



RESEARCH ARTICLE

COMPARISON BETWEEN TOBACCO AND NON TOBACCO CHEWERS WITH RESPECT TO  
SALT TASTE PERCEPTION

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ABSTRACT

**Introduction:** Taste perception is the basic sensory activity for the right selection of food and beverages which we eat daily. Tongue recognizes five fundamental tastes out of which salt provides more than just salty taste to the food. Salt provides sodium and chloride ions which are needed by the body. But the habit of tobacco consumption alters taste perception. Nicotine the core content in tobacco is leading cause for decreased effectiveness of gustatory system. This eventually leads to excess salt consumption by tobacco chewers causing other health problems.

**Methodology:** An observational study with a total of 50 samples was carried out in Vidarbha region from February to April 2017. Out of which 25 were tobacco chewers and 25 were non-tobacco consumers of age 21 to 55 years were taken. Different concentrations of salt solutions were made. The samples were made to sip different solutions. The response scale was made with different age group people reacting to different salt solutions. The data was further collected and analysed statistically.

**Result:** The analysis showed no correlation between the age and salt taste perception. But there was significant relation between the tobacco chewers and taste perception. Chronic tobacco chewers (in any form) had a significant loss of salt taste perception.

**Conclusion:** The result of this study shows that we need to have various National Health programmes to create awareness about ill effects of tobacco consumption. It not only hampers the normal taste perception but also is responsible for all other fatal health related diseases.

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INTRODUCTION

Food has different meanings for different people. People who starve, for them food serves as a means of survival whereas rich people who are proud of their culture believe traditional foods as a part of their heritage. Food serves as a symbol of love, religion, hospitality etc. Clearly, food satisfies much more than meeting a basic physical need. It meets social, emotional, and mental needs as well. Not only does food nourishes the body, it provides nourishment for the soul. Food speaks to us via taste. It's due to taste that eating is well thought of a gratifying practice one that humans like to go over quite a lot of times a day instead of a dull chore. Therefore, it is necessary that our food is well wrapped with taste. Reception of taste is the basic sensory activity for right selection of food and beverages (Bigiani, 2016). Our tongue recognizes five fundamental tastes i.e. sweet, salt, sour, bitter and umami (Henney *et al.*, 2010). Salt provide more than just a taste of salt to overall food. Work done on various foods such as soups, rice, eggs, and potato chips etc showed that salt improves the perception of product thickness, enhance

sweetness, mask metallic or chemical off-notes, and round off overall flavor while improving taste intensity. Among different chemicals our taste system recognizes, sodium ions are of particular significance (Caldwell *et al.*, 2000). Salt is a substance which is mainly composed of sodium cation and chloride anion (NaCl) and is used in food for preserving taste and quality and adding flavor. Sodium and chloride ions are needed in minute quantities by all- most all the organisms living on this earth. Salt is involved in the most important physiologic phenomenon i.e. regulation of water content (fluid balance) of the body. The sodium ion is used for generating electrical signals in the nervous system (Caldwell *et al.*, 2000). Therefore, Sodium is the main cation in extracellular fluid and an important factor in various physiological processes.<sup>1</sup> Various studies has showed that taste perception decreases with age. Other contributing factors to this are flu, allergies, obesity, smoking; tobacco consumption etc (Mojet *et al.*, 2003). Of all the factors responsible for taste loss, the most alarming is nicotine consumption. Nicotine consumption is socioeconomically and in particular geographically distributed in India (Rani *et al.*, 2003). Tobacco consumption in any form is estimated to be 182 million in India (Subramanian *et al.*, 2004). Twenty percent of tobacco consumption is through

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cigarette smoking and the rest through chewing (pan, masala, gutka, and mishri). Ten per 100 are the estimated annual rate of oral malignancy in men regardless of how it is consumed. Nicotine is the core content in any form of tobacco, either being smoked or non-smoked is a leading cause for decreased effectiveness of gustatory system to detect salt in foodstuffs. Due to this, smokers tend to ingest saltier food than non-smokers. But consuming salt beyond the physiological needs affect the extracellular fluid volume and blood pressure giving rise to hypertension (Rani *et al.*, 2003; Subramanian *et al.*, 2004). Hypertension is an important risk factor for numerous cardiovascular diseases including coronary heart disease, stroke, cardiac failure renal disease etc. Recommendations to prevent hypertension include low sodium diet and avoiding factors, such as smoking and tobacco chewing that may interfere with salt perception by taste system. Hence the aim of our study is to analyse salt taste perception varying with age in tobacco and non tobacco chewers.

