1.00±0.02 Cm</td>
</tr>
<tr>
<td>Mean± S.E of weight</td>
<td>1.013±0.12</td>
<td>1.18±0.02</td>
</tr>
</tbody>
</table>

Also the layers of the tongue are similar as follow:
Mucosa was covered by keratinized stratified squamous epithelium in dorsal surface, thick submucosa with blood vessels and glands in lamina proper and thick muscularis layer were observed (Figure 2, 3). This arrangement is thicker in posterior of their tongue (Figure 4, 5). The numerous blood vessel were in the lamina propria (connective tissue) spatially in *R. norvegicus*.
Two kinds of papilla include mechanical type include filiform papilla (Figure 1, 2) and gustatory papillae covering fungiform (Figure 4, 5) and vallate papilla (Figure 8).
Density and distribution of filliform. P in *R. norvegicus* is different with *R. wistar*. These papilla were numerous on whole of tongue in *R. norvegicus* (Figure 2 & 4) but they weren't on posterior of tongue in *R. wistar* (Figure 7).
Figure 2: Apex of tongue in *(R. norvegicus)* - (10x- H&E)

Figure 3: Apex of tongue in *(R. wistar)* - (10x- H&E)

Figure 4: Body of tongue in *(R. norvegicus)* - (10x- H&E)
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Figure 5: Body of tongue in (R. wistar) - (10x- H&E)

Figure 6: Posterior of tongue in (R. norvegicus) - (10x- H&E)

Figure 7: Posterior of tongue in (R. wistar) - (10x- H&E)
Figure 8: Circumvallate on tongue in (R. norvegicus) - (10x H&E)

Figure 9a: Cartilage in anterior of tongue (R. wistar) - (10x H&E)

Figure 9b: Ventral surface in (R. norvegicus)- (10x H&E)
keratinized stratified squamous epithelium (K.S.S.E), pseudostratified squamous (Ps.S.E), lamina propria (L.P); mucosa (m); submucosa(Sm); connective tissue (C); longitudinal muscle (L.M) circular muscle (C.M); filiform papilla (F); fungiform papilla (F); blood vessel (v); circumvallate, P(c.P); taste bud (T.b); cleft (cl), serous gland (S.g), cartilage (Car)

Table 2: Characteristic of lingual papillae in R. norvegicus & R. wistar

<table>
<thead>
<tr>
<th>Papillae</th>
<th>R. norvegicus</th>
<th>R. wistar</th>
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<tbody>
<tr>
<td>Mean length</td>
<td>Mean length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(mm)</td>
<td>(mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fungiform</td>
<td>0.201 A:</td>
<td>0.284 A:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.132 W:</td>
<td>0.154 W:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.010 A:</td>
<td>0.782 A:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.871 W:</td>
<td>3.502 W:</td>
<td></td>
</tr>
<tr>
<td>Filiform</td>
<td>0.286 A:</td>
<td>0.300 A:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.068 W:</td>
<td>0.123 W:</td>
<td></td>
</tr>
</tbody>
</table>

*Note: A: (attitude), W: (width)

Fungiform P was a few in both of species; its mushroom shape is similar together and has one taste bud on dorsum of them. These papillae inter filliform P and the most of them located in apex in R. norvegicus (4 & 5).

One circumvallated P with macroscopic size was observed on front of the root and it has many taste buds especially in lateral walls (Figure 8). There is less keratinisation on the ventral surface and many glands include serous, mix and mucous gland (Figure), thick lamina propria and more muscular mass (circular and longitudinal) was observed in this surface (Figure 3, 4). The most of muscle were transverse bundle and longitudinal bundle were between them (Figure 2 & 3). In the collagenous fiber and cartilage was in anterior (Figure 7).

Filiform papillae have a pointed needle shape with high density were placed in the anteriolateral of the tongue and their orientation forward to pharynx (Figure 2-5).

