

Correlation of Dental Caries to Sweet Taste Perception and Dietary Habits amongst Students in the Ages 18 To 23 Years (A Cross-Sectional Study)

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Abstract

Aim: The aim of study was to assess the correlation between an individual's sweet taste perception and dietary habits to the dental caries incidence.

Methodology: This cross-sectional study was conducted among 75 college going students aged 18-23 years from different colleges in Pune city. The frequency of food consumption was assessed using a beverages and snacks questionnaire (Sarah Kehoe's Dietary pattern), alongside a 3-day dietary record was obtained. The level of sweet taste perception was assessed through both the sweet taste threshold and sweet taste preference. Based on their sweet taste perception levels, individuals were categorized into low, medium and high groups. The incidence of dental caries was recorded using the DMFT and DMFS index. Then correlation was assessed using inferential statistics.

Results: Individuals with a preference for higher sweetness levels exhibit a greater incidence of dental caries compared to those with lower sweetness preferences, likely as a result of increased sugar consumption which is statically significant.

Conclusion: The level of sweet taste perception has a significant impact on dietary behaviour and the consumption of sweet foods.

Keywords: Dental caries, Dietary habits, taste threshold, taste preference

I. INTRODUCTION

Dental caries is a multifactorial disease that leads to the demineralization and destruction of the hard tissues of the teeth due to acids produced by cariogenic bacteria in presence of carbohydrates ^[1]. It is influenced by various factors such as oral hygiene practices, diet, bacterial factors, saliva composition, and genetic predisposition. Interaction among these factors creates an environment that promotes development and progression of dental caries ^[2].

Dietary habits and food consumption are determined by various factors, including taste perception, which can be influenced by cultural and genetic aspects. Additionally, frequent consumption of a certain food can alter taste perception leading to habituation and enhancing preference for that particular food ^[2]. Taste perception plays a key role in shaping eating habits. The nervous system transmits the sensory information of taste perception from the tongue. Sweetness is recognized by sweet taste receptors (TASR2 and TASR3) found on taste buds. When these receptors are activated, sodium or potassium channels in the cells open, leading to the generation of receptor potential and subsequent activation of G proteins ^[3].

College students are at higher risk of dental caries due to poor dietary choices, irregular eating habits, limited access to dental care, stress, and lifestyle factors such as alcohol and tobacco use. Additionally, many students may lack awareness of proper oral hygiene practices and the impact of their dietary habits on

dental health. This combination of factors emphasizes the need for increased education and resources to promote better oral health among college students.

A preference for sugary, acidic, and processed foods increases the chances of dental caries, while healthier snack choices can reduce this risk. Additionally, personal attitudes toward oral hygiene practices, such as brushing and flossing, significantly impact dental health. Promoting healthier dietary and lifestyle preferences can significantly contribute to the prevention of dental caries.

Research conducted by J Pharm Bioallied Sci. 2022 showed that there is direct relation between sweet threshold and dental caries, Similarly, Peres et al. 2010 revealed that groups consuming higher amounts of sugar had a greater incidence of dental caries. Likewise, Bernab et al. 2014 discovered a link between daily consumption of sweetened beverages and an increased risk of caries. Furthermore, Mathur et al. 2015 identified the consumption of sugary foods and increased snacking between meals as significant contributors to the development of caries. In contrast to the results of those study, Nilsson and Holm 1983 found no connection between sugar consumption and dental caries. Similarly, Ashi et al. 2017 discovered no significant link between sweet intake and dental caries. Additionally, Van Loveren 2019 reported that sugar intake and dental caries exhibited little to no relationship^[3]. This type of study has not been conducted in Pune city; therefore, we are initiating this research among college going students aged 18 to 23 years. The aim of the study is to evaluate correlation of dental caries to sweet taste perception and dietary habits among college going students. The results of study will help to raise awareness about dietary habits, oral hygiene practice.

