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A Comparative Study to Assess Taste Perception among Tobacco Chewers and Non-Chewers

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Abstract

Background: Impaired taste perception has impact on quality of life. Tobacco is a perilous factor that contributes to an impaired taste.

Objective: To evaluate and compare taste perception among tobacco chewers and non-chewers.

Materials and Method: 60 subjects (30 tobacco chewers + 30 non-chewers as controls) were enrolled in the study for evaluating taste perception. Taste identification time using four aqueous solutions of basic tastes sweet, salty, sour, bitter were recorded (in seconds) and compared between tobacco chewers and controls. The data was analyzed using student t test and ANOVA using SPSS 20.0 version software.

Results: A statistically significant increase in taste identification time for salty taste in tobacco chewers (12.32 sec) was noted compared to non-chewers (10.21 sec) ($p = 0.03$). The average taste identification time was higher for tobacco chewers than non-chewers for sweet and salty taste. However, the average taste identification time was lower for tobacco chewers than non-chewers for sour and bitter taste. In non-chewers, the average taste identification time was 13.01 sec, 10.21 sec, 8.43 sec, 7.56 sec for sweet, salty, bitter and sour taste respectively. In tobacco chewers, the average taste identification time was 15.16 sec, 12.32 sec, 7.75 sec, 7.04 sec for sweet, salty, bitter and sour taste respectively.

Conclusion: The findings from the study demonstrated marked decrease in taste perception to salty taste among tobacco chewers when compared to non- chewers. There is a significant difference in taste perception to basic tastes among tobacco chewers and controls.

Keywords: Tobacco; Basic tastes; Taste identification time; Taste perception

Introduction

'Taste' is the sensation produced when a substance in the mouth reacts chemically with taste receptor cells located on taste buds in the oral cavity, predominantly on the tongue[1]. The sense organs for taste or gustatory sensation are the taste buds, which are ovoid bodies with a diameter of 50 to 70 microns. Apart from tongue, taste buds are also located on the palate, pharynx, epiglottis, uvula, and at the beginning of the esophagus[2]. Common causes of taste disturbances include oral and perioral infections, oral appliances, aging, gastric reflux, systemic conditions like diabetes mellitus, pernicious anaemia, Sjogrens syndrome, etc[2]. Various medications, trauma, metal exposure, surgical procedures and radiation may also contribute to an impaired taste perception. According to the recent Government of India's National Sample Survey Data, there are 184 million tobacco consumers in India. About 40% of these tobacco consumers use smokeless tobacco, 20% consume cigarettes, and another 40% smoke beedis[3]. Tobacco is composed of several components such as, nicotine, carbon monoxide, nitrogen oxides, metals, and many of them act as chemical carcinogens and irritants. Tobacco in any form (smoke / smokeless) when used intraorally, the chemicals from it get leached out in oral mucosa and may al-

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ter taste parameters[4]. The taste perception has been studied and evaluated in cases of aging[1], denture wearers[2], Oral sub-mucous fibrosis[4], radiation, chemotherapy[5,6], and use of specific medications[7]. Yet, corroboration correlating the use of tobacco and taste perception is sparse. This contemplated the intention of the study. Thus, the present study was aimed to evaluate these taste perception parameters among tobacco chewers and to compare it with non-chewers.

Materials and Methods

A comparative study was conducted to assess and compare taste identification time among 60 patients (30 tobacco chewers + 30 non-chewers) visiting the Department of Oral Pathology and Microbiology, School of Dental Sciences, KIMS "Deemed to be University", Karad after the due approval of the Ethical Committee. The subjects received clarifications regarding the objectives and procedures of the study and signed terms of informed consent, agreeing to their participation.

The study group constituted patients with a history of chewing tobacco for more than 6 months[4] and the age group of 25-50 years of either sex was taken. The individuals with the same age group of either sex with no deleterious tobacco habits were taken as control group. Subjects with the history of any systemic disease, smoking, head trauma, upper respiratory tract infections, chemotherapy, radiation therapy and use of any medications known to influence taste perception were excluded from the study.

