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Don't Waste Your Taste: - A Comparative Evaluation Of Altered Gustatory Perception In Patients Of Oral Submucous Fibrosis

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ABSTRACT

Introduction: The major disabilities like trismus and odynophagia that occur in the patients with OSMF are well documented, but impairment of the taste sensation has not received much attention, owing to limited research work in the field. Due to scarcity of the literature on this aspect of the disease process and influence of OSMF on taste perception, the present study intended to assess and compare the alteration in taste perception among patients with OSMF and healthy subjects.

Aim: To evaluate altered taste perception in Oral submucous fibrosis (OSMF) patients.

Materials and Methods: The comparative study included 70 patients, both males and females with the age range of 20 to 55 years. Four basic tastants (sweet, salty, sour, bitter) were prepared as follows: sucrose for sweet, sodium chloride for salty, citric acid for sour, and quinine sulphate for bitter and full mouth rinse test was performed. The data obtained were tabulated and analysed by the Pearson Chi-Square test; 0.05 was considered statistically significant.

Results: The overall result suggested that there is significant alteration of taste. The sweet taste was altered followed by salty and bitter, sour taste was not altered in any of the patients. It also showed that there was more alteration in sweet taste with the progression of stages of OSMF.

Conclusion: The study points out at the significance of alteration in taste perception in OSMF patients by using physiological stimuli tastants.

Keywords: *Taste alteration, OSMF, Gustatory Perception*

1. INTRODUCTION

Taste perception is an important factor in sustaining human life. Although commonly recognised as important for epicurean pleasure. Taste is perceived by taste buds which are present on papillae on dorsum of the tongue which are of 4 types: Filiform, fungiform, foliate, and circumvallate. [1,2]

Taste buds, the sensory organs responsible for detecting taste, contain three main types of taste receptor cells, each specialized in detecting different taste modalities. (Figure 1)

Type I taste receptor cells primarily detect salty tastes. These receptors are located on the lateral border of the tongue, specifically within the fungiform papillae. This type of receptor plays a crucial role in our ability to sense saltiness, which is important for electrolyte balance and hydration.

Type II taste receptor cells are responsible for detecting sweet, bitter, and umami tastes. These receptors are found in both the fungiform and circumvallate papillae of the tongue. The detection of these tastes helps in identifying energy-rich nutrients (sweet), potentially harmful substances (bitter), and amino acids (umami), which are vital for protein nutrition.

Type III taste receptor cells are specialized for detecting sour tastes. These receptors are located in the circumvallate and foliate papillae. The ability to detect sourness is important for identifying acidic foods, which could signal the presence of vitamin C-rich fruits or spoilage in foods.

Each type of taste receptor contributes to the complex experience of taste, allowing us to enjoy and evaluate a wide variety of flavors and food qualities. [1,2,3,4]

In literature numerous reasons for alteration in gustatory perception are documented but the most acceptable and commoner causes for the same include inflammatory reaction with or without infection in the oral cavity, which reduces blood flow causing alteration in the normal physiology and function the taste buds, bringing about the atrophy of the papillae with the progression of the disease process.[5,6,7]

2. MATERIALS AND METHOD

A comparative study was conducted to assess and compare the taste perception among 70 outpatients between the age group of 20–55 years attending the Outpatient Department of Oral Medicine, Diagnosis and Radiology (OMDR) department.

This study established specific criteria. The inclusions required Systemically healthy participants with clinically diagnosed OSMF. Participants with the age group of 20–55 years. Participants who have not undergone any treatment for OSMF earlier. Exclusions targeted Participants with known systemic illness, Participants taking medications which may cause alteration in perception of taste, Lactating and pregnant females and participants allergic to taste solution.

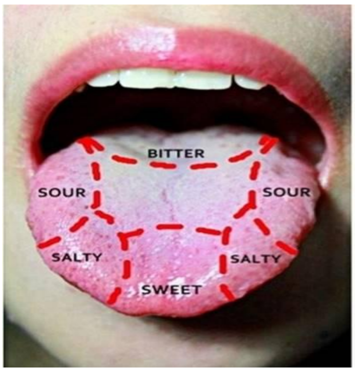

Figure 1: TONGUE AND TASTE DISTRIBUTION

In this study, we included 70 consent patients, both male and females, aged 20–55 years conducted in the department of OMDR to assess and compare the taste perception alteration among OSMF patients.

