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EFFECT OF FASTING AND SATIETY STATE ON TASTE PERCEPTION AMONG HEALTHY MALE ADULTS

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ABSTRACT

Context: The detection of taste perception is an important ability not only for animals but also for humans. The taste threshold is altered by various factors. The increased taste sensitivity has been observed in fasting subjects. **Aim:** The aim of the present study was to assess the effect of fasting and satiety state on taste threshold in lean normal subjects. **Material and methods:** After ethical clearance taste threshold was determined for four basic taste modalities during fasting and satiety state, fifty healthy male undergraduate students aged 18–21 years participated in the study. The taste threshold was evaluated using 7 different serially half diluted concentrations of glucose (2.00 M–0.031 M), NaCl (1.00 M– 0.0156 M), citric acid (0.05 M–0.0007 M) and quinine sulphate (0.001 M–0.000015 M). **Statistics:** The statistical analysis was done by using Mann Whitney U test. **Result:** A significant increase in taste threshold for sweet & salt taste was observed in satiety state ($p<0.05$). **Conclusion**: we conclude that there is decreased taste sensitivity in satiety state for sweet & salt taste.

KEYWORDS: Taste threshold, Hunger, Satiety.

INTRODUCTION

The detection of taste perception is an important ability not only for animals but also for humans. Taste plays an important role in maintaining appropriate nutritional balance. [1] It is also well known that taste threshold changes throughout life and decline with ageing. [2] Gender differences have also been reported by several authors.[3]

Variations of taste sensitivity are also seen in local and systemic disease also like diabetes, infectious diseases to zinc and cyancobolamin deficiency, excessive alcohol drinking, drug dependence and smoking.[4]

It has been observed that taste recognition thresholds are lower in massively obese adolescent than in non-obese adolescents.[5] Also, the increased taste sensitivity with hunger has been observed in heavy overweight subjects, during a fasting cure.[6]

However the evidence for relationship between taste sensitivity and metabolic status (hunger, satiety, and body weight and body composition) is far from being completely understood, because of the complex interaction of genetic, biological and psychological factors, in addition to methodological confounding factors.[7] The possible variation of taste recognition thresholds in relation to fasting and satiety state is still debatable, and also very few studies are available from Indian population. So, the present study was designed to assess the effect of fasting and satiety state on taste threshold in lean normal subjects from central India.

METHODS

After institutional clearance the present study was conducted in the Department of Physiology, Government Medical College and Hospital, Nagpur. Total fifty healthy male undergraduate students aged 18–21 years were included in this study.

Inclusion criteria

All males having Body Mass Index (20.5–25 units), non-smoking, non-drinking with satisfactory state of oral hygiene and without history of any significant illness were selected for the study (4). The purpose of the study as well as the methods and procedure were explained to the participants.

Procedure: - The subjects took their last meal between 6 pm and 7 pm, they missed a breakfast in the following morning and they had a lunch at 1.00 pm. All subjects had the same food at lunch in the students mess. Taste thresholds in hunger state in all subjects were measured between 9 am and 10 am, after 13 – 15 hours of fasting.

A one hour interval was allowed between food intake and measurements of taste thresholds in order to avoid the lingering effects of taste adaptation. Taste thresholds were initially detected in the morning in hunger state and then in satiated state after a standard lunch.[4]

Taste stimuli: Stimulus representing the four classical basic tastes was included for tasting the recognition taste threshold for particular taste. Seven serial half dilutions of the stock concentration were made for each taste solution, by using deionized distilled water and used for experiment.[8] The starting concentrations were glucose (2.00 M), sodium chloride (1.00 M), citric acid (0.05 M), and Quinine sulphate (0.001 M). The taste threshold for each solution was investigated as per Harris and Kalmus method assisted by forced choice and updown tracking procedure for better output and result.[9] Subjects were given two or three drop of the solution of lowest concentration on the dorsum of tongue to taste first and then tasted successive higher solution until a definite taste was identified. Distilled water was used in between two solutions for rinsing. Rinsing of mouth was repeated till the subject volunteer said that no taste of the previously tasted concentration lingers on. Accordingly the actual threshold concentration was determined and the bottle number noted. Standard sequence was followed for taste recognition threshold i.e. sweet first followed by salt, sour and bitter taste solution.[10]

The statistical analysis was done by using Mann Whitney U test.

RESULTS

Table 1: Taste response to different concentrations of glucose solutions in fasting and satiety state.

Bottle no.	Glucose conc. (Moles)	Fasting state	Satiety state	p value
1	2.0 M	0	0	
2	1.0 M	0	0	
3	0.5 M	10	16	
4	0.25 M	18	22	< 0.05
5	0.125 M	15	8	
6	0.062 M	7	4	
7	0.031 M	0	0	

Taste recognition threshold for sweet taste (Table 1)
It was observed that at 0.125 molar and lower concentrations twenty two subjects were able to recognize sweet taste properly in fasting state while twelve subjects recognize it in satiety state correctly. For higher concentration that is 0.25 molar and above, twenty eight in fasting state and thirty eight subjects recognized sweet taste properly in satiety state. In general satiety state subjects were more blunted in taste recognition threshold than in fasting state subjects ($p < 0.05$) for sweet taste.

Table 2: Taste response to different concentrations of Nacl solutions in fasting and satiety state.