II. METHODOLOGY

This Cross-sectional Study was conducted among 75 college-going students aged 18-23 years, of Pune City after obtaining the approval from the Research and Ethical Committee (EC/MCES/971/2024). These included students that were willing to participate and give their dietary details after having explained the purpose of the study. Students suffering from any systemic disease, taking any antibiotics or any medication that would alter the taste, or undergoing any orthodontic treatment were excluded from the study. A pilot study was conducted on 20 students to verify the reliability and obtain a sample size of 75 students. Data collection was done using the evaluation proforma, where details regarding the demographic data and the following were taken:

FACTOR 1 (Annexure 1)

Main meal intake was taken as three-day food records including 2 weekdays and 1 weekend. Students were asked to report the meal intake in terms of time and quantity as breakfast, lunch, and dinner. Any food intake within 30 minutes was considered as one intake. The number of main meal intakes was calculated.

FACTOR 2 (Annexure 2)

Sweet intake frequency was calculated from the beverage and snack intake questionnaire adopted from Sarah Kehoe's dietary pattern in South Indian Population. The questionnaire consisted of 13 snack and beverage items, including 6 beverages and 7 snacks. The students were asked to select options ranging from Never (Score 0) to More than three times a day (Score 4) for each item for a day. The scores were totaled to obtain the sweet intake frequency.

FACTOR 3 (Annexure 3)

The sweet taste perception level of the students was assessed by using modified version of Furquim et al method. Two variables, sweet taste threshold and sweet taste preference, were used to assess the sweet taste perception.

Sweet taste threshold is the minimum concentration of glucose at which the participant first perceives the sweet taste. Sweet taste preference is the concentration of glucose that the participant selects as the preferred sweet taste that he/she may like in a drink.

The glucose solutions were prepared on the day of examination by adding increasing amounts of glucose to distilled water to create 8 solutions of increasing concentration ranging from 15mM/L to 120 mM/L with a gradation of 15 mM/L (15, 30, 45, 60, 75, 90, 105, 120) as done by Jayasinghe et al.

10 ml of each solution were given to the participant in ascending order, and they were asked to swirl the solution in the mouth for at least 5 seconds to stimulate the taste buds and then expectorate. The participants

were asked to rinse their mouth with filtered water every time they tasted different solutions. They were asked to choose the option which matched with the sweet taste threshold and preference respectively.

According to the options chosen, the participants were classified as “LOW” (15-30 Mm/L), “MEDIUM” (45- 75 Mm/l) and “HIGH” (90-120 mM/L) depending on the concentration chosen.

FACTOR 4 (Annexure 4)

Dental caries was assessed using the decayed, missing and filled teeth (DMFT) and decayed, missing, filled surfaces (DMFS) index. The score was calculated by adding up the values.

All collected data was entered into Microsoft Excel and undergone statistical analysis keeping 95% CI and 80 as power of the study. The results are presented in the form of tables and graphs.

III. RESULTS

STUDY POPULATION

This section presents the findings on the correlation between dental caries, sweet taste perception, and dietary habits among 75 college-going students from Pune City, aged 18–23 years. Of the participants, 41 were males (54.6%) and 34 were females (45.3%). The study population was further stratified by socio-economic status, with 52% belonging to middle-income families and 24% each to low- and high-income families.

SWEET TASTE THRESHOLD

According to Table 1, the population in the medium threshold group exhibited a higher incidence of dental caries compared to the low threshold group, with the difference being statistically significant ($P = 0.036$). Similarly, the medium threshold group reported a higher sweet intake than the low threshold group, which was statistically highly significant ($P = 0.000$). However, the main meal intake between the two groups was comparable, with no statistically significant difference observed ($P = 0.907$). (Table 1)

SWEET TASTE PREFERENCE

According to Table 2, the high threshold group exhibited the highest incidence of dental caries, followed by the medium and low threshold groups, with the difference being statistically significant ($P = 0.000$). Similarly, sweet intake was highest in the high threshold group, followed by the medium and low threshold groups, also showing statistical significance ($P = 0.000$). In contrast, the main meal intake was similar across all three groups, with no statistically significant difference ($P = 0.207$).

