

# Caries risk in children of Udaipur City, India using genetic taste sensitivity to 6-*n*-propylthiouracil

Payel Karmakar, Ruchi Arora<sup>1</sup>, Chhaya Patel<sup>2</sup>, Bhumi Sarvaiya<sup>3</sup>, Aditi Singh, Mittal Patel<sup>4</sup>

Departments of Pediatric and Preventive Dentistry, Mithila Minority Dental College and Hospital, Darbhanga, Bihar, <sup>1</sup>Darshan Dental College and Hospital, Udaipur, Rajasthan, <sup>2</sup>Goenka Research Institute of Dental Science, Gandhinagar, Gujarat, <sup>3</sup>Ahmedabad Dental College, Ahmedabad, Gujarat, <sup>4</sup>Ex-Private Practitioner, Ahmedabad, Gujarat, India

**Corresponding author** (email: <pkpedo2016@gmail.com>)

Dr. Payel Karmakar, Department of Pediatric and Preventive Dentistry, Mithila Minority Dental College and Hospital, Laheria Sarai, Bihar, India.

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## Abstract

**Aims and Objectives:** Dental caries still remains the single most common disease of childhood. The present study was conducted to test the hypothesis that a higher prevalence of dental caries would be observed among nontaster children compared to medium tasters or supertasters of 6*n* propylthiouracil impregnated filter papers.

**Materials and Methods:** The present study was conducted on a random sample of 600 school children aged 6–12 years in Udaipur city. 6-*n*-propylthiouracil strips were prepared. The food preference questionnaire was filled by the participants, and their decayed missing filled status as well as taste sensitivity to the propylthiouracil impregnated filter papers were noted. The data obtained was then used for statistical analysis using chi square, analysis of variance, and Students *t*-tests with the consult of a statistician using the Statistical Package for the Social Sciences version 17 software.

**Results:** Nontasters had a greater caries experience than the supertasters and medium tasters. Females were found to be more tasters than nontasters. It was also found that nontasters belonged to caries active group more than the tasters.

**Conclusion:** The caries status was higher among the nontaster children with more sweet preference than in taster children and they belonged more to the caries active group.

**Key words:** *Caries, caries active, caries free, propylthiouracil, taste*

## INTRODUCTION

Vargas<sup>[1]</sup> in 1998 suggested ethnicity and socio-economic status as having roles in caries prevalence where as Ernest Newbrun in 1967 described sucrose as the “arch-criminal of dental caries.” Data of sugar consumption per capita with caries prevalence have clearly associated high caries prevalence with high sugar consumption.<sup>[2]</sup> The physiological mechanisms that affect a child’s craving for sweets have not been well documented among the recent studies.<sup>[3]</sup>

6-*n*-propylthiouracil (PROP) and phenylthiocarbamide (PTC) are members of a class of compounds known as “thioureas.” These compounds carry the chemical group N-C5S. This compound gives thioureas their characteristic bitter taste. PROP are of significant interest to taste researchers. They act not only as tools for understanding the genetic transmittance of taste but for gaining knowledge into the seemingly endless variations in taste preferences and food habits. Taste sensitivity to PTC and PROP can

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be determined by the use of threshold methods. The threshold is defined as the lowest concentration of a test solution that can be distinguished from plain water. Tasters have very low thresholds for PROP (i.e., they can taste even at very low concentrations), whereas nontasters have higher thresholds.<sup>[4]</sup> The present study was conducted to test the hypothesis that a higher prevalence of dental caries would be observed among nontaster children compared to children who are medium tasters or supertasters among school going children.

## MATERIALS AND METHODS

### Source of data

The present study was conducted among a random sample of 600 boys and girls aged 6–12 years. In this study, a wide age range of 6–12 years was selected. This is a dynamic phase of growth and represents mixed dentition period in children. A similar age group was also selected by Verma *et al.*,<sup>[5]</sup> Sharma and Hegde,<sup>[6]</sup> and Rupesh and Nayak<sup>[7]</sup> Boys and girls were both considered to take into account the gender differences and differences in the growth milestones, body structure, and hormonal effects. Labelled magnitude scale (LMS) was used for the study. LMS<sup>[8]</sup> provided not only an absolute lower bound at which there is no sensation but also an absolute upper bound labeled “strongly imaginable of any kind.” Both Bartoshuket *al.*<sup>[9]</sup> and Green *et al.*<sup>[8]</sup> believed that preparing the scale in this manner puts different people’s responses on the same metric scale creating a “universal ruler.”

