

Original Research Article

Evaluation and comparison of taste perception and caries experience between father, mother and child

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ABSTRACT

Background: Individual taste perception is used to evaluate the clinical assessment of caries susceptibility. Given that parents have a major influence on their children's eating habits, it would be beneficial to evaluate the relationship between the father, mother and child's taste perception and caries experience in order to predict the child's susceptibility to dental caries. Thus the aim of the present study is to compare the taste perception and caries experience between father, mother and child.

Methods: A sample of 113 parents and their child aged between 6-12 years were selected for the study. After gathering information on dietary patterns and dental hygiene procedures through cross sectional-based questionnaire survey, caries experience of parents and their child were recorded using DMFT and deft indices respectively, then the 6-n propylthiouracil (PROP) test strips were used to evaluate taste. Participants were grouped into supertasters, medium tasters and non-tasters based on their perception of taste. The obtained data was statistically analyzed by using Kruskal Wallis and chi square test in SPSS software 21.0.

Results: Statistically significant results were obtained in comparing taste perception of mother and child, but no significance was noted between taste perception of father and child. Significance was noted regarding caries experience among parents and children and no correlation was noted between parents' taste perception and child's caries experience.

Conclusions: The present study concluded that there is strong inverse correlation between the ability to taste the bitterness of PROP tester strip and the caries experience but there is no correlation between taste perception of parents to caries experience of their child. PROP sensitivity test can be a valuable tool in the future to assess the inherent genetic sensitivity of a person for dietary preferences.

Keywords: 6-n-propylthiouracil, Medium tasters, Non-tasters, PROP strips, Supertasters, Taste perception

INTRODUCTION

Oral health is often undervalued, especially in children. Studies reveal that more the sugar consumption in children higher the caries rates.¹ Children are born with a sensitivity to taste. Additionally, a link between genetically determined taste sensitivity and dental caries has been described. The TAS2R38 gene mediates the

insensitivity to bitter substances such as PROP, a compound used to treat hyperthyroidism.² People who feel PROP paper is very bitter are known as supertasters. On the other hand, non-tasters might need a stronger concentration to detect bitter taste because they are unable to detect sweet or bitter taste at the same concentration. Consequently, children who are non-tasters are more likely to have dental caries because they consume more sugar and do so more frequently than

children who are medium or supertasters.³ Several studies have been done comparing the taste perception and caries experience in children, but there is no literature comparing the taste perception and caries experience within the members of the family. Thus, the present study aimed at comparing the taste perception and caries experience between the family members of three, i.e., the father, mother and child.

METHODS

The design of the study was cross sectional analytical study. The study was carried out from December 2022 to February 2023. The study was conducted as a door-to-door survey in cities and rural areas of Davangere and Ranebennur. A sample of 113 children accompanied by their father and mother, were tested for PROP sensitivity through a door-to-door survey. Children and their parents were informed about the objective of the study and the methodology to be employed. Written informed consent was obtained from the parent or guardian. Ethical clearance was obtained from institutional review board of the college for the study (Ref No. Cods/IEC/61/2021-22).

6-12 years old children of both sexes and their parents were included in the study. While guardians who didn't give consent for the examination, those possessing underlying systemic disorders, a medical history of taste sensation alteration, a known allergy or a history of adverse reactions to 6-n-propylthiouracil and who did not fall under the American Society of Anesthesiologists (ASA) physical status of class I were not considered for the study.

Procedure

A sample of PROP was procured from the pharmaceuticals and the PROP strips were prepared in the department of pharmacology at the J.J.M. Institute of Medical Sciences, Davangere. Whatman filter paper was cut into 2 × 2 cm pieces and autoclaved for 15 minutes at 121 °C to sterilize it. Before being utilized, the sterilized strips were weighed and kept in a desiccator. 5 ml of ethyl alcohol was used to dissolve 10 mg/ml of 6-n-propylthiouracil in a beaker. For the full absorption of the drug, ten Whatman filter paper strips that had been cut and sterilized beforehand were soaked in the above solution for an hour. After being taken off, the strips were left to dry at room temperature. Following drying, the

weight of the strips was noted. The actual amount of drug impregnated on each strip was determined by comparing the weight of the filter paper at the beginning and the end after the drug had been infused. Each strip had an average of 1.6 mg of the drug in it.¹

A PROP taste test was conducted on the father, mother and their child. A 2×2 cm strip of Whatman grade-1 filter paper impregnated with roughly 1.6 mg of propylthiouracil was placed on the tongue's dorsal surface, which was then allowed to be thoroughly moistened with saliva for 30 seconds.

