Bmi And Sugar Intake Probable Predictors Of Caries Risk In Children

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Abstract

Dental caries is influenced by a complex interplay of genetic and environmental factors, including dietary habits. Previous reports have characterized the influence of genetic variation on taste preferences and dietary habits.
The earliest references to the connection between sugar and dental caries dates back to the middle of the fifteenth century, when sugar was a scarce luxury enjoyed only by nobility. Queen Elizabeth in 1598 was noted by a German traveler named Hentzer to have black teeth. It was attributed by Hentzer to her high sugar consumption.

Keywords: Basal metabolic index (BMI), dental caries, sugar intake, DMFS, dmfs, T1R genes

INTRODUCTION:

A significant relationship of sugar frequency to dental caries was found by **Anderson CA et al (2009)** [1]. An increase in carbohydrate (mainly sugar) definitely increases the caries activity was concluded by Vipeholm Study by **Gustafson et al**[2], that dates back to 1954.

AIM:

To evaluate and statistically analyze the correlation between BMI, sugar intake and Dental caries and to determine the reliability of using BMI and sugar intake to predict caries risk

OBJECTIVES:

1. To correlate dental caries with Body Mass Index (BMI)
2. To correlate dental caries with sugar preference and sugar intake

MATERIAL AND METHODS:

A. **STUDY SETTING**: Outdoor patients of Department of Dentistry
B. DEFINITION OF PROBLEM: Dental caries is a multi-factorial disease which demands correlation with various parameters.
C. DEFINITION OF POPULATION:

6-14 ears old children who had reported to the Out Patient Department and could communicate.

INCLUSION AND EXCLUSION CRITERIA:

1. **Inclusion Criteria:** Healthy children in 6-14 years age group, whose parents had given their consent. And, those who had American Society of Anesthesiologists (ASA) physical status of I to II and stable mental condition and who were not taking any chronic medication were eligible

2. **Exclusion criteria:** Patients with systemic diseases. And those who gave unsatisfactory or ambiguous responses during questioning session.

D. **SAMPLE SIZE:**

122 samples were studied. (54 Males, 68 Females)

E. **SAMPLE DESIGN:**

Patients were selected randomly from the outdoor. Their caries statuses were checked by clinical methods and DMFS/dmfs (as per WHO guidelines) were recorded first to avoid investigator bias. BMI and sugar preferences were then documented.

F. CONTROL REQUIRED OR NOT:

Not required

I. METHOD OF DATA COLLECTION:

Patients were selected randomly from outpatient department as per inclusion and exclusion criteria, irrespective of gender. The procedures were explained to the guardians of the children and their written consents were obtained. Caries experience were noted and after measuring height and weight the sugar preferences and total sugar intake per day was charted.

Decayed Missing, Filled Surfaces (DMFS):

Purpose: To determine total caries experience, past and present, by recording tooth surfaces involved instead of teeth

1. Posterior teeth: Each tooth has five surfaces examined and recorded Facial, lingual, mesial, distal and occlusal.
2. Anterior teeth: Each tooth has four surfaces for evaluation, facial, lingual, mesial and distal.
3. Tooth surface count for a DMFS : Surface of 28 teeth, 16 are posterior (16 x 5 = 80) and 12 are anterior (12 x 4=48). The same criteria for instruments and examination apply as listed for DMFT specific criteria must be predetermined.

dmfs: Purpose: To determine the dental caries experience as shown by the primary teeth present in the oral cavity.

Principles and Rules in Recording DMF Index:

1. No tooth should be counted more than once for decayed, missing, filled or sound and the recording is done separately.
2. Restorations with recurrent decay, should be included as decayed separately.
3. Teeth lost only due to dental caries should be listed as missing and also those teeth which are indicated for extraction.
4. Unerupted teeth, missing due to accident, congenitally missing teeth, tooth extracted for orthodontic reasons are not counted as missing.
5. A tooth having several restorations is counted as one tooth only while recording dt and depending on the number of surfaces filled the DS is recorded.
6. A tooth with one occlusal pit decayed and another occlusal pit filled is considered as decayed tooth in DT and while recording DS both decayed surface and filled surface are recorded separately.
7. While recording DMFS – if anterior tooth is missing due to caries, four surfaces are considered as missing and if posterior tooth is missing five surfaces are considered as missing.
8. A tooth is considered to be present even though the crown has been destroyed due to caries and only the roots are left. In such cases it is considered as 1 missing tooth (MT) while recording DMFT and 5 surfaces as missing surfaces (MS) while recording DMFS.

.The equivalent index for measuring caries in the primary dentition is the def index described by **Grubbel in 1944**. As defined by Grubbel, 'd' stands for decayed teeth, 'e' means indicated for extraction and 'f' stands for filled teeth The nutritional status of children was assessed by anthropometric measurements of weight and height by the researcher. Weight was measured in kilograms using an Equinox analog anthropometric scale with capacity of 150 kg and height was measured in meters with a measuring tape. A single data collection was performed and the children were evaluated without shoes. The height in centimeters and weight in kilograms of each subject was recorded for determining Body Mass Index and nutritional statuses were identified as per revised IAP growth charts published in January 2015.