## MATERIALS AND METHODS

Observational study was carried out in the department of public health dentistry in Vidarbha region in which a total of 50 samples were selected out of which 25 were smokers and 25 were non smokers within age group of 20 to 55 years. The study was carried out for the duration of 2 months i.e. February to April 2017. The study was carried out after approval of ethical committee. The subjects selected were essentially smokers who have been smoking for a minimum duration of 2 years, ruling out underlying medical conditions. Age groups between 21 years to 55 years were included in the study keeping out severely geriatric patients and adolescents. Prior to the commencement of the study subjects were explained about the procedure before the informed consent was taken. Step by step procedure was carried out by the interviewer in which he/she collected the data. First the interviewer explained the procedure to the patients who then gave their responses to the interviewer. After which, interviewer entered the responses.

Concentrations were prepared using electronic weighing machine by dissolving (0.58gm=0.01M, 10.5gms=0.18M, 18.7gms=0.32M, 32.75gms=0.56M, 58.44gms=1M) in 1 litre of commercialised packaged distilled water of which 5 different concentrations of NaCl were taken in small dropper bottles. Firstly, subjects were asked to rinse the mouth with distilled water so as to avoid any discrepancies. Starting from the lowest concentrations and then moving towards higher, the subjects were asked to sip the solution of different concentration with in-between rinsing the mouth with distilled water and the responses were recorded accordingly. The response scale consisted of preliminary smokers or non smokers of different age groups who reacted differently with different molar concentrations of NaCl. The different concentrations of NaCl used were 0.01 moles, 0.18 moles, 0.32 moles, 0.56 moles and 1 mole. The collected data was tabulated in excel sheet version 2010 and the edited data was analysed statistically into the Statistical Package of Social Science Software (SPSS) version 11.5 for statistical analysis using descriptive statistics and chi square test. The level of significant difference was set at <0.05.

## RESULTS

Table 1 illustrated that the 8(88.9%) chewers responded to high perception and 24(58.5%) non chewers responded to low perception. The p value is 0.010. The odds ratio signifies that out of total chewers 41.5% have about 11 times more risk of low salt perception. Table 2 illustrated that 16(94.1%) subjects chewing tobacco for duration of 1-10 years responded to low perception and 3(37.5%) subjects chewing tobacco for duration of 11-20 years responded to high perception. The p value is 0.044. The odds ratio signifies that out of total chewers 5.9% have 9.6 times more risk of low salt perception. Table 3 stated that 9(64.3%) non chewers belong to the age group of 31-35 yrs and chewers 10(66.7%) and 4(66.7%) belongs to the age group of 20-25 yrs and 36-40 years respectively. The p value is 0.253.

**Table 1. Comparison between chewers and non chewers with reference to taste perception**

Tobacco	Mole				$\chi^2$	p Value	Odds ratio	95% confidence interval	
	Low Perception		High Perception					Lower	Upper
	n	%	n	%					
Non chewers	24	58.5	1	11.1	6.640	0.010*	11.294	1.290	98.889
Chewers	17	41.5	8	88.9					
Total	41	100	9	100					

**Table 2. Comparison between the tobacco chewers with reference to duration of chewing**

Tobacco	Mole				$\chi^2$	p value	Odds ratio	95% confidence interval	
	Low perception		High perception					lower	Upper
	n	%	n	%					
DURATION					4.046	0.044*	9.600	0.807	114.173
1-10 years	16	94.1	5	62.5					
11-20 years	1	5.9	3	37.5					
Total	17	100.0	8	100.0					

**Table 3. Comparison between chewers and non-chewers with reference to age**

Tobacco		Age								$\chi^2$	p value
		20-25 years		26-30 years		31-35 years		36-40 years			
		n	%	n	%	n	%	n	%		
	Non chewers	5	33.3	9	60	9	64.3	2	33.3	4.076	0.253*
	chewers	10	66.7	6	40	5	35.7	4	66.7		
Total		15	100.0	15	100	14	100	6	100		

## DISCUSSION

Among the world's most populated countries India occupy 2<sup>nd</sup> rank in demographics. India is a land with literacy rate of 74.04% according to 2011 census considering variations across states and gender (Shah, 2013). National family health survey conducted in 1998-99 by S V Subramanian, Shailen Nandy came up with the results showing strong association between individual's socio-cultural characteristics and consumption of tobacco (Subramanian *et al.*, 2004). Consumption of tobacco was markedly higher in low economic strata, less educated, scheduled tribes and scheduled caste populations. In India, half of all the cancers in men and one fourth in women are caused due to consumption of tobacco either in smoked or smokeless form (Rani *et al.*, 2003). Apart from cancers other severely affecting physiological conditions such as taste perception loss, hypertension, hormonal, central nervous and behavioural systems are the victims of taking nicotine. Albertino Bigiani (2015-2016) recognized tobacco as an agent that lowers the efficacy of gustatory system especially salt taste imparted by (NaCl) of which sodium ion is responsible for saltiness and Chloride ion plays a modulatory role. Electrophysiological analysis showed that exposure of nicotine for long duration levelled down the ion current carried out by the Epithelial Sodium Channel (ENaC), the sodium receptors explaining the reason for adding more salt when flavouring the foods (Bigiani, 2010). As a consequence, daily requirement of the salt exceeds the FDA recommended value of not more than 2300mg per day (Rani *et al.*, 2003).