Following the removal of filter paper, the participants were asked to rate the bitter taste with the help of the Green's Labeled Magnitude Scale and were classified into groups of supertasters (>60), medium tasters (12–60) and non-tasters (<12). During the tasting, facial expressions were noted to support the spoken response.

Information regarding the subject's taste preferences was recorded using a simple subjective questionnaire.

Using a mouth mirror and a probe, the parents' and child's caries experiences were documented according to the WHO guidelines for evaluating oral health. Participants with a total decayed, missing, filled teeth (DMFT)/deft score of >5 were classified as being in the high caries group.

Information about diet, dental caries and healthy eating practices was given to parents and kids, along with instructions on maintaining good oral hygiene.

Statistical evaluation

The acquired information was subjected to statistical analysis using SPSS software 21.0. An Intergroup comparison was made using the Kruskal Wallis and Chi-square tests.

RESULTS

Table 1 shows distribution of tasters in population. More than half of the population was made up of nontasters, while the remaining people were super and medium tasters. When father's, mother's and child's taste status and caries experience were compared, caries was highest in medium tasters and least in super tasters (Table 2).

Table 1: Distribution of tasters.

	Supertaster	Medium taster	Nontaster	Total
Father	40	44	29	113
Mother	34	26	53	113
Child	33	36	44	113
Total	107	106	126	339

Non taster mothers and children had the highest taste comparison, followed by supertasters and medium tasters (Table 3). Supertaster father and child had greater taste comparisons than medium and non-tasters (Table 4). The

caries experience between father, mother and child could be correlated with statistical significance (Table 5). Comparison could not be achieved between a parent's taste and a child's caries. (Table 6).

Table 2: Comparison of father's, mother's and child's taste status and caries experience.

		N	Caries (Mean)	Caries (Std. Deviation)	P value
Father's taste	Super taster	40	0.28	0.784	0.000
	Medium taster	44	1.36	1.163	
	Non taster	29	2.00	2.138	
	Total	113	1.14	1.535	
Mother's taste	Super taster	34	1.44	1.812	0.016
	Medium taster	26	3.00	2.857	
	Non taster	53	2.85	2.552	
	Total	113	2.46	2.504	
Child's taste	super taster	33	2.12	2.162	0.046
	medium taster	36	3.97	3.953	
	non taster	44	3.16	2.770	
	Total	113	3.12	3.113	

Table 3: Comparison of taste perception between mother and child.

Comparison of taste perception between mothers and child						
		Taste-child			Total	P value
		Super taster	Medium taster	Non taster		
Taste-mothers	Super taster	Count	16	11	7	34
		% within taste-mother	47.1%	32.4%	20.6%	100.0%
		% within taste-child	48.5%	30.6%	15.9%	30.1%
	Medium taster	Count	8	10	8	26
		% within taste-mother	30.8%	38.5%	30.8%	100.0%
		% within taste-child	24.2%	27.8%	18.2%	23.0%
	Non taster	Count	9	15	29	53
		% within taste-mother	17.0%	28.3%	54.7%	100.0%
		% within taste-child	27.3%	41.7%	65.9%	46.9%
	Total	Count	33	36	44	113
		% within taste-mother	29.2%	31.9%	38.9%	100.0%
		% within taste-child	100.0%	100.0%	100.0%	100.0%

Table 4: Comparison of taste perception between father and child.

Comparison of taste perception between father and child						
		Child-taste			Total	P value
		super taster	medium taster	non taster		
Father taste perception	Super taster	Count	13	14	13	40
		% within father-taste	32.5%	35.0%	32.5%	100.0%
		% within child-taste	39.4%	38.9%	29.5%	35.4%
	Medium taster	Count	13	15	16	44
		% within father-taste	29.5%	34.1%	36.4%	100.0%
		% within child-taste	39.4%	41.7%	36.4%	38.9%
	Non taster	Count	7	7	15	29
		% within father-taste	24.1%	24.1%	51.7%	100.0%
		% within child-taste	21.2%	19.4%	34.1%	25.7%
	Total	Count	33	36	44	113
		% within father-taste	29.2%	31.9%	38.9%	100.0%
		% within child-taste	100.0%	100.0%	100.0%	100.0%

Table 5: Comparison of caries experience between father, mother and child.

