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GUSTATORY CHANGES DUE TO ARECA NUT CHEWING AND OSMF

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ABSTRACT

Over the past several decades, dental researchers reported different aspects of oral submucous Fibrosis (OSMF). Yet, there is a big lacunae in the present scenario of evidence based dentistry which correlates the role of taste perception among OSMF affected individuals and areca nut chewers. The present study intends to assess and compare different taste perception among areca nut chewing, OSMF and control subjects. Comparative study was adopted to assess and compare the 4 basic tastes: sweet, salt, sour and bitter among 135 out patients attending The Oxford Dental college and Research hospital, Bangalore. A detailed case exemplified using a structured proforma and the taste strips were executed for assessing the taste perception. Statistical analysis was done using SPSS 21.0 software. Statistically significant hyperguesia to sweet (28.89%) and bitter taste (35.56%) among areca nut group and hypoguesia to salty (62.2%) and dysguesia to sour taste (40%) among OSMF patients were observed compared to apparently healthy subjects. The present study remarked hyperguesia to sweet and bitter taste among areca nut chewers and hypoguesia to salty taste followed by bitter, sour and sweet taste among OSMF subjects.

KEYWORDS: **OSMF; Areca nut; Taste perception; Taste strips.**

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INTRODUCTION

Taste is a sensation which is perceived due to the presence of taste buds over the dorsum of tongue, larynx and oesophagus.[1,2] The ability to taste occurs when the molecules released during chewing, drinking or digesting the food stimulate the special sensory cells in the mouth and throat.[2] Numerous causes for alteration in taste perception are known, one of which may be due to inflammation and infection in oral cavity reducing blood flow and leading to injury to taste buds or atrophy of papilla.[3]In Indian population, areca nut chewing has been reported to be presently fourth dependent substance followed by nicotine, alcohol and caffeine, which is a main cause for the occurrence of OSMF.[4]Areca nut chewing causes the leaching of several chemicals which alter the salivary flow and pH. Salivary flow functions in dissolving the taste stimulus and carry it to the taste buds, therefore an alteration in saliva can affect taste perception both qualitatively and quantitatively.[5] OSMF is a chronic disease featuring the deposition of fibrous tissue in the juxta epithelial layer of mucous membrane. There is a progressive decrease in the mouth opening, associated with difficulty in eating, changed gustatory sensation and dryness of mouth and thus have decreased quality of life.[6]Paltriness in literature concentrating on effect of taste perception among areca nut chewers and OSMF have intended for conducting the present study.

MATERIALS AND METHODS

The present study constituted 135 out patients (45 areca nut chewers + 45 OSMF + 45 control) attending Department of Oral medicine and Radiology in The Oxford Dental College and Research hospital, Bangalore. Written consent was obtained from each subject after explaining the objective of the study. The present study was part of a project approved by the institutions ethical committee. The study group comprised between the age group of 18-45years, including both males and females equally distributed and matched with the OSMF subjects. Clinical examination was performed and subjects were provisionally diagnosed with OSMF based on clinical features and staged according to Pindborgs[7] criteria. . Control group included subjects who were apparently healthy with the absence of any systemic illness and habits like areca nut chewing, alcohol consumption, etc .Inclusion criteria of the study group consisted of patients with a chewing habit of areca nut for more than six months and those with clinically proven OSMF (Stage I and Stage II) (burning sensation, restricted mouth opening, palpable fibrous bands). Patients excluded were those above the age of 45 years, presence of associated habits like smoking, drinking or tobacco chewing; OSMF patients undergoing treatment and patients with known systemic illness or those taking medications which may cause alteration in perception of taste. Symptomatic variation in taste was recorded using Questionnaire by University of Connecticut Health Centre[8]. Counseling to quit the habit by using various counseling methods like tobacco cessation charts, books, etc were also implemented. The study was conducted between 09.00 a.m to 11.00 a.m avoiding the circardian variation in saliva creating a bias in inferring the taste perception. Study subjects were abstained 2 hours prior the procedure from eating, areca nut chewing or drinking. Taste papers {Sweet (Arrow India Limited, Mumbai), Salt paper [sodium benzoate- 17-4020], sour paper [PTC-17-4010], bitter paper [thiourea -17-4030] (Carolina genetics-Blades biological Ltd. Cowden, The United Kingdom)} were utilized in the present study (Photograph I).