A two-stage random sampling method was followed. The school served as the primary sampling unit and individual child as the unit of enquiry. Children were selected proportionate to the number of children in each school. The children were selected by systematic random sampling.

### Study areas

Information regarding the number of primary and upper primary schools in the Udaipur district was procured from the office of the District Education Officer, Udaipur district.

### Study schedule

A detailed monthly schedule was prepared well in advance by informing and obtaining consent from the authorities of respective institutes.

### Ethical clearance

This proposed study was reviewed by the institutional ethical committee of Darshan Dental College and Hospital, Udaipur city, Rajasthan and clearance was obtained.

### Exclusion criteria

- Children with any systemic disease.
- Children with unstable mental condition.
- Children whose parents did not give consent or failed to bring the consent form on the date of examination.
- Children under any regular medication.
- Children with exaggerated gag reflex.

### Preparation of 6-*n*-propylthiouracil strips

The pure sample of PROP was obtained from the Macleod’s pharmaceuticals, Mumbai. PROP strips were made in the Sukhariya University in The Department of Pharmacology, Udaipur. Whatman filter paper was procured and cut into 2 × 2 cm sizes and were sterilized in an autoclave at 121°C for 15 min. The sterilized strips were weighed and stored in desiccators and the preweight of the papers was noted.

First, in a beaker, PROP (10 mg/ml) was dissolved in 5 ml of ethyl alcohol. Ten previously cut and sterilized Whatman filter paper strips were weighed and then kept in the PROP solution for 1 h for complete absorption of the drug. The strips were removed and were then air dried at room temperature. The weight of the strips after drying was recorded. The preweight and postweight difference was noted down. It was found that in each strip of filter paper approximately 1.6 mg of drug was impregnated.

### PROP sensitivity test

PROP sensitivity test was carried out by placing the PROP impregnated filter paper strips on the dorsal surface of the anterior two-third region of the subject tongue for 30 s.

The participating children were divided into two groups as PROP tasters and PROP nontasters. This was done by their ability to rate the intensity of bitter taste of the PROP impregnated filter paper strips on the LMS.<sup>[8]</sup>

### PROP taster status

The children were subdivided as follows:

- Supertasters are individuals who have low taste threshold to bitter and sweet substances. This

set of population perceives the taste as strongest imaginable and very strong.

- Medium tasters are those who have the ability to perceive bitter and sweet substances in moderation.
- Nontasters are the individuals who have high taste threshold to the bitter and sweet substances. They perceive the taste as weak and barely detectable.

### Clinical assessment and data collection

Clinical examinations were performed by a single examiner (postgraduate student) in well-lighted classrooms. The examination was carried out with the help of a mouth mirror and an explorer. The students present on that particular day were selected for the examination.

### Evaluation of dietary preferences

Food preference questionnaires were distributed among the students. The older children filled the questionnaire by themselves whereas the parents of younger children were asked to fill the questionnaire.

### Recording of caries status

#### Criteria

A tooth was diagnosed as caries when there was catch with No. 23 explorer accompanied by any of the following signs

- If there is softness at the base area of the lesion.
- If there is any opacity adjacent to the region signifying demineralization.
- If there is any soft enamel adjoining to the region. The enamel can be scraped away by an explorer thus indicating its softness.

When in doubt, caries was not recorded as present. Missing teeth included only those teeth that were missing due to caries and those teeth that were indicated for extraction. Teeth that have been extracted for orthodontic reasons, unerupted teeth, or congenitally missing were not included. Teeth were recorded as filled if only they had permanent restorations. Indices were calculated for whole set of dentition, 32 for permanent dentition, and 20 for primary teeth. Thus, the highest DMFT and dmft scores possible were 32 and 20, respectively.

The data obtained was subjected statistical analysis. The analysis was done by using chi square test, analysis of variance test, and Students *t*-test using the SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.