Comparison of caries between mother, father and child-correlations				
		DEFT	DMFT-mother	DMFT-father
DEFT	Pearson correlation	1	0.175	0.064
	Sig. (2-tailed)		0.063	0.502
	N	113	113	113
DMFT-mother	Pearson correlation	0.175	1	0.250
	Sig. (2-tailed)	0.063		0.008
	N	113	113	113
DMFT-father	Pearson correlation	0.064	0.250*	1
	Sig. (2-tailed)	0.502	0.008	
	N	113	113	113

*Statistically significant.

Table 6: Comparison of parent's taste and child's caries.

	DEFT	N	DEFT	Std. Deviation	P value
Mother's taste	Super taster	34	3.35	3.813	0.71
	Medium taster	26	2.69	2.51	
	Non taster	53	3.17	2.914	
	Total	113	3.12	3.113	
Father's taste	Super taster	40	3.25	3.821	0.873
	Medium taster	44	3.16	2.587	
	Non taster	29	2.86	2.838	
	Total	113	3.12	3.113	

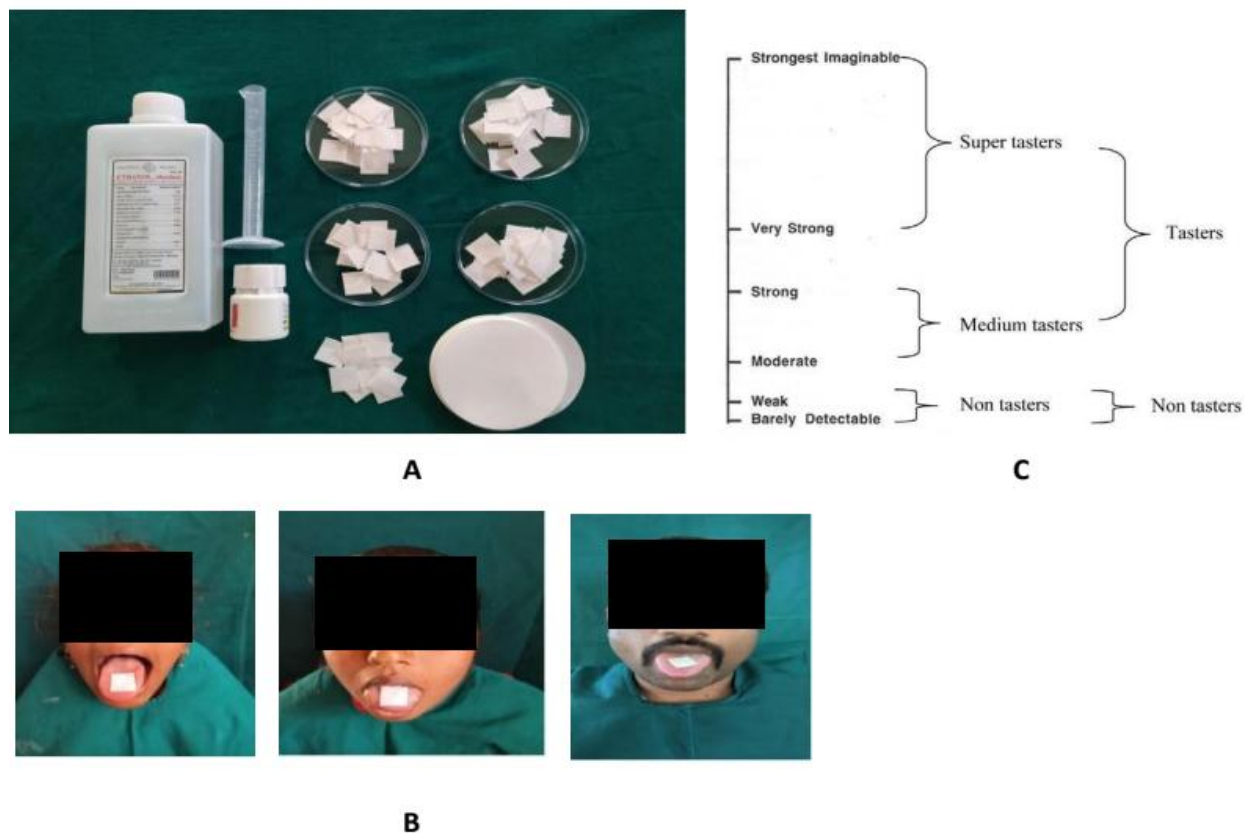


Figure 1: (A) armamentarium, (B) checking taste perception in father, mother and child, (C) labelled magnitude scale.