Taste determination by Edible taste strip method[9]-(Photograph II)

Before assessing the taste in the individuals, the subjects were asked not to eat or drink 1 hour prior procedure, and asked to rinse the mouth in tap water .The taste strips were 4 in number with the 4 basic tastants, i.e, sweet, salty, sour and bitter. Each taste strip with specific taste was placed over the dorsum portion of the tongue, and the subject was asked to identify the taste of the strip. The strip gradually dissolved within 2 minutes. [9]

Inference

- Hypoguesia: diminished sensitivity of taste with elevated thresholds and reduced ability to perceive supra threshold stimuli.
- Hyperguesia: Elevated sensitivity of taste.
- Dysguesia: Distorted normal taste.
- Aguesia: Absence of taste. Aguesia is rare because of the reductant and complex anatomic pathways involved.[10,11]

Statistical analysis

All the findings were entered in Microsoft excel and analysed using SPSS 21.0 software. The groups were compared using chi-square test and degree of freedom (df) between variables were also observed. Spearman correlation coefficient was done for measuring statistical difference between 2 variables to show +1 or -1 occurrence between the variables. A $p<0.05$ indicated a significant association with the parameters.

RESULTS

The data in the study showed that majority of the OSMF subjects, 55.6% belonged to the age group of 21-30 years and male: female ratio of 13:2. Higher percentage of lower socioeconomic status among areca nut chewers (57.8%) and OSMF (66.7%) was observed when compared to control group who belonged mostly to middle socioeconomic status (60.0%). Out of 45 Oral submucous fibrosis 14 (31.1%) were Stage I and 31 (68.9%) were Stage II OSMF.The respondents were compared with the habit frequency, duration and exposure among areca nut chewers and OSMF subjects. Among the 45 areca nut chewers, the majority of them i.e. 48.9% and amongst 45 OSMF patients 31.1% had a habit frequency of maximum1-3/day. With exposure of the habit, a maximum of 40% among areca nut chewers and 44.4% among OSMF group with habit usage of ≥11min were detected. The respondents displayed 44.4% of the OSMF group and 37.8% of the areca nut chewers had the habit for a maximum of 5+ years and 1-3years respectively with statistical significance of $p<0.05$.Comparisons of taste perception between three study groups were demonstrated in Table I. Out of the 45 areca nut chewers; 24 (53.3%) normal, 13 (28.9%) hyperguesia, 8 (17.8%) hypoguesia with no subjects showing aguesia, to sweet taste ; 16 (35.6%) normal, 15 (33.3%) hypoguesia, 11 (24.4%) hyperguesia, 3(6.7%) dysguesia with no subjects showing aguesia to salty taste ; 18 (40%) normal, 14(31.1%) hypoguesia, 6(13.3%) hyperguesia, 6 (13.3%) dysguesia and 1 (2.2%) aguesia to sour taste ; 23 (51.1%) normal, 16 (35.6%) hyperguesia, 6 (13.3%) hypoguesia with no subjects showing dysguesia and aguesia, to bitter taste perception were observed.Out of the 45 OSMF subjects; 22 (48.9%) normal, 17 (37.8%) hypoguesia, 5 (11.1%) hyperguesia, 1 (2.2%) showed dysguesia with no subjects showing aguesia to sweet taste ; 28 (62.2%) hypoguesia, 10 (22.2%) normal, 4 (8.9%) dysguesia, 2 (4.4%) aguesia and 1(2.2%) hyperguesia to salty taste; 18 (40%) dysguesia, 15 (33.3%) hypoguesia, 7 (15.6%) normal, 4(8.9%) aguesia and 1 (2.2%) hyperguesia to sour taste; 25 (55.6%) normal, 16 (35.6%) hypoguesia, 4 (8.9%) hyperguesia with no subjects showing aguesia and dysguesia to bitter taste perception were observed.Out of the 45 control subjects, 1 (2.2%) hyoguesia to salty taste, 3 (6.7%) dysguesia and 2 (4.4%) hypoguesia to sour taste and 2 (4.4%) hyperguesia to bitter taste were observed. The remaining subjects had normal perception to the different tastants.A statistical significance ($p=0.00001$) was observed among the three groups; suggestive of hyperguesia among areca nut chewers, hypoguesia among OSMF group and normal taste perception among control group. (Graph I, II, III and IV)The correlation of frequency, exposure and duration of habit among areca nut chewers and OSMF subjects on different taste perception were depicted in Table II. Spearman's coefficient showed positive correlation with statistical significance ($p<0.05$) to bitter and sweet taste perception with the habit parameters; suggestive of hyperguesia to bitter and sweet with increase in habit parameters and negative correlation with statistical significance ($p<0.05$) observed to sour taste with habit frequency suggestive of hypoguesia to sour taste among areca nut