## RESULTS

Two-third of the total population were tasters (supertasters as well as medium tasters), and the remaining one-third were nontasters [Graph 1]. Females belonged more to the taster group, with *P* value less than 0.001 [Table 1]. The total decayed, missing and filled (dmft) value of the taster group was much lower than nontaster children (*P* < 0.001) [Table 2]. There was no statistically significant difference in the dmft/DMFT scores among both the sexes [Table 3]. The distribution of caries free and caries active children among the taster and nontaster children revealed that, in the taster group, only 2.32% were caries active. Caries active children belonged more to the nontaster group than the taster group [Graph 2].

## DISCUSSION

A total of 65.7% children were found to be tasters and 34.3% were found to be nontasters in the present study. This is in accordance with the study reported by Lin<sup>[9]</sup> The results in the present study indicated that, in general, the overall caries status (mean DMFT/dmft) was significantly much higher for non taster children. Lin<sup>[9]</sup> Verma *et al.*,<sup>[5]</sup> Sharma *et al.*,<sup>[6]</sup> and Rupesh and Nayak<sup>[7]</sup> also reported similar results. This could be due to the overall increase in the consumption of sugar rich food by nontaster children than the taster group and

**Table 1: Gender distribution among the various groups of tasters**

Gender	Tasters			Total
	Supertaster	Medium taster	Nontaster	
Female	64 (20.2%)	128 (40.4%)	125 (39.4%)	317 (100.0%)
Male	145 (51.2%)	59 (20.8%)	79 (27.9%)	283 (100.0%)
Total	209 (34.8%)	187 (31.2%)	204 (34.0%)	600 (100.0%)

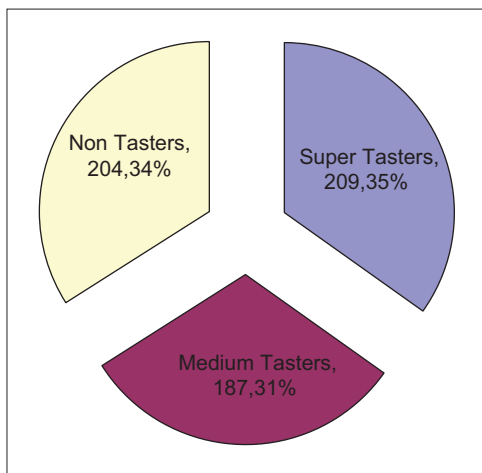
**Table 2: Comparison of mean and standard deviation of dmft among tasters and nontasters**

	Taster status	N	Mean	Std. deviation	Std. error mean	z
D	Taster	396	0.52	0.997	0.050	12.498
	Nontester	204	2.07	2.048	0.143	10.229
M	Taster	396	0.00	0.000	0.000	6.588
	Nontester	204	0.24	0.711	0.050	4.725
F	Taster	396	0.06	0.288	0.014	4.719
	Nontester	204	0.23	0.594	0.042	3.859
Dmft	Taster	396	0.57	1.032	0.052	14.729
	Nontester	204	2.53	2.223	0.156	11.941

their preference of sweet and cariogenic food items. Verma *et al.*<sup>[10]</sup> also found similar results [Table 4].

Among females, tasters accounted for more than one-third of the group. The findings were in accordance to the studies by Duffy *et al.*,<sup>[11]</sup> Drewnowski *et al.*,<sup>[12]</sup> and Hussain *et al.*<sup>[13]</sup> This may be due to the presence of more fungiform papillae among females. Though Feeney and Hayes<sup>[14]</sup> found a contradictory result.

Dietary preferences showed that among nontasters only 29.4% disliked sweets. Fischer<sup>[15]</sup> in 1967 found that PTC tasters showed more dislike toward food items. Looy and Weingarten<sup>[16]</sup> reported that participants who did not like sucrose were nearly all PROP tasters. Loper *et al.*<sup>[17]</sup> found that PROP nontasters tend to have a higher caloric intake. Monneuse *et al.*<sup>[18]</sup> reported that both sex and age determined the preference for sweet taste.