Based on the below tables and graphs, it can be inferred that individuals with a higher sweet threshold and sweet taste preference tend to have a higher sweet intake, which makes them more prone to dental caries, likely driven by increased consumption of sugary foods.

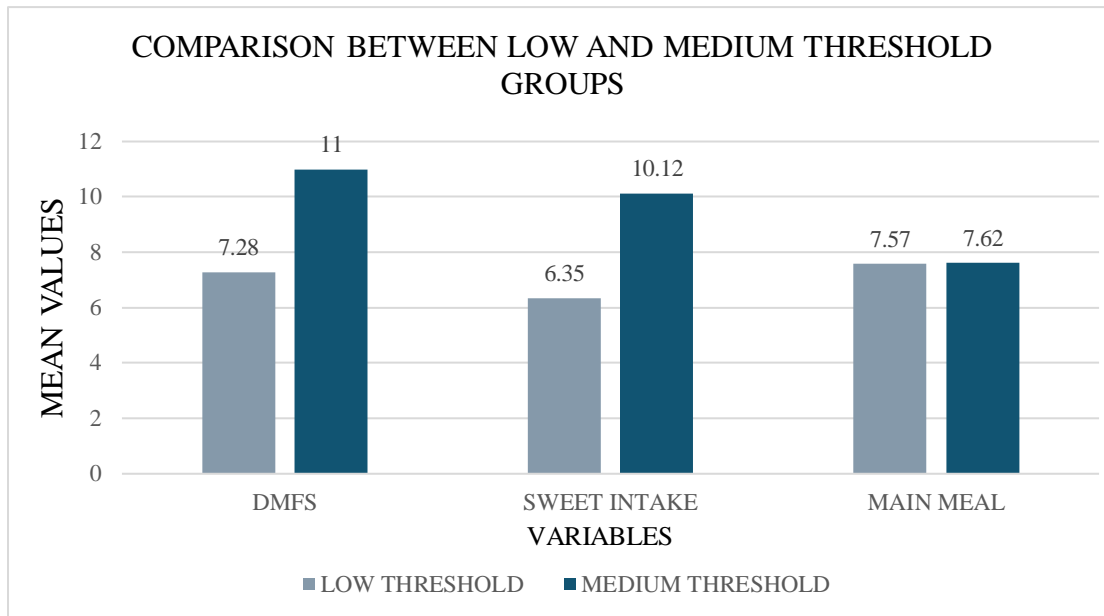
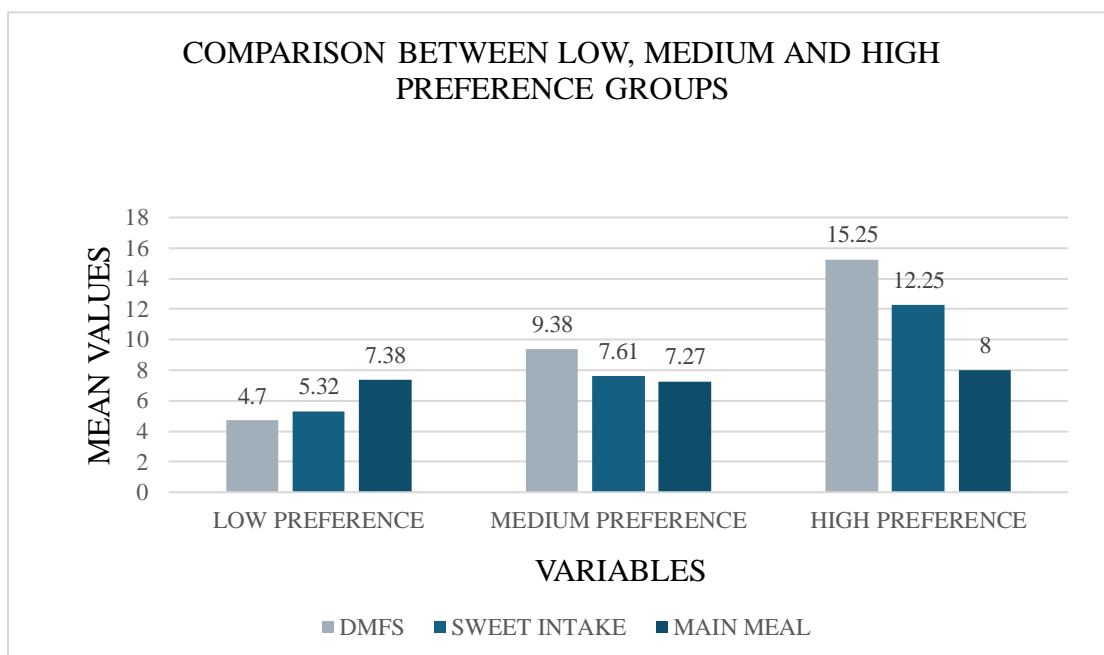
TABLE 1: MEAN DMFS, SWEET INTAKE, AND MAIN MEAL AMONG VARIOUS SWEET THRESHOLD LEVELS