Bottle no.	NaCl concentration (Moles)	Fasting state	Satiety state	p value
1	1.0 M	0	0	
2	0.5 M	0	0	
3	0.25 M	0	0	
4	0.125 M	5	10	< 0.05
5	0.0625 M	22	25	
6	0.0312 M	21	15	
7	0.0156 M	2	0	

Taste recognition threshold for salt taste (Table 2)
It was observed that at 0.0312 molar and lower concentrations twenty three fasting state subjects were able to recognize salt taste properly while fifteen satiety state subjects recognize it correctly. For higher concentration that is 0.625 molar and above, twenty seven in fasting state and thirty five satiety subjects recognized salt taste properly. In general satiety state subjects were more blunted in taste recognition threshold than in fasting state subjects ($p < 0.05$) for salt taste.

Table 3: Taste response to different concentrations of citric acid solutions in fasting and satiety state.

Bottle no.	Citric acid concentration (Moles)	Fasting state	Satiety state	p value
1	0.05 M	0	0	
2	0.025 M	0	0	
3	0.0125 M	7	9	
4	0.00625 M	12	14	> 0.05
5	0.003125 M	22	17	
6	0.00156 M	8	10	
7	0.00078 M	1	0	

Taste recognition threshold for sour taste (Table 3)
It was observed that at 0.003125 molar and lower concentrations thirty one fasting state subjects were able to recognize sour taste properly while twenty seven satiety state subjects recognize it correctly. For higher concentration that is 0.00625 molar and above, nineteen fasting state and only twenty three satiety state subjects recognized sour taste properly. In general no statistically significant difference is seen between fasting and satiety state subjects ($p > 0.05$) for sour taste.

Table 4: Taste response to different concentrations of quinine sulphate solutions in fasting and satiety state.

Bottle no.	Quinine sulphate concentration (Moles)	Fasting state	Satiety state	p value
1	0.001 M	0	0	> 0.05
2	0.0005 M	0	0	
3	0.00025 M	0	0	
4	0.000125 M	12	16	
5	0.000062 M	17	19	
6	0.000031 M	19	14	
7	0.000015 M	2	1	

Taste recognition threshold for bitter taste (Table 4)
It was observed that at 0.000031 molar and lower concentrations, twenty one fasting state subjects were able to recognize bitter taste properly while fifteen satiety subjects recognized it correctly. For higher concentration that is 0.000062 molar and above, twenty nine subjects in fasting state and thirty five satiety state subjects recognized bitter taste properly. In general no statistically significant difference is seen between fasting and satiety state subjects ($p > 0.05$) for bitter taste.

DISCUSSION

The present study conducted was mainly aimed at comparing the taste thresholds in fasting and satiety state. The results obtained that taste recognition thresholds for sweet and salt taste in healthy subjects is increased during satiety states than that of fasting state. However taste recognition thresholds was unaltered for sour & bitter taste.

Our study is not unanimous about the same, previous researcher have come out with varied results. Pasquet et al,[11] and Pangborn[12] reported that there is no difference for the sense of taste between fasting and satiety state for all the four basic taste modalities. Zuvere et al[4] concluded increased taste threshold for sweet and salty taste during satiety state, which is in agreement with our results.

Several mechanisms might be important for the modulation of taste sensitivity in fasting and satiety states. Firstly, systemic activation of the brain during food motivation or caloric satiety might alter sensitivity of the central structures involved in perception of taste stimuli.[13] However Scott et al. have demonstrated that in satiety state food does not reduce responsiveness to taste stimuli of the brain areas devoted to the food analysis but in the areas concerned with motivation and reinforcement.[14] A study conducted on primates also indicated the possibility of variations in taste sensitivity which was not related to variations in taste nerve signals from the peripheral structures.[15] Secondly, the efferent influences on gustatory receptors evoked by hunger or satiety might affect sensitivity of the gustatory receptors. Such possibility has been demonstrated by several authors. Plata-Salaman has showed that impulsation from gastric mechanoreceptors and osmo-receptors during sensory satiety state contributed to both short-term satiety signals and to efferent control of sensory responses of the gustatory receptors.[16]

Such centrifugal "tuning" influences on the taste receptors may take place through the efferent neurons of the glossopharyngeal and lingual nerves. It has also been shown that activation of the gastric mechanoreceptors or osmoreceptors through the vagus and nucleus solitarius, and further through the efferent neurons in the lingual nerve, inhibits sensory responses of the gustatory receptors and therefore increases taste thresholds.[17] Budilina et al has demonstrated that in deprived animals the pattern of glossopharyngeal nerve discharge can be modulated by irritation of the stomach with the rubber balloon which was reflected in alteration of perception of the taste stimuli.[18] Thirdly, alteration of the autonomic nervous system activity during fasting state might contribute to modulation of perception of taste stimuli.[19,20]

Sweet and salty tastes are indicators of eatable substances and trigger consumption, while sour & bitter taste indicates substances which are not suitable for consumption and should be rejected. Therefore the relatively constant sensitivity of the gustatory system to a sour and bitter substance found in our present study might be an important determinant of the ability of the taste system to detect substances potentially dangerous for consumption in both satiety and hunger states.

The natural significance of dietary value of substances declines after a meal. Therefore, a decrease in sensitivity of the gustatory system to sweet and salty substances reflects the shift of responsiveness from nutritional to non-nutritional factors during satiety state. Thus gustatory system also shows physiological feedback mechanism as seen in other organ systems. However, this is preliminary study & more detailed study amongst wide age range groups is needed.

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