chewers. Among OSMF subjects, Spearman's coefficient showed negative correlation with statistical significance ($p<0.05$) with habit frequency to salty taste and habit exposure to salty and sour taste suggesting the decrease in salty and sour taste perception with exposure and frequency of habit among OSMF group.

TABLE I

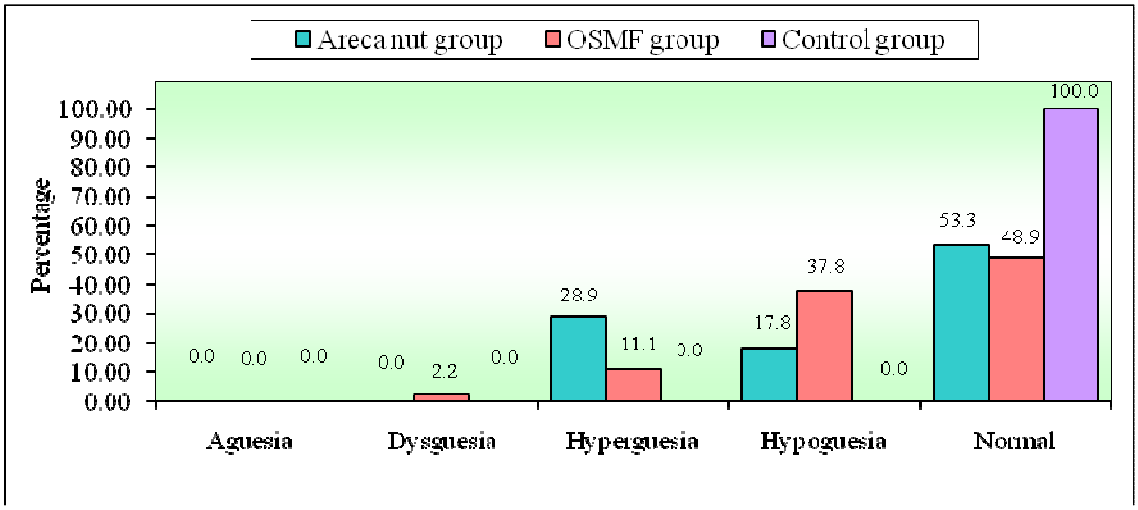
COMPARISON OF TASTE PERCEPTION BETWEEN STUDY GROUPS

Sweet taste	**Areca nut group**	**%**	**OSMF group**	**%**	**Control group**	**%**	**Total**	**%**
Aguesia	0	0.00	0	0.00	0	0.00	0	0.00
Dysguesia	0	0.00	1	2.2	0	0.00	1	0.7
Hyperguesia	13	28.9	5	11.1	0	0.00	18	13.3
Hypoguesia	8	17.8	17	37.8	0	0.00	25	18.5
Normal	24	53.3	22	48.9	45	100.00	91	67.4
Total	45	100.00	45	100.00	45	100.00	135	100.00
		Chi-square=44.3971,		**df=6,**	**p=0.00001***			
Salty taste	**Areca nut group**	**%**	**OSMF group**	**%**	**Control group**	**%**	**Total**	**%**
Aguesia	0	0.00	2	4.4	0	0.00	2	1.5
Dysguesia	3	6.7	4	8.9	0	0.00	7	5.2
