

Original article

## Study of evaluation of taste perception in kharra eaters and kharra noneaters

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### Abstract

**Background:** Impaired taste perception has great impact on quality of life; kharra is more popular in vidarbha region in young and middle age group population. Tobacco is the integral component of kharra which leads to impaired taste and dependency. The change mainly takes place in sensory organs which manifest in oral cavity. Alteration in taste perception is important as it has impact on diet and general health.

**Material and methods:** 100 subjects [50 kharra eaters and 50 non-eaters] were included in the study for taste perception; it was tested by using various molar solutions for five basic modalities of taste perception like sweet, sour, salty, bitter and Umami. The taste perception was identified and compared between kharra eaters and non-eaters. The data was analysed by using paired t test by software Epi Info-7.

**Results:** A statistically significant increase in taste perception was found for sweet, sour, salty, bitter and Umami in kharra eaters as compared to non-eaters where  $P > 0.01$ .

**Conclusion:** The results of the study revealed noticeable decrease in taste perception for sweet, sour, salty, bitter and Umami in kharra eaters when compared with kharra non-eaters.

**Keywords:** Kharra eaters, taste perception, sweet, umami

### Introduction

Taste is one of the five basic human senses belongs to the gustatory system. Taste sensation is produced when a substance in mouth reacts chemically with the taste receptor cells located on taste buds in the oral cavity, mostly on the tongue. [1] The gustatory cortex is responsible for the perception of taste; it includes five established basic tastes like sweetness, sourness, saltiness, bitterness and umami. Scientific experiments have proven that these five tastes exist and are distinct from one another. The most common causes of taste alterations are oral and perioral infections, senescence, pernicious anaemia, trauma, diabetes mellitus, drugs, medication. [2] Apart from this the major life threatening disease is mouth cancer caused by oral use of any tobacco product like kharra which alter taste perception primarily. According to the most recent government of India's sample survey data, there are 184 million tobacco consumers in India, 40% of these use smokeless tobacco, 20% consume cigarettes, and remaining 40% smoke bidis.[3] In vidarbha region kharra is the most popular among young and middle age group. Tobacco is the integral part of kharra which contain carcinogenic agents and it is used widely in India, it is

used in a number of smokeless forms like betel quid chewing, mishri, gutka, mawa and kharra.[4] Kharra is a mixture of tobacco [ Mazaa 108 ] areca nut, slaked lime and condiments like green cardamom, clove, jaisthamadh, nisarg supari sachet and several other substances in powdered or granulated form according to individuals' preference, the kharra is called as 108 Mazaa kharra. It is rubbed with the help of hand or machine for 2 minutes keeping the ingredients in plastic wrapper. The most dangerous disadvantage of this process is that, during rubbing process the plastic wrapper gets torn and it get mixed with kharra and it may get eaten by the people which contain carcinogenic elements and irritants [5]. The only known use of this product is, it is put in the mouth and then chewed and sucked or it may spat out later after hours. After eating kharra person's mood get elevated and increases concentration. This may lead to alteration of normal function of oral mucosa. [6] The findings or theories correlating the use of kharra and taste perception are very sparse. This factor thoughtfully intended to take up the study. Thus, this study was aimed to evaluate and compare taste perception in kharra eaters and non-eaters.

**Material and methods**

The present case control study was conducted to evaluate and compare the taste perception among 100 male age matched subjects, out of which 50 were kharra eaters and 50 were kharra non-eaters from ENT& Dental OPD Shri vasantrao naik government medical college Yavatmal. The ethical clearance was obtained from the institutional ethical committee.

Before testing, the subjects were well explained regarding the objectives and protocol of the study. For this a written informed consent in local language was taken from all the subjects. The study group comprised of patients having history of eating kharra for more than one year between the age group of 20 to 50 years.

The subjects with history of any systemic disease, smoking, head trauma, upper respiratory tract infection, chemotherapy, radiation and use of any medication which was known to affect the taste perception was excluded from the study. The age and sex matched subjects with no harmful effect of kharra habit were taken as the controls.

Stimulus for testing the taste perception for specific taste, five basic molar solutions of various concentrations were prepared for sweet, sour, salty bitter and umami by using deionised distilled water as shown in table I.