Four taste variables were prepared using aqueous solutions containing 50% sucrose for sweet taste, 0.9% saline solution for the salty taste, 4.2% solution of vinegar for sour taste and 20% solution of coffee (without sugar) for bitter taste[8]. The study was carried in the morning hour (09:00 am-11:00 am) for preventing the bias in results caused due to circadian variation, and subjects were refrained from eating and drinking 1 hour prior the appointment[4]. Subjects were asked to rinse the mouth with distilled water and a stopwatch was given in their right hand to record the time duration of taste identification. The aqueous solutions with four basic tastes i.e. sweet, salty, sour and bitter were presented to the subjects with the help of paper strips of equal size and shapes. The taste strips were placed on the anterior two-third of the dorsum of tongue. After placing the strips, the taste recognition time (in seconds), recorded by the subjects were documented for every taste. Between testing of each of the samples, the subjects were asked to rinse their mouth thoroughly with distilled water.

Statistical analysis

All the findings were entered in Microsoft Excel using SPSS 20.0 software and were expressed as mean ± standard deviation and calculated using one way ANOVA. Unpaired t test was done to compare taste identification time in study and control groups. A $p < 0.05$ indicated significant association at 5 % level of significance.

Results

A total of 30 control subjects were matched with 30 study subjects. Unpaired t test was done to compare taste identification time in study and control groups.

Table 1: Comparison of taste identification time (in seconds) in tobacco chewers and non- chewers

Taste	Groups	N	Mean	Std. Deviation	t statistic	p value
Sweet	Control Group	30	13.01	4.69	1.60	0.12
	Study Group	30	15.16	5.69		
Salty	Control Group	30	10.21	3.91	2.22	0.03*
	Study Group	30	12.32	3.47		
Sour	Control Group	30	7.56	2.74	0.83	0.41
	Study Group	30	7.04	2.15		
Bitter	Control Group	30	8.43	3.51	0.97	0.34
	Study Group	30	7.75	1.68		

It was found that average taste identification time was higher for tobacco chewers than non-chewers for sweet and salty taste. Hence, the taste perception was lower for tobacco chewers than non- chewers for sweet and salty taste.

Taste identification time was significantly higher for salty in tobacco chewers (12.32) than non-chewers (10.21) ($p = 0.03$). Hence, the taste perception was lower for tobacco chewers than non- chewers for salty taste.

It was also found that average taste identification time was lower for tobacco chewers than non-chewers for sour and bitter taste. Hence, the taste perception was higher for tobacco chewers than non-chewers for sour and bitter taste.

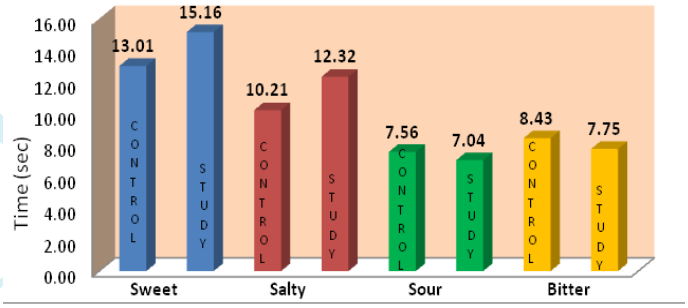

Figure 1: Bar diagram showing average taste identification time among study and control groups with respect to four basic tastes

One way ANOVA was done to compare between different tastes identification times of tobacco non-chewers. It was found that there was significant difference between different tastes for group of tobacco non-chewers ($p < 0.05$). The average taste identification time for sweet (13.01) was significantly higher than salty (10.21) which was higher than bitter (8.43) followed by sour taste (7.56).

Table 2: Taste identification time (in seconds) in tobacco non-chewers

Tobacco non-chewers	Minimum	Maximum	Mean	Std. Deviation	F statistic	p value
Sweet	5.8	22	13.01	4.69	12.14	< 0.001
Salty	3.3	19.3	10.21	3.91		
Sour	2.8	16	7.56	2.74		
Bitter	4.3	20.8	8.43	3.51		

One way ANOVA was done to compare between different tastes identification times of tobacco chewers. It was found that there was significant difference between different tastes for group of tobacco chewers ($p < 0.05$). The average taste identification time for sweet (15.16) was significantly higher than salty (12.32) which was higher than bitter (7.75) followed by sour taste (7.04).