Method of collection of data: 35 participants with OSMF (case) and 35 healthy/without OSMF (control) will be randomly selected from the routine OPD will be divided into two groups:

· Group 1 (CONTROL): 35 Healthy individuals without OSMF

·Group 2 (CASE): 35 participants having OSMF along with habit of chewing/placing areca nut alone or with masala/with or without tobacco.

Preparation of tastants:

Three different concentrations (low, medium, and high) of the four tastants will be prepared for gustatory testing from the institute of Shree Naranjibhai Lalbhai Patel College Of Pharmacy. (Table-1), (FIGURE 2)

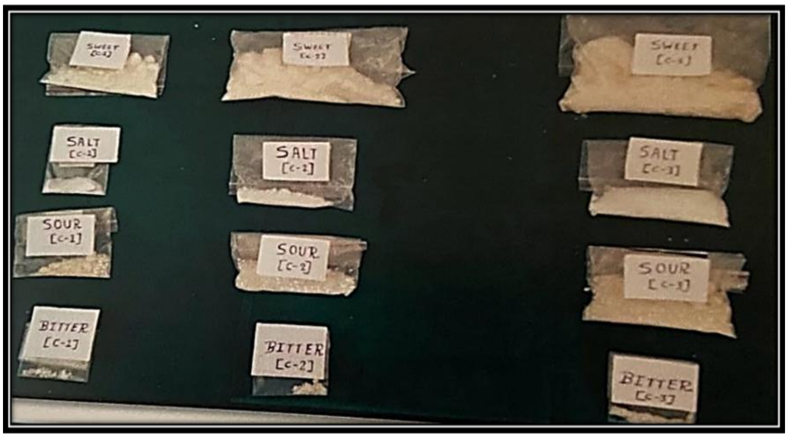

Figure 2: CONCENTRATIONS OF SOLUTIONS

Before assessing the taste, the participants will be asked not to eat/drink 1 h prior procedure and were also asked to rinse the mouth in distilled water.

Taste determination

The whole mouth rinse test will be performed as follows: Initially, the lowest concentration of each tastant will be randomly arranged. Participants will be asked to sip the solution and rinse their mouths for 10 seconds. After rinsing, they will be asked to identify the taste of the solution. The corresponding score for their response will be noted. If a participant is unable to identify the taste correctly, they will be given another sample with the next higher concentration of the tastant. This process will continue until the participant can identify the taste or the maximum concentration is reached.

The scores will be recorded based upon response to low concentration as 3, medium concentration as 2, and high concentration as 1 for all tastes, and the total score will made by adding the scores of different concentrations of all four tastants in each subject as low, medium and high concentrations as 1–3, 4–6, and 7–9 respectively. (FIGURE 3)

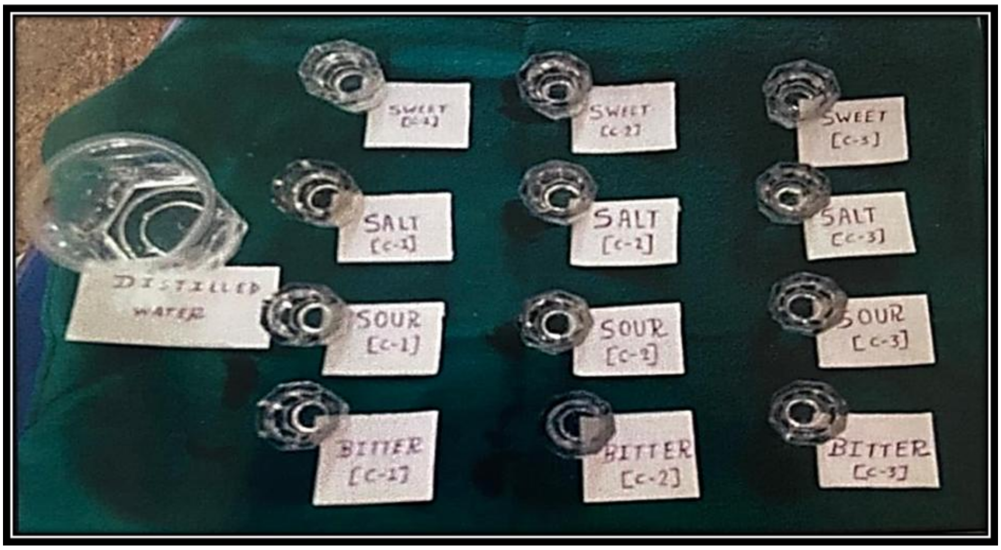

Figure 3: TASTES OF SOLUTIONS

The data collected will analyze by applying descriptive and inferential statistical analysis using SPSS version 22.0 (IBM, Chicago, IL, USA). Pearson Chi-square test will be used to compare the groups, and P values ≤ 0.05 will be considered statistically significant.