The study was undertaken in the morning hours between 9.30 to 11.30 am to eliminate the bias in results caused due to diurnal variation. The subjects were asked not to eat or drink one hour prior to testing. To taste for specific taste perception we added one drop of each molar concentration on tongue with the help of dropper. We added sweet molar solution drop on tip of the tongue, salty and sour on lateral sides, bitter on posterior side and umami on the dorsum of the tongue. As soon the subjects perceived the taste we had noted down the molar concentration for each taste perception. After each taste perception the subjects were asked to rinse the mouth with deionised water to avoid any error

**Table I**

**Sodium chloride** NaCl molecular weight 58.4gm/mol  
 100ml of deionised water contains 0.584gm of Nacl that is 0.1molar Solution **Salty** taste perception

0.1M	0.58
0.2M	1.01
0.3M	1.75
0.4M	2.33
0.5M	2.92

**Dextrose** molecular weight 180.16 gm/mol  
 100ml of deionised water contains 1.802gm of Dextrose that is 0.1molar Solution **Sweet** taste perception

0.1M	1.80
0.2M	3.60
0.3M	5.40
0.4M	7.20
0.5M	9.00

**Chloroquine phosphate** molecular weight 515.86 gm/mol , 100ml of deionised water contains 0.516 gm of chloroquine phosphate that is 0.01molar Solution **Bitter** taste perception

0.01M	1.80
0.02M	3.60
0.03M	5.40
0.04M	7.20
0.05M	9.00

**Citric acid** molecular weight 192.12 gm/mol  
 100ml of deionised water contains 0.192 gm of citric acid that is 0.01molar Solution **Sour** taste perception

0.01M	0.192
0.02M	0.384
0.03M	0.576
0.04M	0.768
0.05M	0.961

**Monosodium glutamate** molecular weight 169.11 gm/mol 100ml of deionised water contains 0.169 gm of monosodium glutamate that is 0.01molar Solution **Umami [Delicious]** taste perception

0.01M	1.80
0.02M	3.60
0.03M	5.40
0.04M	7.20
0.05M	9.00

Statistical analysis was done by using paired't' test by using software Epi Info -7 where P> 0.01 for salty, sweet, bitter, sour and umami.

**Result**

A total of 50 control [ kharra non-eaters ] were compared with 50 study subjects [ kharra eaters]. Paired t test was applied for statistical significance. It was found that the taste perception was higher in kharra eaters as compare to non-eaters for sweet, sour, salty, bitter and umami. It was also found that the taste

perception for umami, bitter, and sour was highly significant as compare to sweet and salty taste perception. As the subjects were new to umami taste it was little difficult to appreciate the taste by subjects. We also observed that salty, sweet and bitter tastes were better perceived as compare to sour and umami as shown in table II.

**Table II**

**Salty taste perception perceived at 0.1 molar concentration is considered as normal and above it is affected P<0.01.**

Taste perception	Case	Control	Total
Normal taste perception	40	47	87
Affected taste perception	10	03	13
Total	50	50	100

**Sweet taste perception [Dextrose] perceived at 0.1 molar concentration is considered as normal and above it is affected P<0.01.**

Taste perception	Case	Control	Total
Normal taste perception	32	45	77
Affected taste perception	18	05	23
Total	50	50	100

**Sour taste perception [Citric acid] perceived at 0.01 molar concentration is considered as normal and above it is affected P<0.01.**

Taste perception	Case	Control	Total
Normal taste perception	12	40	52
Affected taste perception	38	10	48
Total	50	50	100

**Bitter taste perception [Chloroquine phosphate] perceived at 0.01 molar concentration is considered as normal and above it is affected P<0.01.**

Taste perception	Case	Control	Total
Normal taste perception	27	43	70
Affected taste perception	23	07	30
Total	50	50	100

**Umami [Delicious] [Monosodium glutamate] taste perception perceived at 0.01 molar concentration is considered as normal and above it is affected P<0.01.**

Taste perception	Case	Control	Total
Normal taste perception	18	40	58
Affected taste perception	32	10	42
Total	50	50	100

## Discussion

The parietal lobe of cerebral cortex is capable to judge the taste perception, adults can perceive hundreds of tastes and they are all combinations of the basic taste sensations like sweet, salty, sour, and bitter and umami. [7] The taste buds are the receptors for taste sensations primarily located on the tongue; they are responsible for communicating the sense of taste to the brain. [8] More over on the tongue, the microvilli are the tiny hairs on the taste buds that send signals to the brain. These signals are interpreted by the brain, and tell the brain what things taste like. Over time as a person tastes more and more things, the brain stores the information the microvilli send in a databank of information as memory. [9]

