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Foliate Papillae of Human Tongue - A Microscopic Study

KEYWORDS: Foliate papilla, taste buds, lymphoid infiltration.

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ABSTRACT *Background:Foliate papillae are several leaf like papillae present on the lateral margin of the tongue at the junction of anterior two thirds and posterior one thirds. Aims:1)To note the distribution and age changes in foliate papillae and tastebuds. 2)To find whether lymphoid infiltration is seen in relation to foliate papilla in all cases. Materials and methods:The study was conducted in 42 specimens of tongue collected from Department of Forensic Medicine and Labour Room, Govt Medical College, Kozhikode.Tissue bits from the region of foliate papilla were fixed, processed, stained and analysed under light microscope. Results: Foliate papillae were identified in 76% of the specimens. Connective tissue papillae were observed only in few cases. No taste buds /lymphoid infiltrates were observed in fetal specimens. In the age group 1-80 years, 69% of the foliate papillae contained taste buds which were located on the sides of the papillae, in the adjacent epithelium or both. Statistical analysis revealed no significant correlation between the number of taste buds and age. Lymphoid infiltration was seen in association with the foliate papilla in 43% of specimens.*

INTRODUCTION

Lingual papillae are projections of the mucosa covering the dorsal surface of the tongue[1]. Foliate papillae lie bilaterally in two zones at the sides of the tongue near the sulcus terminalis, each formed by a series of red, leaf like mucosal ridges covered by a non keratinised epithelium.[1].

Under the microscope, the non keratinized surface epithelium that lines the ridges of these papillae is punctuated by numerous taste buds whose sensory receptive endings open into the intervening grooves that separate an individual foliate papilla from its neighbour [2]. The increased surface area allows for prolonged contact with chemical substances introduced into the oral cavity, thus enhancing their ability to stimulate taste signals [2].

The taste bud is a barrel shaped organ extending the full thickness of the epithelium and opening at the surface via the taste pore[3]. Like the oral epithelium, all the cells of the taste bud, which represent highly specialized epithelial cells are renewed continuously although the gustatory and sustentacular cells are replaced at different rates [3].

Over 1000 taste buds are distributed over the sides of the tongue, particularly over the most posterior folds of the two foliate papillae [1]. There is considerable individual variation in the distribution of taste buds in humans [1]. Beyond the age of 45 years, many taste buds degenerate, causing taste sensitivity to decrease in old age [4].

The connective tissue papillae are sometimes termed papillae simplices and are present beneath the entire tongue surface including the mucosal papillae and this arrangement serves to increase the anchorage of the epithelium to the underlying tissues [5].

The cores of foliate papillae contain lymphoid tissue [6].

AIMS AND OBJECTIVES

- To note the distribution and age changes in foliate papillae and taste buds.
- To note whether lymphoid infiltration is seen in relation to foliate papilla in all cases.

MATERIALS AND METHODS

42 specimens of tongue and epiglottis in the age group 0- 80 years were collected. Autopsy specimens were collected from the Department of Forensic medicine, Medical College, Kozhikode. Specimens of still born babies were taken from the labour room of Medical College, Kozhikode. Ethical Committee clearance was obtained for the same.

Exclusion criteria :

- Post mortem bodies of burns cases.
- Decomposed bodies.
- Bodies with severe maxillofacial injuries.

Tissue bits were taken from the posterolateral region of the tongue near the sulcus terminalis and fixed in Bouin's fluid overnight. They were then processed using ascending grades of alcohol, cleared in xylene and were embedded in paraffin wax. Sections with 6 microns thickness were taken and stained with haematoxylin and eosin. Ehrlich's haematoxylin was used since it could be kept for years after ripening and gave brilliant nuclear stain. Results of the microscopic study were analysed statistically using Spearman's correlation.

RESULTS

See Table 1 & Fig :1,2,3.

Fetal specimens

In youngest fetus studied (13 weeks), only one developing foliate papilla was seen per low power field. Number of foliate papillae in fetal specimens varied from 0-4/LPF. None of them contained taste buds and there was no lymphoid infiltration. Connective tissue papilla was observed only in one case.

Age group 1-80 years

The number of foliate papillae per low power field varied from 0-2. Taste bud was first noted at the age of three. Taste buds were identified in 69% of foliate papillae and when present , it was in the lateral epithelium of the papilla, epithelium lining the adjacent groove or both. Lymphoid infiltration was seen near the foliate papilla in 43 % of specimens, irrespective of age. Connective tissue papillae were observed only in a few cases.

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Table 2.

			Age	Taste buds/ LPF
Spearman's rho	Age	Correlation coefficient	1.000	.278
		Sig (2-tailed)	.	.106
		N	35	35

Table 2 Shows the statistical analysis of the data representing the taste buds/ LPF in the foliate region of the tongue (excluding fetal specimens), using Spearman's correlation. No significant correlation was found between the number of tastebuds/ LPF and age.