Table 3: Taste identification time (in seconds) in tobacco chewers

Tobacco chewers	Minimum	Maximum	Mean	Std. Deviation	F statistic	p value
Sweet	7.8	28.5	15.16	5.69	34.47	< 0.001
Salty	6.1	20.8	12.32	3.47		
Sour	3.2	12.4	7.04	2.15		
Bitter	4.5	12.1	7.75	1.68		

Discussion

The gustatory cortex is responsible for the perception of taste[1]. In adults, about 1000 taste buds are present[2]. Taste buds are able to differentiate among different tastes through detecting interaction with different molecules or ions[1]. The sensation of taste includes four established basic tastes: sweetness, saltiness, sourness and bitterness[9]. Data based on counting all papillae on a series of cadaver tongues, suggest an average of approximately 200 fungiform papillae per tongue contributing to taste perception. However, taste sensations depend not only on the number of papillae but also on the integrity of taste buds within papillae as well as nerve carrying information from papillae to brain[10]. The classic taste map of the tongue shows that sweet is perceived on the tip of the tongue, salty at the lateral border of the tongue, bitter and sour on the posterior part, and lateral areas of tongue. It is now known that all four basic taste quantities can be perceived in all areas of the tongue and palate where taste buds are located[11]. Taste cannot be broken down onto these four primaries, sweet, sour, salty, and bitter, but that it consists of a range of stimuli that form a spectrum of sensations making up all taste senses[12].

Among humans, taste perception begins to fade around 50 years because of loss of tongue papillae and a general decrease in salivary flow rate[13]. Saliva serves a primary role in dissolving the taste stimulus to taste buds[4]. Alteration in salivary flow due to any reason can in turn cause changes in its pH which is important in buffering action and consequently the taste perception[14]. Various studies propose that the sensory specific satiety decreases with age[15]. The decrease in the taste intensities is because of the number of taste buds decreases and the rest begin to shrink[1].

Tobacco exposes the chewer to ~ 4,720 toxic substances, 60 of which have carcinogenic potential, proven to be harmful to the health of the individual. When the gustatory systems are exposed to these substances, they suffer injuries that might be reversible or permanent[16]. The degree of the injury is related to the exposure time and the concentration and toxicity of tobacco[17]. The gustatory disturbance is a consequence of the change of form, quantity and vascularization of the taste buds by tobacco consumption[18]. Tobacco also causes significant changes in size, shape and vascularization of the papillae[19,20], decreasing the number of taste cells[10, 21], and also impacting salivary glands[22, 23]. One other explanation concerning the mechanism of reduced taste sensitivity is that nicotine from the tobacco acts at a central level and modulates the taste signal. An experimental study on rats showed that the application of nicotine on the tongue surface modified the response of the neurons in the nucleus of the solitary tract (NTS) and relay in the gustatory pathway of taste buds of the tongue[24].

Tobacco on consumption releases various byproducts such as nitrosamine and nitrosonornicotine which on close contact with mucosa facilitate infiltration of these products into mucosa and can influence cellular morphometry causing pronounced cellular changes[25]. These irritants are also responsible for thickening of the epithelium i.e. hyperkeratosis of the papillae and this thereby alters taste identification time[26]. Tobacco causes peripheral vasoconstrictions. Carbon monoxide and other chemical produced during combustion of tobacco can reduce capillary blood flow within mouth[27].

A general trend was observed that sweet taste was perceived in a better degree in comparison to the other tastes[1]. In our study, the salty taste is mainly affected followed by sweet, bitter and sour taste, which is in accordance with the study conducted by Deeplaxmi et al[28]. Khan AM et. al. in his case control study concluded that smokers have a high taste threshold because of decrease in the number of fungiform papillae on the tongue[10]. S Dyasanoor et al. also demonstrated marked decrease in taste perception to salty and sour taste among OSMF subjects[4]. Such findings could provide a motivational help to encourage tobacco chewers to quit the habit and can be reinforced by the observation of taste perception.

Conclusion

From this study, it is clear that tobacco has an impact on taste perception. This would help in motivating tobacco chewers to give up the habit, as it has negative effects on taste perception. However, considering the small number of samples in each group and sparse existence of literature relating the relation between tobacco use and the changes in taste; further investigations with higher number of samples are necessary to confirm the issue.

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