VARIABLE	LOW THRESHOLD	MEDIUM THRESHOLD	P VALUE
DMFS	7.28 ± 6.56	11.00 ± 4.19	0.036 (S)
SWEET INTAKE	6.35 ± 3.47	10.12 ± 3.11	0.000 (HS)
MAIN MEAL	7.57 ± 1.52	7.62 ± 1.25	0.907 (NS)

TABLE 2: MEAN DMFS, SWEET INTAKE, AND MAIN MEAL AMONG VARIOUS SWEET PREFERENCE LEVELS

VARIABLE	LOW THRESHOLD	MEDIUM THRESHOLD	HIGH THRESHOLD	P VALUE
DMFS	4.70 ± 5.31	9.38 ± 5.71	15.25 ± 4.09	0.000 (HS)
SWEET	5.32 ± 3.76	7.61 ± 2.68	12.25 ± 2.05	0.000 (HS)

INTAKE				
MAIN MEAL	7.83 ± 1.46	7.27 ± 1.46	8.00 ± 1.30	0.207 (NS)

GRAPH 1**GRAPH 2**

IV. DISCUSSION

Our study aimed to assess how sweet taste perception influences dietary habits, ultimately contributing to the development of dental caries. Our findings support the main hypothesis, individuals with a higher sweet taste threshold and preference are more likely to consume greater amounts of sugar, making them more susceptible to dental caries due to their increased intake of sugary foods. These results align with studies by Selvaraju, Girija et al^[3] and Mithra *et al*^[4] which indicates that sweet taste perception can impact dietary habits, influencing food choices and resulting in increased intake of sugar and snacks. Similarly, our

findings are consistent with research conducted by Peres et al. in 2010^[5], Bernabé et al. 2014^[6] and Mathur et al. in 2015^[7].

On other hand, Nilsson and Holm in 1983^[8], Ashi et al. in 2017^[2] and Van Loveren in 2019^[9] found that the relationship between sugar intake and dental caries was either negligible or relatively weak might be due to several possible reasons, such as focusing on specific population, challenges in accurately measuring sugar intake, the role of intake frequency over total quantity, oral hygiene, and study duration.

In general, our study emphasize that higher sweet taste threshold was associated with increased DMFS and sweet intake. The preference for sweet taste exhibited a positive correlation with DMFS as well as sweet intake, while simultaneously showing a statistically insignificant difference with the intake of main meal. This indicates that individual with a heightened preference for sweetness tend to have higher level of dental caries and increased consumption of sweet foods.

However, further investigation is needed to reinforce our finding by taking into account other factors that affect the relationship between sugar intake and dental caries.

V. CONCLUSION

In this study, we explored the relationship between the incidence of dental caries, sweet taste perception, and dietary habits among college students. The results revealed a positive correlation between dental caries and sweet taste perception, with higher caries incidence observed in individuals with greater sensitivity to sweet tastes.

These findings highlight the significant role of sweet taste perception in shaping dietary habits, particularly the frequent consumption of sucrose-rich foods, which increases the risk of developing dental caries. Promoting a healthy diet with reduced sugar intake is essential not only for oral health but also for overall well-being.