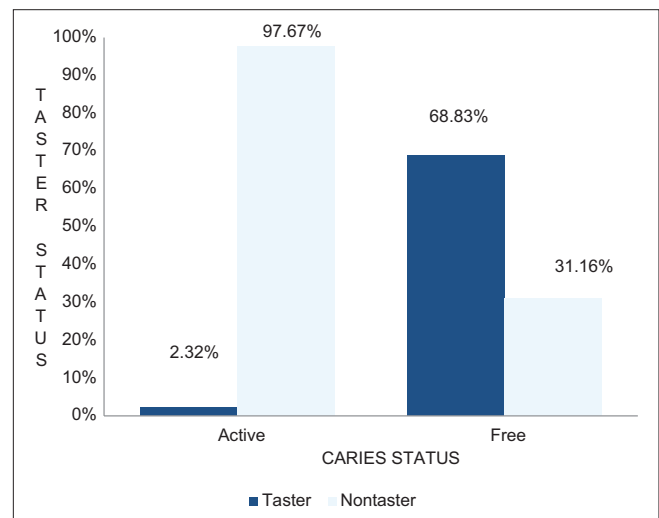
**Graph 1:** Types of tasters based on PROP test

Females among all age groups preferred low sugar concentrations than males.

The present study included 234 children who were caries free and 58 children who were caries active. Most of the caries active children belonged to the nontaster group, and the result was statistically highly significant. A reverse result was observed for caries free children. Thus, the taste preference can be considered to be one of the factor for such distribution of caries free and caries active children. Shetty *et al.*<sup>[19]</sup> also found a similar result.

The limitations of the study were:

- The children falling into a medium category were difficult to categorize, leading to comparable results with the other two groups occasionally.
- Children less than 6 years of age were not selected for the present study due to their inability to



**Graph 2:** Distribution of caries free and caries active children among taster and nontaster groups

**Table 3: Comparison of mean and standard deviation of dmft/DMFT with gender**

	Gender	N	Mean	Std. deviation	Std. Error mean	Significance value	t value
Dmft	Male	317	1.38	1.851	0.104	0.333	0.341
	Female	283	1.07	1.729	0.103		
DMFT	Male	317	0.94	1.274	0.072	0.503	0.678
	Female	283	0.87	1.327	0.079		

**Table 4: Comparison of food preference with taster status**

Taster status	Food preference			Total
	Does not prefer	Prefers occasionally	Prefers frequently	
Taster	142 (35.9%)	138 (34.8%)	116 (29.3%)	396 (100.0%)
Non taster	60 (29.4%)	62 (30.4%)	82 (40.2%)	204 (100.0%)
Total	202 (33.7%)	200 (33.3%)	198 (33.0%)	600 (100.0%)

comprehend the LMS scale.<sup>[5]</sup> However, Hu *et al.*<sup>[20]</sup> and Sachdeva *et al.*<sup>[21]</sup> stated the importance of early identification and introduction of preventive measures.

- The salivary factors in the development of dental caries were not included in this study whereas various studies by different authors such as Bhayat *et al.*<sup>[22]</sup> and Singh *et al.*<sup>[23]</sup> have found increase in salivary *Streptococcus mutans*, decrease in salivary flow rate, and increase in the severity of dental caries.
- In China, Yang *et al.*<sup>[24]</sup> found a correlation between caries status and severity with growth and development retardation in children. The present study did not take these factors into consideration.
- Ingle *et al.*<sup>[25]</sup> found caries incidence to be higher among government school children than private school children. In the present study, caries difference were not compared among schools.

#### Scope of the study:

- There is a rising trend in the dental caries incidences and decrease in the total tooth loss, as seen from a study conducted between 1990 and 2010 by Kassebaum *et al.*<sup>[26]</sup> PROP test, thus, can be carried out in the mixed dentition period and preventive measures can be undertaken accordingly.
- Scope of the study also includes consideration of hormonal factors. Bennadi *et al.*<sup>[27]</sup>
- Socioeconomic factors and basal metabolic rate (BMR) can also considered in further studies.

## CONCLUSION

The caries status was higher among the nontaster children with more sweet preference than in the taster children. Females belonged to the taster groups with a lower caries experience. Caries active individuals were more in the nontaster group whereas the caries free individuals more in the taster group.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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