Hyperguesia	11	24.4	1	2.2	0	0.00	12	8.9
Hypoguesia	15	33.3	28	62.2	1	2.2	44	32.6
Normal	16	35.6	10	22.2	44	97.8	70	51.9
Total	45	100.00	45	100.00	45	100.00	135	100.00
		Chi-square=79.3072,		**df=6,**	**p=0.00001***			
Sour taste	**Areca nut group**	**%**	**OSMF group**	**%**	**Control group**	**%**	**Total**	**%**
Aguesia	1	2.2	4	8.9	0	0.00	5	3.7
Dysguesia	6	13.3	18	40.0	3	6.7	27	20.0
Hyperguesia	6	13.3	1	2.2	0	0.00	7	5.2
Hypoguesia	14	31.1	15	33.3	2	4.4	31	22.9
Normal	18	40.00	7	15.6	40	88.9	65	48.2
Total	45	100.00	45	100.00	45	100.00	135	100.00
		Chi-square=64.2482,		**df=6,**	**p=0.00001***			
Bitter taste	**Areca nut group**	**%**	**OSMF group**	**%**	**Control group**	**%**	**Total**	**%**
Aguesia	0	0.0	0	0.0	0	0.0	0	0.0
Dysguesia	0	0.0	0	0.0	0	0.	0	0.0
Hyperguesia	16	35.6	4	8.9	2	4.4	22	16.3
Hypoguesia	6	13.3	16	35.6	0	0.0	22	16.3
Normal	23	51.1	25	55.6	43	95.6	91	67.4
Total	45	100.00	45	100.00	45	100.00	135	100.00
		Chi-square=41.4552,		**df=4,**	**p=0.00001***			

P<0.05 states significance.