3. RESULTS

According to result of Table 2, There is no statistically significant difference in the mean ages of the Control group (28.97 ± 12.18) and the Test group (33.23 ± 13.17) ($p = 0.165$). This indicates that age is not a differentiating factor between the groups.

Table 1: Concentration Levels of Taste Compounds

TASTANTS	C1 (gm/L)	C2 (gm/L)	C3 (gm/L)
SWEET	34.2	188	342
SALTY	0.58	29	58
SOUR	6.14	33.7	61.4
BITTER	0.392	1.96	8.92

A statistically significant difference exists between the Control and Test groups for the SWEET parameter (p = 0.006). The Control group reported a higher mean score (3 ± 0) compared to the Test group (2.8 ± 0.41), suggesting a different perception of sweetness.

The SALT parameter also shows a significant difference between groups (p < 0.001). The Control group's mean score is 3 ± 0, while the Test group has a lower mean score of 2.69 ± 0.47, indicating a differing perception of saltiness.

Both groups have the same mean score (3 ± 0) for the SOUR parameter, indicating no difference in perception between the Control and Test groups.

No significant difference is found in the BITTER parameter (p = 0.16). The mean score is similar for both groups, with the Control group at 3 ± 0 and the Test group at 2.94 ± 0.24.

There is a significant difference in the TOTAL SCORE between the groups (p < 0.001). The Control group has a higher mean score (12 ± 0) compared to the Test group (11.43 ± 0.66), suggesting an overall difference in taste perception.

Significant differences are observed in the SWEET and SALT parameters between the groups, indicating different perceptions or experiences. However, no significant differences are seen in SOUR and BITTER suggesting similar perceptions in these aspects.

Table 2: Comparison of Sensory Parameter Scores between Control and Test Groups

PARAMETER	Control (N- 35) Mean ± sd	Test (N-35) Mean ± sd	t	P value
AGE	28.97±12.18	33.23±13.17	-1.404	0.165
SWEET	3±0	2.8±0.41	2.915	0.006
SALT	3±0	2.69±0.47	3.948	<0.001
SOUR	3±0	3±0	1.730	0.329
BITTER	3±0	2.94±0.24	1.435	0.16
TOTAL SCORE	12±0	11.43±0.66	5.164	<0.001

According to table 3, the mean ages across the four stages—Stage I (37.63 ± 12.094), Stage II (32.36 ± 10.717), Stage III (31.5 ± 16.416), and Stage IV (32.5 ± 3.536)—do not differ significantly, as indicated by the ANOVA results (F = 0.374, p = 0.773). This suggests that age distribution is similar across all stages, with no notable variations.

The perception of sweetness shows no significant differences among the stages. The mean scores are Stage I (3 ± 0), Stage II (2.82 ± 0.405), Stage III (2.71 ± 0.469), and Stage IV (2.5 ± 0.707). The ANOVA results (F = 1.255, p = 0.307) indicate that there is no statistically significant variation in sweetness perception across the stages, implying consistency in how sweetness is perceived regardless of the stage.

The mean scores for saltiness across the stages are Stage I (2.5 ± 0.535), Stage II (2.82 ± 0.405), Stage III (2.64 ± 0.497), and Stage IV (3 ± 0). The ANOVA analysis shows no significant difference in saltiness perception (F = 1.044, p = 0.387). This suggests that the perception of saltiness is relatively stable across all stages.

Table 3: Comparison of Sensory Parameters Across Stages of OSMF

Parameters	Stage I	Stage II	Stage III	Stage IV	F /welch	P value
AGE	37.63±12.094	32.36±10.717	31.5±16.416	32.5±3.536	0.374	0.773
SWEET	3±0	2.82±0.405	2.71±0.469	2.5±0.707	1.255	0.307
SALT	2.5±0.535	2.82±0.405	2.64±0.497	3±0	1.044	0.387
BITTER	2.88±0.354	2.91±0.302	3±0	3±0	0.589	0.627
SCORE	11.38±0.744	11.55±0.688	11.36±0.633	11.5±0.707	0.184	0.906

For the bitterness parameter, the mean scores are quite similar across all stages: Stage I (2.88 ± 0.354), Stage II (2.91 ± 0.302), Stage III (3 ± 0), and Stage IV (3 ± 0). The ANOVA results (F = 0.589, p = 0.627) confirm that there are no statistically significant differences in bitterness perception between the stages, indicating that bitterness is perceived consistently across stages.