DISCUSSION

Though studies on the structure of various lingual papillae and taste buds can be traced back to 1868, most of the works were done on animals. Even now studies on human tissues are few.

Foliate papillae are few in number and situated on the posterolateral aspect of the tongue. The name is derived from the shape of the papilla which resembles a leaf (folium).In the present study, foliate papillae were identified only in 76% of specimens (32/42). The number of papillae during intrauterine life is more reaching upto 4/ LPF. In 8 month old fetus itself, the number has reduced. After birth, the number varies between 0 and 2. But in majority of cases ,only one foliate papilla is seen per LPF. So this study agrees partly with Fawcett[7],who states that foliate papillae are rudimentary in humans, but in many animals they are the sites of main aggregations of taste receptors. Arthur etal [2] also reports that in many individuals the foliate papillae may be subtle and therefore difficult to identify on clinical examination. According to Kobayashi K etal[8], moderately developed foliate papillae are found in human.

Lymphoid infiltrations were observed from 3 year onwards, though not in all cases . In the posterior one third of tongue, lingual tonsils develop. They must have moved to the lateral wall. Sonntage [9] suggested that the diffuse infiltration of lymphoid cells in the lamina propria beneath the foliate papillae should be regarded as a primitive form of lingual follicles lying in the pharyngeal portion of the tongue. Kinziro Kubota etal[10] also reported infiltration of lymphoid cells in the lamina propria of foliate papillae in marmosets.

Presence of lymphoid aggregate is clinically relevant. According to Di Felice R etal[11], foliate papillae may occasionally become irritated ,resulting in hypertrophy of lymphoid tissue. He reported a case of foliate papillitis in which the lesion had a polypoid morphology and the mass appeared microscopically as aggregates of lymphoid tissue showing a reactive hyperplasia.

In most of the specimens, connective tissue papillae were not observed. It was seen only in the case of "12" and when present, the number varied from 1-7 and most of them were minor. As can be seen (Fig 1), the foliate papilla is already bent to one side. The presence or absence of stiff connective tissue core doesnot alter the shape of the papilla. Hence connective tissue papillae seem to have no significance in foliate papilla. Their number does not change significantly with age. (Table 1). This study agrees with Kobayashi K etal (2001)[12], who emphasized the fact that there is a great deal of individual variation of human lingual papillae regardless of age. According to Kobayashi K etal (1994)[13], foliate papillae of human tongue consist of 10-15 parallel folds at the posterior margin of the tongue and the connective tissue core of the foliate papillae appear as ridges and grooves.

The most important part of foliate papilla is the presence of taste buds. In addition to making eating a pleasant one, the sensation of taste has a protective role also.

According to Keith L Moore etal[14], lingual papillae appear towards the end of the 8th week and the vallate and foliate papillae appear first, close to the terminal branches of the glossopharyngeal nerve. Taste buds develop during 11 -13 weeks by inductive interaction between the epithelial cells of the tongue and invading gustatory nerve cells .As per Richard A Polin etal[15], the vast majority of taste buds are found in the foliate and circumvallate papillae in prenatal development. Bradley R M etal[16] reports that specialized taste cells appear in the human fetus at 7-8 weeks of gestation, and morphologically mature cells are recognizable at 13-15 weeks. In the present study, eventhough foliate papilla was observed in the specimen of 13 week old fetus, taste buds could not be identified in any of the fetal specimens.

In adults, more number of taste buds are seen compared to children, in case of foliate papilla, though not in all cases. 25 taste buds per papilla was observed in 78 year old. The available literature doesnot show much details of taste buds on human foliate papilla. According to Kobayashi K etal[13], foliate papillae of human tongue revealed numerous taste buds arranged in single file in the lateral epithelium. In the present study, apart from lateral epithelium, some taste buds were also observed in the adjacent epithelium lining the groove of foliate papilla.

As per Suzuki T[17], approximately 5000 taste buds cover the surface of human tongue with about 30% fungiform, 30% foliate and 40% circumvallate papillae. In a study conducted in adult rhesus monkey, Bradley etal (1985)[18] observed that age did not affect the number of taste buds within the foliate papilla. The present study agrees with Bradley as the statistical analysis revealed no significant correlation between the number of taste buds per LPF and age. Yamaguchi etal[19] conducted a study on common marmoset and reported that the effect of aging on taste bud number was different among individuals and did not simply depend on increasing age. Azzali G etal[20] also noted that age does not seem to influence taste perception in humans. The present study disagrees with Mochizuki (1937)[21] who stated that the investigations on human circumvallate and foliate papillae showed a reduction in the number of taste buds with old age. But as per Mochizuki (1939), the change in foliate taste buds with aging was equivocal.