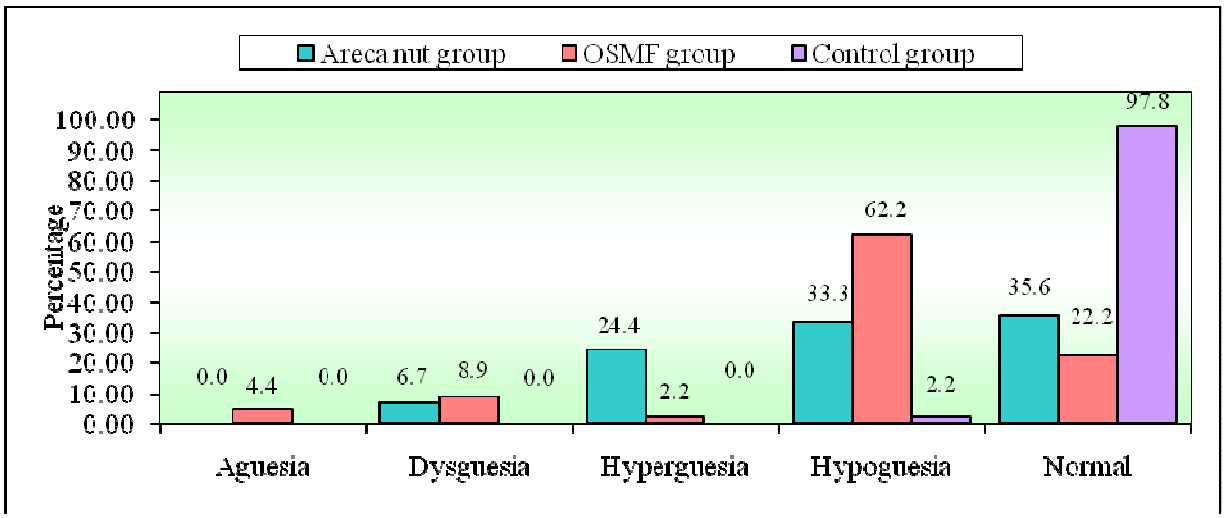
GRAPH I

COMPARISON OF SWEET TASTE PERCEPTION BETWEEN THREE STUDY GROUPS



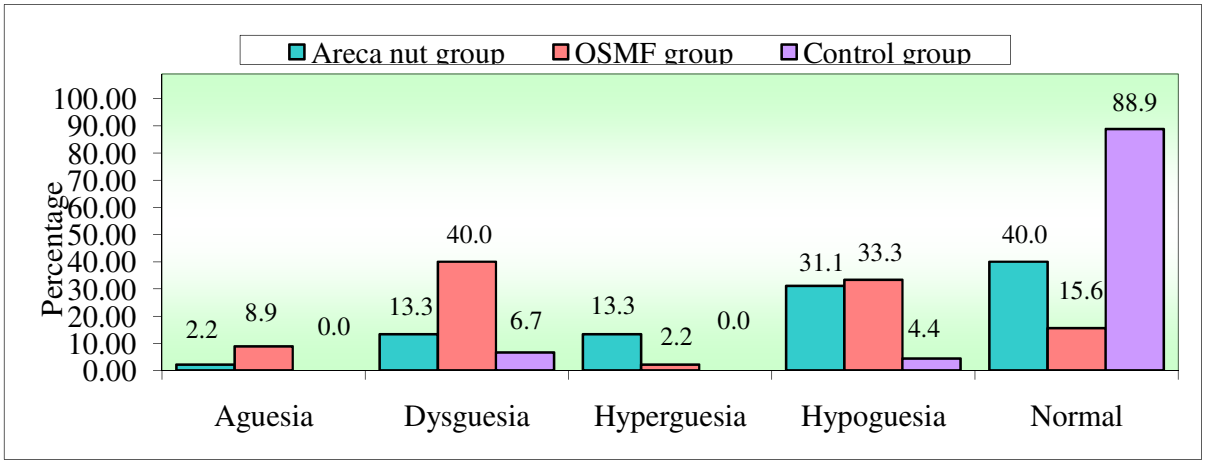
GRAPH II

COMPARISON OF SALT TASTE PERCEPTION BETWEEN THREE STUDY GROUPS



GRAPH III

COMPARISON OF SOUR TASTE PERCEPTION BETWEEN THREE STUDY GROUPS



GRAPH IV
COMPARISON OF BITTER TASTE BETWEEN THREE STUDY GROUPS

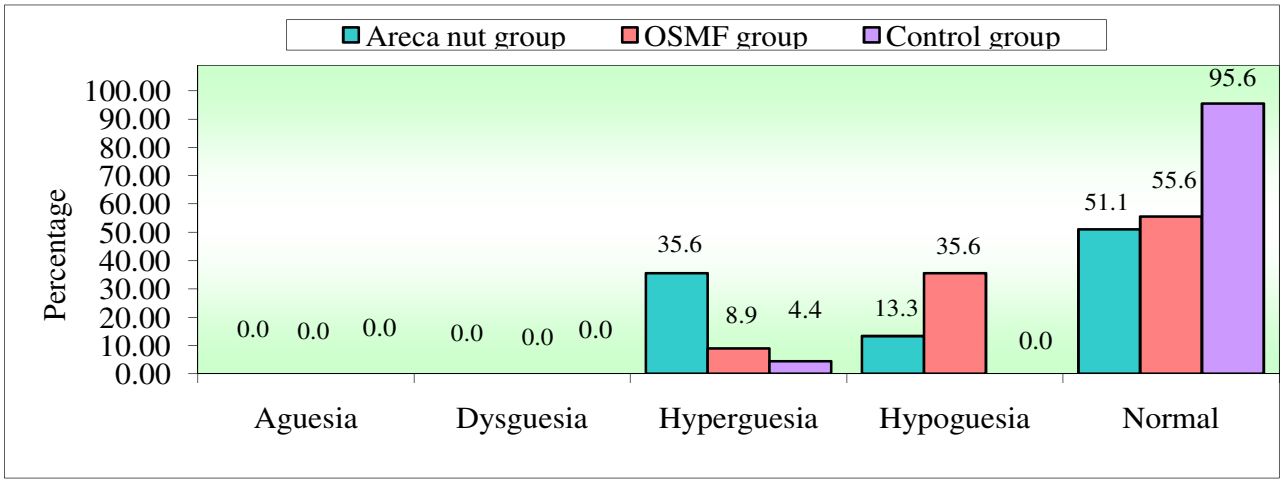


TABLE 2
CORRELATION OF FREQUENCY, DURATION AND EXPOSURE OF HABIT ON DIFFERENT TASTE PERCEPTION AMONG ARECA NUT CHEWERS AND OSMF GROUPS

Correlation of frequency, duration and exposure of habit on Different Taste perception among areca nut chewers.

Variables	Spearman's R	p-level
Frequency (per day) with sweet taste perception	-0.1276	0.4035
Frequency (per day) with salty taste perception	-0.4637	0.0013*
Frequency (per day) with sour taste perception	-0.2685	0.0745
Frequency (per day) with bitter taste perception	-0.1874	0.2176
Exposure (in min) with sweet taste perception	-0.1429	0.3491
Exposure (in min) with salty taste perception	-0.5471	0.0001*
Exposure (in min) with sour taste perception	-0.4504	0.0019*
Exposure (in min) with bitter taste perception	-0.0072	0.9626