The total taste scores are also consistent across stages, with mean scores of Stage I (11.38 ± 0.744), Stage II (11.55 ± 0.688), Stage III (11.36 ± 0.633), and Stage IV (11.5 ± 0.707). The ANOVA results (F = 0.184, p = 0.906) show no significant differences, suggesting that overall taste perception does not vary significantly among the stages.

Overall, there are no statistically significant differences in age, sweetness, saltiness, bitterness, or total taste score across the four stages. This indicates that these parameters remain relatively consistent regardless of the stage, suggesting uniformity in taste perception and demographic distribution.

4. DISCUSSION

Taste is the sense by which the chemical qualities of food in the mouth are distinguished by the brain, based on information provided by taste buds. Human beings are able to perceive the four basic tastes: sweet, salt, sour and bitter. Recently, a new taste umami is also incorporated. Out of various factors, inflammation and irritation is an aetiology for alteration in taste. [4] When a substance in the mouth reacts chemically with the taste receptor cells located on taste buds in the oral cavity, predominantly over the dorsum of tongue, they produce “taste” sensation. [6] The sense organs for taste or gustatory sensation are the taste buds, which are ovoid bodies with a diameter of 50–70 µm. Apart from tongue, taste buds are also found on the pharynx, palate, uvula, epiglottis, and at the beginning of oesophagus. [7] The common causes of taste disturbances include oral and perioral infections, oral appliances, aging, gastric reflux, systemic conditions such as diabetes mellitus, pernicious anaemia, Sjogren’s syndrome, and so on. [1]

Among the 70 participants with OSMF and a history of areca nut use, the majority experienced burning sensations and reduced mouth opening. Ulceration was observed only in participants at clinical Stage I and II, consistent with findings from Rajendran and Gupta et al., who report that the most common symptoms of OSMF are burning sensation and reduced mouth opening, while ulceration typically appears in the earlier stages of the condition..[8,9]

Chronic chewing of areca nut leads to persistent irritation in the oral cavity and intraoral structures, which can result in conditions such as Oral Submucous Fibrosis (OSMF), potentially impacting gestation and presenting with various clinical features. In India, areca nut chewing is currently the fourth most common substance of dependence, following nicotine, alcohol, and caffeine. According to Nishant Fatima Abdul Khader et al., areca nut is the primary cause of OSMF. The lack of research on how OSMF affects taste perception prompted this study. R Deeplaxmi et al. have noted that OSMF is highly prevalent across Southeast Asia, including India.[2,3]

In the present study, the participants were divided into two groups i.e., subjects with the habit of areca nut and having OSMF and subjects without OSMF to determine that weather it is the content of areca nut or the disease which is responsible for changes in taste perception which is in accordance with Abhinandan Gokhroo et al (2021).[1] Subjects with any coexisting systemic illness or with any other local disease such as tobacco related lesions were excluded because they also affect the taste perception which is in accordance with Deeplaxmi et al (2012). [3] In present study three different concentrations (low, medium, and high) for four basic tastants (sweet, salt, sour, bitter) were prepared for assessing the altered taste perception. The tastants used for sweet, salt, sour and bitter are sucrose, sodium chloride, citric acid, quinine sulphate respectively which is in accordance with Abhinandan Gokhroo et al (2021).[1] In this study comparison of response to different tastants, was done for subjects having OSMF which shows that for sweet tastant many subjects responded to lower concentration (C1) and some of them responded to medium concentration (C2) and higher concentration (C3) was not required for any of the subjects. In case of the salt tastant majority of subjects responded to lower concentration (C1) and remaining few responded to medium concentration (C2) so higher concentration (C3) was not required. For bitter tastant majority subjects responded to lower concentration (C1) and very few of them responded to medium concentration (C2) higher concentration (C3) was not required. For sour tastant all subjects responded to lower concentration (C1) so medium concentration (C2) and higher concentration (C3) was not required.[7,10] Which is suggestive that sweet is a taste to alter and sour taste is least affected. The alteration in taste perception among OSMF can cause cachexia and affect the quality of life of an individual. Therefore, attention to this parameter is of prime importance along with the fundamental medical and physiotherapeutic management.[1,11,12,13]

5. CONCLUSION

Based on the present study the following interference can be drawn: Among all the tastants, the most affected taste was sweet followed by salty and bitter. Sour taste was not altered in any of the patients. With the progression of OSMF stages, sweet taste was found to be most affected by patients with stage IV followed by stage III, stage II & stage I. Thus, it is reasonable to assume that OSMF will produce taste impairment.

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