CONCLUSIONS

Majority of human foliate papillae contain taste buds in the side walls of the papilla, adjacent epithelium or both. There is no significant correlation between the number of taste buds per LPF and age.

Lymphoid infiltration is seen near the foliate papillae in 43% of specimens in the age group 1-80 years, irrespective of age.

Connective tissue papillae are present only in few cases .

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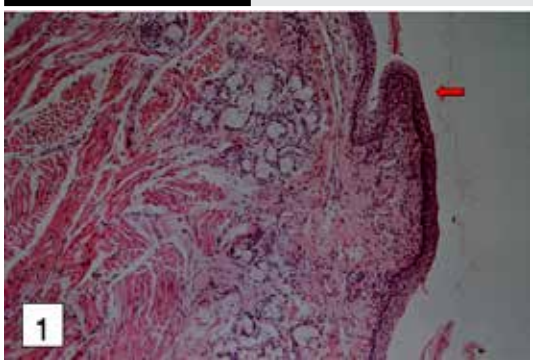

Fig:1-Section of the foliate region of tongue of 33 wk old fetus showing foliate papilla (red arrow). Haematoxylin & Eosin staining. Magnification x 100.

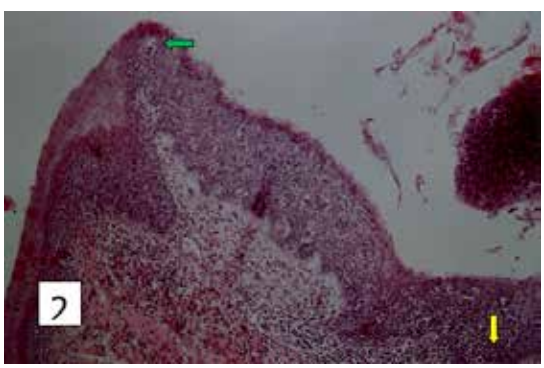

Fig:2-Section of foliate region of tongue of 3 year old, showing foliate papilla with taste bud (green arrow) Note lymphoid infiltration (yellow arrow).Haematoxylin & Eosin staining. Magnification x 100.

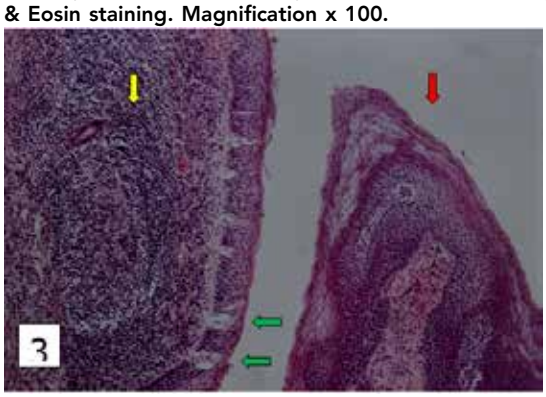

Fig:3-Section of foliate region of tongue of 66 year old, showing foliate papilla(red arrow),several taste buds(green arrow) in the adjoining epithelium and lymphoid aggregate(yellow arrow). Haematoxylin and Eosin staining. Magnification x 100.

AGE	No/LPF	TB/LPF	CT Papilla	Lymphoid aggregate
13wks	1	0	0	N
20wks	3	0	0	N
21wks	4	0	0	N
25wks	2	0	0	N
28wks	4	0	2	N
30wks	0	0	0	N
33wks	2	0	0	N
3yrs	2	1	0	Starting
5yrs	0	0	0	N
9yrs	1	1	0	N
10yrs	0	0	0	P
12yrs	1	0	0	P
14yrs	1	0	2,1*	N
19yrs	1	0	4	N
20yrs	1	6	3*	N
22yrs	0	0	0	N
24yrs	1	0	0	N
25yrs	1	9	0	P
26yrs	1	4	1*	P
32yrs	2	11(6,5)	2*	P
34yrs	1	0	0	N
36yrs	0	0	0	N
38yrs	0	0	0	N
40yrs	2	6(4,2+)	2	P
43yrs	1	0	0	N
45yrs	1	1	6	N
46yrs	1	0	0	P
47yrs	1	7	7*	N
48yrs	1	0	0	P
50yrs	1	9(4,5+)	1*	P
55yrs	1	6	0	P
58yrs	0	0	0	N
60yrs	0	0	0	N
61yrs	0	0	0	N
62yrs	0	0	0	N
64yrs	1	17(11,6+)	0	P
66yrs	1	7+	2*	P
70yrs	1	3	1*	P
72yrs	2	29(8,21)	0	N
73yrs	1	11	0	N
75yrs	1	3	0	N
78yrs	1	25	0	P

TABLE 1

No/LPF- Number per low power field

TB/LPF- Tastebuds per low power field

CT Papilla- Connective tissue papilla

N- Not present

P- Present

+- On adjacent epithelium lining groove

*- Minor CT papilla

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