Duration (yrs) with sweet taste perception	0.2296	0.1293
Duration (yrs) with salty taste perception	-0.1217	0.4258
Duration (yrs) with sour taste perception	-0.1297	0.3960
Duration (yrs) with bitter taste perception	0.0074	0.9617

Correlation of frequency, duration and exposure of habit on Different Taste perception among OSMF groups.

Variables	Spearman's R	p-level
Frequency (per day) with sweet taste perception	0.4523	0.0018*
Frequency (per day) with salty taste perception	0.0115	0.9403
Frequency (per day) with sour taste perception	-0.3654	0.0136*
Frequency (per day) with bitter taste perception	0.4997	0.0005*
Exposure (in min) with sweet taste perception	0.3710	0.0121*
Exposure (in min) with salty taste perception	0.1483	0.3309
Exposure (in min) with sour taste perception	-0.1587	0.2976
Exposure (in min) with bitter taste perception	0.4362	0.0027*
Duration (yrs) with sweet taste perception	0.2338	0.1222
Duration (yrs) with salty taste perception	-0.1009	0.5095
Duration (yrs) with sour taste perception	-0.1024	0.5031
Duration (yrs) with bitter taste perception	0.4500	0.0019*

PHOTOGRAPH I: TASTE PAPERS

PHOTOGRAPH II: TASTE PERCEPTION DETERMINATION USING TASTE STRIPS.