DISCUSSION

Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and degradation of the tooth's organic material, which frequently results in cavitation. In an effort to detect the caries risk early on, theories like genetic taste sensitivity and taste threshold have been proposed. A study done by Lin et al revealed that the only independent variable was taste, which had a strong correlation with overall experience of caries after adjusting for related factors (age, race, number of teeth and OHI-S).⁴ Such is the relationship between taste and caries. The drug PROP, used in the treatment of Grave's disease, was discovered by Arthur L. Fox, has led to thorough research in the subject of genetic taste sensitivity, which led to the association of the TAS2R38 gene in the genetic taste inheritance.

People who found the substance bitter were categorized as 'tasters' and those who did not 'non-tasters'. The basis for this fact emerged from the study done by Mennela et al who categorised 143 children and their mothers into groups of three depending upon their TASR38 genome type.⁵ Type AA was composed of two bitter insensitive alleles (non-tasters). Type PP was composed of two bitter insensitive alleles (supertasters) and type AP was composed of one of each (medium tasters). According to family studies, individuals who were non-tasters were those who were unable to taste PROP and carried two recessive alleles. According to research by Bartoshuk et al, saccharine, potassium chloride, sodium benzoate and potassium benzoate have more bitter tastes to tasters than to non-tasters. Additionally, research has demonstrated that tasters perceived sucrose, succharin and neohesperidine dihydrocalcone as sweeter than non-tasters.⁶ The method employed in this study employed filter paper impregnated with phenylthiourea. (PROP test strips). According to Zhao et al the paper disc method is a sound and trustworthy method to classify subjects according to PROP taste status.³ This was supported by a study done by Basile et al which suggested that tastants presented on impregnated filter paper ("Taste Strips") have longer a shelf life than that of liquid taste solutions.^{1,7}

Because their mouth sensations are too strong to tolerate the powerfully bitter and sweet substances, tasters who dislike sweets may avoid sweet food, which reduces their susceptibility to decay. Another possible explanation for this could be the distribution of fungiform papillae, which are abundant on the tongue's sides, anterior third and tip. The genetic variation in taste sensitivity is correlated with the number of fungiform papillae. Fungiform papillae grow more frequently in tasters than in non-tasters.⁸ Mothers are the backbone of the family and tend to influence their children with their own food preferences, limiting the foods offered to their children. Very few studies have been done on the influence of mothers' taste perceptions on caries in their children.

Therefore, the purpose of this study was to examine the relationship of mothers' taste perception and the prevalence of caries in their children.⁹ Father, being the head of the family in the majority of Indian households, plays a major role in making the food choices and eating behavior of his children; therefore, his taste preference might influence their food habits and dental risk. There is paucity in the literature on the influence of father and mother on a child's caries experience. This study is perhaps the first to examine the impact of fathers' genetic taste sensitivity on dental caries in his children. A labeled magnitude scale (LMS) is utilized to convey the bitterness of the PROP strip. Six verbal labels make up this system, arranged based on the geometric averages of their ranked magnitudes. viz., supertasters (>60), medium tasters (>12-<60) and non-tasters (<12).²

This study has been carried out between the age groups of six to twelve years due to their better ability to comprehend the LMS scale, similar to the study performed by Abhiram et al, Verma et al and Lin et al.^{1,4,6} From the questionnaire, we infer that the majority of study participants, irrespective of the taster category to which they belonged, were sweet likers, which is comparable to the findings of Abhiram et al where mothers and children both expressed a preference for sugary foods irrespective of taste status.¹ It is because people choose sweet-fat snacks such as chocolates, cakes and biscuits over fruits and vegetables. The close relationship between gut microbial signals and diet, the impact of these signals on gut satiety mediators and their disruption of brain homeostatic mechanisms controls this preference for sweet foods. This leads to a shift towards a greater influence of hedonic reward mechanisms driving the preferred intake of high-calorie foods reinforcing gut dysbiosis.¹⁰ Another reason is the easy availability and affordability of such foods on the market.