This study was done to analyse salt taste perception varying with age in tobacco and non tobacco chewers/smokers. It is important to address the ill effects of consuming nicotine though adversity varies with age, physiologic build, environment etc. Chronic administration of nicotine which inhibit the activity of ENaC results in loss of salt taste perception and thus 8 chewers have responded on high perception of salt (88.9%) whereas 1 non chewers responded on high perception i.e. 11.1%. In a study conducted by Albertino Bigiani of Italy in 2015-2016 concluded that long consumption of nicotine affects salt receptors and thus tobacco chewers tend to add more salt to their diet (Bigiani, 2016). Sodium ion functions to regulate extracellular fluid balance and volume, therefore blood pressure. Increase intake of dietary sodium contributes to increase in the systolic blood pressure (Sung, 2014). Hypertension is the key factor for numerous cardiovascular diseases including coronary heart disease, cardiac failure and end stage renal disease. Thus, tobacco may concur to worsen hypertension by acting on salt perception, i.e. by reducing the efficacy of the taste system (Rani *et al.*, 2003). As per the result 17 chewers and 24 non chewers responded to low perceptions (Table-1). Consumption of nicotine for a small duration didn't show any significant changes in taste perception on the contrary chronic use of tobacco has ended up in loss of taste perception. In this study duration of exposure to nicotine played an important role. A specific time period is required for nicotine to alter the ion current of ENaC receptor. The chewers who were taking tobacco for less than 2 years responded to salt taste even at lower concentrations. There exist a direct relationship between duration of nicotine intake and the loss of taste sensation, especially for salt. According to the study, out of twenty five tobacco consumers 16 subjects accounting to 94.1% who have been taking tobacco for 1 – 10 years have lower perception

whereas only one subject corresponding to 5.9% responded to low perception. Statistical analysis concluded that subjects who were exposed to nicotine for long run have ended up in loss of taste sensation indeed they added more salt to their diet resulting in conditions like hypertension, cerebrovascular disease and even more fatal situations like renal failure (Meneton *et al.*, 2005) (Table-2). Aging process in human is accompanied by loss in sensory functioning and neural efficiency (Kremer *et al.*, 2005). Another important factor which was included in the study was how taste perception alters with advancing age. Numerous studies shows that taste perception changes in geriatric population but these studies were confined either in perceptual aspects such as suprathreshold, threshold intensities or preferences or by the medium in which substances were dissolved (Mojet *et al.*, 2003) Little and Brinner, 1984 found that alteration in salt taste perception is because of change in salivary composition (Kremer *et al.*, 2005) (Table 3)

Murphy *et al.* in the year 1991 conducted a study to find out the co relation between taste and olfactory perception which summarised that young individuals use their smelling senses to rate taste intensities and perceptions on the contrary elders are less able to detect taste because of deterioration in olfactory acuity (Savic and Berglund, 2000). Therefore, intensity and perception discrimination are resistant to effect of aging. It is of utmost importance to restore sodium sensitivity in nicotine consumers. A failure to do so may result in more fatal health issues in both the young as well as old population (Bachmanov and Beauchamp, 2007). Perception of sodium taste in humans is because of two very important components namely amiloride-sensitive (ENaC-mediated) and amiloride-insensitive (Sollai *et al.*, 2017; Bigiani, 2015). Any failure in these components or reduced number of ENaC leads to loss of salt taste perception. Sensitivity of sodium to taste cells exposed to nicotine for long duration can be enhanced by accelerating the activity of residual ENaCs. Various substances act like positive modulators for these channels such as amino acids arginine and lysine enhances ion currents through ENaC. Amino acids, arginine and lysine are expressed in *Xenopus* oocytes thereby make salt taste perception better in tobacco chewers. Therefore, adding appropriate modulator of ENaCs to table salt possibly correct the sensory deficit in salt taste perception (Bigiani, 2016).

## Conclusion

The result of this study focuses on the need to have numerous national programmes to improve health of the people living in rural setup, especially in lower socioeconomic sections. The agenda should cover effective interventions to control usage of nicotine. Apart from loss of taste sensation other fatal diseases can occur affecting all the vital organs of the body. The burden of diseases will double if we fail to improve health related issues caused by tobacco.

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