DISCUSSION

Taste is the sense by which the chemical qualities of food in the mouth are distinguished in the oral cavity which are distinguished by the brain, based on information provided by the taste buds.[10] Human beings are able to perceive the four basic tastes: sweet, salt, sour and bitter. Recently, a new taste umami is also incorporated.[1, 2, 10, 11] Neurologically distinct component system responds independently to each taste and clinical example for inability in perception of taste may be due to any pathological state. Out of various factors, inflammation and irritation is an etiology for alteration in taste. Chronic chewing of areca nut also causes continuous irritation to the oral cavity and other intraoral structures causing conditions like OSMF which may affect gustation with other clinical features.[1, 2,10] Oral sub mucous fibrosis is an insidious, chronic disease affecting any part of oral cavity and sometimes the pharynx. Occasionally it is preceded by and/or associated with vesicle formation and is always associated with a juxta-epithelial inflammatory reaction followed by progressive hyalinization of the lamina propria.[6, 11, 12] OSMF is indeed one of the classic "Disease of civilization" with large differences being seen between races, geographic areas and individuals at different levels in both prevalence and the degree to which it transforms into malignancy with continuation of habit with increased frequency and duration.[6, 11] The main etiological reason for OSMF is areca nut chewing which causes clinically progressive limited mouth opening, fibrosis, burning sensation, decrease in salivary flow rate and progressively alteration in taste which may be due to the continuous irritation and inflammation of the mucosa and mucosal structures due to leaching out of chemicals like alkaloids, tannins, copper, iron, etc in areca nut.[6, 12] Due to paucity in literature on changes of taste perception in OSMF and areca nut chewers, the present study was implemented.

Previous studies have utilized spatial testing followed by solutions for assessing taste[13] and electrogustrometry[14,15], taste strips were incorporated in the present study because of its ease in use and a newer implementation for evaluation of taste.[9] In the present study areca nut group showed hyperguesia to bitter (35.6%) and sweet (28.9%) taste followed by hypoguesia (31.1%) to sour and normal (35.6%) to salty taste. Hyperguesia among areca nut groups would be due to the increased salivary flow rate in turn increasing the sensitization to taste buds. With the increase in habit parameters there is a statistical significance resulting in hyperguesia to sweet and bitter taste and hypoguesia to sour taste with an increase in exposure of habit. In the present study, OSMF group showed hypoguesia 28 (62.2%) to salty taste followed by dysguesia (40%) to sour, and normal (55.6% and 48.9%) to bitter and sweet taste. Among OSMF group, decreased or altered perception may be due to atrophy of the papillae and decrease in salivary flow rate. In our study the salty taste and sour were mainly affected followed by bitter and sweet, when compared to a study conducted by Deeplakshmi et al[13] in solutions showed decreased taste perception to sweet taste followed by salt, bitter and sour. Study conducted by Soni K et al[14] and Chaturvedi et al[15] utilized electrogustometry in OSMF subjects also showed impairment of taste sensation. But through this method specific taste impairment cannot be determined. Also, electrogustometry uses rods as electrodes which has a general perception of metal taste, thus creating false positive results.[16] The present study also correlated that with increase in frequency and exposure there is reduction in perception of salty and sour taste. Due to the insufficient literature in correlation of habit parameters with taste, comparison with the present study was not possible. No subjective symptoms by the subjects were observed when they were interviewed using the Questionaire by the University of Connecticut Health centre, yet changes in taste perception were observed in the present study. The present study is the first study reported utilizing taste strips among areca nut chewers and OSMF affected individuals. Also, correlation of habit parameters affecting taste due to areca nut chewing and OSMF was also studied. However, patient apprehensiveness may have varied the results to an extent. Selection of OSMF subjects were based on clinical criteria without histopathological confirmation. Stage III OSMF subjects were not included due to insufficient number for the purpose of this study. The validation of taste strips when compared to a solution has to be still done for research purposes. Also, the expiration of taste strips is not known, which may lead to changes in concentration over a period of time.

CONCLUSION

The present study was undertaken to assess and compare taste perception among areca nut chewers, OSMF and control group. The results displayed hyperguesia to sweet and bitter taste among areca nut chewers and hypoguesia to salt followed sour, bitter and sweet taste perception among OSMF subjects with statistically significance. However, increase in all 3 habit parameters showed a statistically significant hypoguesia to sour taste perception among areca nut group and a correlation of habit frequency and exposure showed statistically significant hypoguesia to salt and sour taste perception among OSMF group. The alteration in taste perception among areca nut chewers and OSMF can cause cachexia and affected the quality of life of an individual. Therefore, attention to this parameter is of prime importance along with the fundamental medical and physiotherapeutic management.

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