Limitations: The study was limited to 75 students, which restricts the generalizability of the findings to a broader population. Future studies can include a larger and more diverse sample. Dietary habits were collected using self-reported questionnaires, which may introduce bias or inaccuracies due to underreporting or misreporting by participants. Other factors like genetic predisposition, variations in oral hygiene habits, or environmental influences were not thoroughly examined, which may have affected the study's results.

Recommendations:

Further research can be conducted across diverse demographics to validate these findings and explore other variables that may influence dental caries, such as genetics or environmental factors.

VI. EVALUATION PROFORMA

DEMOGRAPHIC DATA:

NAME-

AGE/GENDER-

SOCIOECONOMIC STATUS:

EDUCATION- OCCUPATION- INCOME OF FAMILY-

ANNEXURE 1:

THREE DAY FOOD RECORDS:

	<u>BREAKFAST</u>	<u>LUNCH</u>	<u>DINNER</u>
<u>WEEKDAY</u>			
<u>WEEKDAY</u>			
<u>WEEKEND</u>			

ANNEXURE 2:**Sarah Kehoe's Dietary Pattern**

Food type	Food group	Description of food group	Never-(0)	One time-(1)	Two times-(2)	Three times-(3)	Morethan threetimes-(4)
Beverages	Teaand coffee						
	Milk	Fresh milk					
	Hot milky drinks	Drinks made with hot milk and processed powder products (brands:'Horlicks', 'Boost', 'Bournvita')					
	Fruit juice	Fresh fruit juice					
	Fruit-based drinks	Processedfruit drinkscontaining added sugar (brands: 'Frooti', 'Maaza')					
	Sweetened drinks	Carbonated drinks; withadded flavouring and sugar(brands:'pepsi', 'sprite')					
Snacks	cakes	Plain cake, cream cake					
	biscuits	Salted biscuits, sweet biscuits, cream biscuits					

Sugary food/sweet	Jam						
	Honey						
	Added sugar	Sugar added to any food or added to fruit juice by the child/parent					
	confectionary	Chocolate bar, toffee, candy, icecream, ice-olly					
	Home-made sweets	Sweet vermicelli					

ANNEXURE 3:

GLUCOSE TASTE PERCEPTION:

Sweet taste threshold:

<u>15 mm/l</u>	<u>30 mm/l</u>	<u>45 mm/l</u>	<u>60 mm/l</u>	<u>75 mm/l</u>	<u>90 mm/l</u>	<u>105 mm/l</u>	<u>120 mm/l</u>

Sweet tastepreference:

<u>15 mm/l</u>	<u>30 mm/l</u>	<u>45 mm/l</u>	<u>60 mm/l</u>	<u>75 mm/l</u>	<u>90 mm/l</u>	<u>105 mm/l</u>	<u>120 mm/l</u>

ANNEXURE 4:

INTRAORAL EXAMINATION:

Decayed Missing Filled Teeth DMFT INDEX:

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Decayed Missing Filled Surfaces DMFS INDEX:

17	16	15	14	13	12	11	21	22	23	24	25	26	27
47	46	45	44	43	42	41	31	32	33	34	35	36	37

INFORMATION SHEET

We, the students of M. A. Rangoonwala College of Dental Sciences and Research Centre, are conducting a study on the **Correlation of Dental Caries to Sweet Taste Perception and Dietary Habits amongst students in the ages 18-23 years: An Observational Study**

The dentition status of the individual would be checked followed by the taste perception using different glucose concentrations. The procedure is not invasive and no intervention would be done.

The study would be beneficial on an individual level and well as for future researches.

Your participation would be highly encouraged and appreciated.

CONSENT FORM

I confirm that Madeeha Khan and Bushara Jikare (investigators) have explained to me the purpose of research, the procedure and that there will be no intervention done on me and there will be no risk that I may experience. All my queries regarding the study are made clear. I consent to participate in the study.

NAME

AGE

GENDER

DATE

SIGNATURE

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