Epithelium and keratin in ventral surface were thinner than dorsal surface (Figure 9 &10). Many glands (serous and mucous gland), thick lamina propria and more muscular mass (circular and longitudinal) were observed in this surface (Figure 9). The most of muscle were transverse bundle and longitudinal bundle were between them (Figure 2-5). The collagenous fiber was in front and many lymphoid cells in posterior of tongue (Figure 6 & 7).
Discussion

The study of tongue in present study was showed that anatomical structure as layers and types of papillae were almost similar in the two species, but thickness of layers, density and distribution of papilla were slightly different. Their structural specifications are taxonomic and adaptations to their feeding patterns (Kobayashi et al., 2003). No difference was in length and weight of studied Rats' tongue. The keratinization on epithelium of its dorsum aid to protection of tongue spatially on apex so the risk of food's collision is higher. According previous study (Iwasaki et al., 1999; Nonaka et al., 2008), stratified squamous epithelium and thick keratin on filiform. P was necessary for protection against damage due to taking hard food (Nonaka et al., 2009). The presence thick lamina propria and muscular layer in R. norvegicus is essential for their diet. Although they are rodent but their digestive system was adapted to omnivorous (nekoii, 2010).

Fungiform papillae less than filiform papillae and were on the tongue apex (Figure 4 & 5). Although fungiform. P is mechanical papillae in most of mammals (Benetti et al., 2009) but thin keratin and one taste buds on conical surface of it, referred to its gustatory function. On the contrary finding of Taiwo et al., (2009), most of the fungiform. P was on side of body of tongue. Present result may be related to the feeding habits and varied diet in this species.

The foliate papillae were observed on tongue in some vertebrates (Jackowiak, 2006) and the most of rodent have this papillae with different number from 34 rows in flying squirrels (Emura et al., 1999), 15–20 rows by in rabbits (Kobayashi, 1992) and four to six rows in mice (Toprak, 2007). On the contrary above findings, in this study wasn't seen the foliate papillae (Adeniyi et al., 2010).

It may be present in these species of Rat but wasn't seen on light microscope. So, observation with electron microscopic study (transmission) is suggested.

The filiform papilla due to consisting of some processes, divided to three types include type I - III which the type I almost were on apex (Benetti et al., 2009). This type were needle shape that is suitable for taking particle and type II & III with thick connective tissue in own process, is suitable for most contiguity and crushing (-Adeniyi et al., 2010). The density and distribution of papillae were different and decreased from the apex to root of tongue in both species but Type I in wistar rat was taller and more than R. norvegicus. Thick keratinized epithelium of filiform. P related to its mechanical role and thicker on apex and its orientation to pharynx, since facilitate to taking food particles and swallow them (Jackowiak & Godinicki, 2007; Ebru et al., 2010).

According to finding in many vertebrates, the one circumvallate papillae (Figure 8) is suited front of root (Kobayashi et al., 2004; Parchami et al., 2010). Its location may be related to its role for helping in taste reception. This papillae is oval and big as seen without microscope, has many taste buds in lateral walls epithelium (Figure 8) and tubular canal is around it (8). The number of this papillae from noting to 14 is varies with species in mammals (Kobayashi et al., 2005). Brown rats are omnivorous and eat a huge variety of foods as milk to meat, vegetables, poultry, all grains and fruits (Meerburg & Singleton, 2009).

The serous, mucous and mix glands which related to taste buds via its canal and aid to gustatory. The most of glands were serous especially in ventral surface (Figure 9 & 10).

Thick lamina propria with blood vessel and collagenous fiber supported the mucosa well (Figure 9 & 10). The muscles and collagenous bundle like and cartilage in anterior of tongue in wistar Rat, allows a range of complex movements for mastication (Ofusori et al., 2008). Furthermore, collagenous fibres are seen surrounding the most transverse muscle bundle in the anterior portion of the tongue. It is believed to confer on the tongue, tensile strength needed for protraction and retraction which in association with the complex muscular allows considerable and complex tongue extensions (Taiwo et al., 2009).

Conclusion

The obtained results showed that tongue in both species is similar and observed difference due to adaptation to habitat and their diet.
ACKNOWLEDGMENTS
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REFERENCES