Regarding frequency of snacking, non-taster children tend to consume snacks more frequently than taster children, but this was not the case with parents. In a study done by Drewnowski et al it was discovered that with age, the fondness for the sweet decreases, which explains why children like sweets more compared to their parents.¹¹ In the current study (Table 1), it was noted that supertasters were fewer in number than medium and non-tasters. This was consistent with the research done by Krithi et al and Pidamale et al.^{8,12}

In the current study (Table 2), we infer that supertasters had fewer caries than medium and non-tasters in fathers, mothers and children. This finding is in agreement with the results of landmark study conducted by Lin et al, Verma et al where there was a noteworthy inverse correlation between caries activity and the capacity to taste PROP tester strips, agreeing with the hypothesis that supertasters always have less caries activity than medium and nontasters.^{1,4,6,13} In the current study (Table 3), we infer that there was a positive correlation regarding taste perception between supertaster mothers and children.

Alanzi et al stated that mothers tend to influence their children with their personal dietary habits, restricting the food that they give their kids.⁹ Drewnowski et al stated that the development of food preference in children occurs through the intrauterine experience with flavors from the mother's food and following birth with flavors of breast milk.¹¹ Hence, the positive correlation could be seen between mother and child, but the result of our study was contradicted by Abhiram et al without any relationship between the mother's and the child's taste perception.¹ This might be the case because, in contrast to the study, the mothers in this group may not have had an equal impact on the children's eating habits. In the current study (Table 4), we conclude that there isn't any relationship between the taste status of fathers and children. The study is the first to correlate and prove that there is no correlation between a father's and a child's taste perception. This could be the case because men do not have the same effect on their children's eating habits as mothers do.

In the current study (Table 5), we infer that the correlation is positive regarding the caries experience between father, mother and child. This result was comparable to those observed by Ersin et al, Bhat et al, Weintraub et al, and Alanzi et al, Smith et al and Pidamale et al discovered that together, three maternal risk factors-active caries, high sugar consumption and Mutans streptococci-can forecast dental decay in children.^{9,14-18} Similar results were seen in a study done by Mattila et al who found that caries was high in children having a father and mother with increased caries activity.¹⁹ The study was the first to correlate the experience of caries in both father and mother with the child and to prove that there is a positive correlation between the experience of caries in parents and their child.

In the present study (Table 6), we infer that there is no correlation between parent's taste status and child's experience of caries. Study done by Abhiram et al contradicted our results, where a marginally favorable correlation was observed in relation to taste perception in mothers and experience of caries in their child even though there was no statistically significant difference.¹ This could be due to the variation in the distribution of types of tasters in two different geographic areas chosen for the study. The result of the present study was also contradicted by Alanzi et al and Krithi et al who demonstrated that children of non-taster mothers had a much higher frequency of dental decay in their 2-3 years old children than did children of taster mothers.^{9,12} This may be the result of the study's selection of ECC children, who are often prone to following their mothers' food and feeding practices. In a study done by Rupesh and Nayak et al and Lin et al when the taste was compared between siblings over half of the sibling groups shared the same taste preference, suggesting a significant genetic makeup among siblings within the same family.^{4,13}

CONCLUSION

The present study proves that there is no relationship between the taste perception of parents to the caries experience of their child. However, more investigation needs to be done to evaluate the same.

It also concludes that the hypothesis concerning perception of taste and caries is supported by the finding that the experience of caries is strongly correlated with the inability to taste the bitterness of the PROP tester strip. The mother and child's taste perception were positively correlated, but the father and child's taste perceptions were not correlated. A statistically significant positive correlation was observed between the experience of caries in parents and children. There was no connection between parents' perceptions of taste and their child's caries experience.

According to the results of the study, the PROP sensitivity test is a useful tool in the future to determine an individual's inherent genetic sensitivity to dietary preferences. The PROP strips are a useful tool for risk assessment to evaluate the oral hygiene and health of parents and children.

The current study's strength is that it is the first to examine the connection between fathers' taste preference and the dental caries experience of his children. The study covered a wide geographic area and included people from both rural and urban areas.

Some restrictions that were uncontrollable and could affect the results are the geographic distribution, risk of dental caries and mitigating factors (e.g., saliva flow rate, drinking fluoridated water). Future research with a greater variety of racial groups, a bigger sample size and ethnic backgrounds is therefore advised.

Future scope for the study include adding siblings to the participant pool, which may allow intergroup comparisons. In order to test perception of taste and caries activity across generations, grandparents can also be included.

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