The taste producing substance dissolves in saliva and comes in contact with the villi through taste pores present in the taste buds this contact brings about changes in the receptors cells of taste buds, impulses then carried to parietal lobe of cerebral cortex where different taste sensations are appreciated. The classic sweet taste is perceived at 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, umami on dorsum of the tongue. Among human beings taste perception decreases at around fifty years and above due to loss of papillae and gradual decrease in salivary flow, saliva plays a vital role in taste perceptions as it dissolves the taste stimulus to taste buds.[10]

Alterations in salivary flow due to any reason have effects on PH of saliva which alters its buffering activity and alters the taste perception.[11] Various studies suggests there is decrease in sensory specific taste perception in elderly as aging decreases the taste intensity due to reduction in number and shrinkage of taste buds. Tobacco present in kharra has dangerous effects on deleterious mucosa of oral cavity. Chronic inflammation lead to strangulation of sub mucosal vascular plexus, tongue becomes bald due to loss of papilla and normal mucosal architecture. Mucosa becomes extremely sensitive to heat, cold, and spice, repeated ulceration is very common. Decrease salivary outflow due to fibrosis around the Stenson's duct. All these factors lead to alter taste sensations. [12]

Tobacco present in kharra on consumption releases various chemicals and irritants such as nitrosamine and nitrosornicotine which when repeatedly come in contact with oral mucosa it increases infiltrations of toxic substances which may influence the cellular morphology causing change in cell function.[13] Other important changes that occur are due to constant irritation of chemicals to oral mucosa

leads to thickening of mucosal epithelium, hyperkeratosis of the papillae these changes will lead to alteration of taste perception.[14] There is peripheral vasoconstriction the release of carbon monoxide and other chemicals generated during degradation of tobacco can hamper capillary blood flow within the mouth. It is observed that the sweet taste was perceived in a better degree in comparison to the other tastes.[15]

The duration of consumption, concentration and the toxic substances in kharra determine the severity of injury. The first change that occurs is impaired gustatory function due to change in form and vascularisation of taste buds. There is visible change in shape, size and vascularisation of papillae,[16] nicotine have predominant effect on central nervous system and regulates the taste signals. In one of the experimental study on animal showed that nicotine when applied on the tongue of particular animal showed change in neurons of nucleus tractus solitarius and change in relay of taste pathway of taste buds.[17,18]

In our present study it was found that the taste perception was decreased in kharra eaters as compare to non-eaters for salty, sweet, sour, bitter and umami. It was also found that the taste perception for umami, and sour was highly affected as compare to salty, sweet and bitter. As the subjects were new to umami taste it was little difficult to appreciate the taste by subjects. Our study have positive correlation with the study conducted by Khan et al and Deepplaxmi et al, in their case control study they have concluded that smokers showed increase threshold for taste perception due to decrease number of fungiform papillae over tongue.[19] Da Re et al, in their study stated that the taste perception for sweet taste was higher as compare to salty taste perception which shows negative correlation with our study.[20] P Keshav Krishnaa et al and J M Boyce et al in their study conducted on five basic tastes mentioned that age has clear relation with taste perception as age advances the taste perception decreases with decrease number of papillae on tongue.[21,22] Thus tobacco and other components present in kharra not only have dangerous effects on oral mucosa but it also produce dependency due to presence nicotine. We hope that the above findings will lead to positive impact in kharra eaters and it will help them to quit this habit. The awareness regarding these product need to be strengthened because the policies run by government of india regarding smokeless tobacco are not working in positive direction. So this article is an attempt to motivate the kharra eaters to quit the habits.

## Conclusion

From present study it has been concluded that tobacco which is the integral component of kharra has great impact on taste perception which on longer use may lead to oral cancer. Considering the enormous adverse health consequences, it is very important to develop preventive strategies to reduce consumption. These dangerous effects of kharra would help to give up the habit of chewing of kharra in children and adolescents in developing country like India. The primary changes occur in taste perception in these people is a signal to

them and physician to guide them to quit the habit by counselling would save the life of young population. The key recommendation is to be enforcing a countrywide ban on production, supply and distribution of all packaged smokeless tobacco.

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