Sample size calculation:

The number of subjects for this study ideally should be 122.7 ~ 122 with power 86%. (From the different studies done, expected proportion of the patients, amongst the cases had been assumed to be 60%). The formula used for sample size calculation is as follows:-

$$n = \frac{4pq}{L2}$$

Where n= Required sample size
p= 0.122
q = 1 - p
L = Loss % (Loss of information)
Hence, sample size for this study is **justified.**

RESULTS

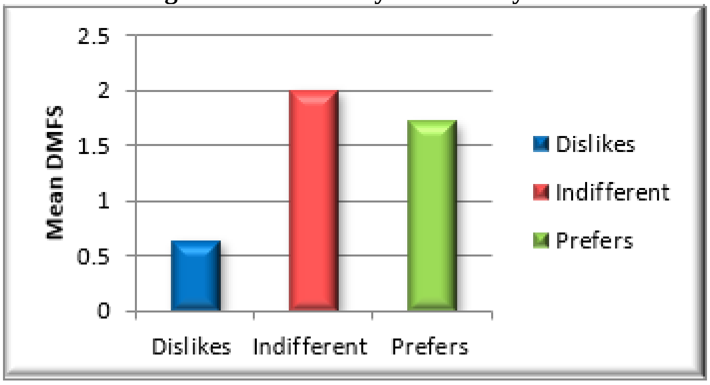
1. Distribution of MEAN DMFS in relation to Sugar intake groups

Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
Dislikes	25	.6400	.8602	0.0000	2.0000	0.0000	0.0426

Indifferent	16	2.0000	2.5820	0.0000	8.0000	0.5000	
Prefers	74	1.7162	2.1231	0.0000	9.0000	1.0000	

p-value: 0.0426, **Statistically significant**

Difference of mean DMFS according Sugar intake groups was statistically significant. Subjects indifferent to sugar/ sweet taste were observed to have the highest DMFS closely followed by the sweet likers.



Graphical representation:1

Table 2: Distribution of MEANS dmfs according Sugar intake groups

Group	Number	Mean	SD	Minimum	Maximum	Median	p-value
Dislikes	21	1.0476	1.2836	0.0000	5.0000	1.0000	0.0007
Indifferent	16	2.4375	4.1468	0.0000	13.0000	0.0000	
Prefers	61	4.0820	3.2828	0.0000	11.0000	3.0000	

p-value : 0.0007**, Statistically highly significant**

Difference of mean dmfs according to Sugar intake groups was statistically significant. Subjects who preferred sugar/ sweet had significantly higher mean dmfs

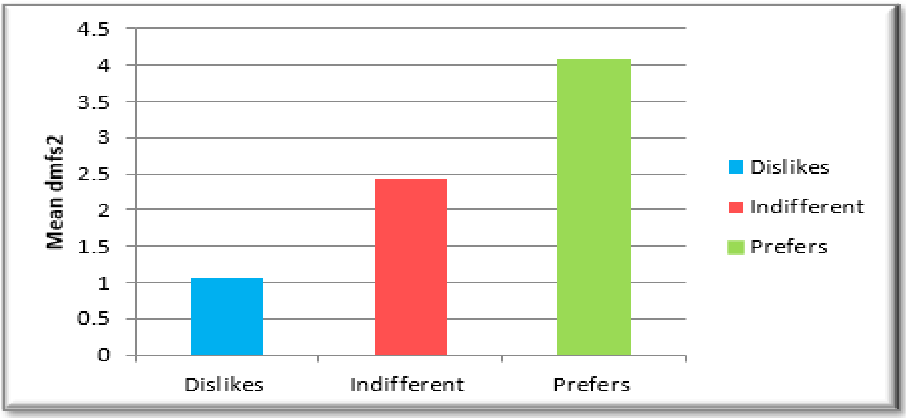


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Table 3: Distribution of BMI Status with Sugar intake/ preference

SUGAR INTAKE

Status	Dislikes	Indifferent	Prefers	TOTAL
At Risk	2	1	4	7
Row %	28.6	14.3	57.1	100.0
Col %	7.1	5.6	5.3	5.7
Borderline	1	0	0	1
Row %	100.0	0.0	0.0	100.0
Col %	3.6	0.0	0.0	0.8
Healthy/Ideal	16	15	56	87
Row %	18.4	17.2	64.4	100.0
Col %	57.1	83.3	73.7	71.3
Overweight	0	1	2	3
Row %	0.0	33.3	66.7	100.0
Col %	0.0	5.6	2.6	2.5
Underweight	9	1	14	24
Row %	37.5	4.2	58.3	100.0
Col %	32.1	5.6	18.4	19.7
TOTAL	28	18	76	122
Row %	23.0	14.8	62.3	100.0
Col %	100.0	100.0	100.0	100.0

Chi-square value: 10.1944; **p-value:** 0.2516, **Statistically not significant. Significant difference can be seen between sugar liking of overweight and underweight children. None of the overweight children are sugar dislikers**

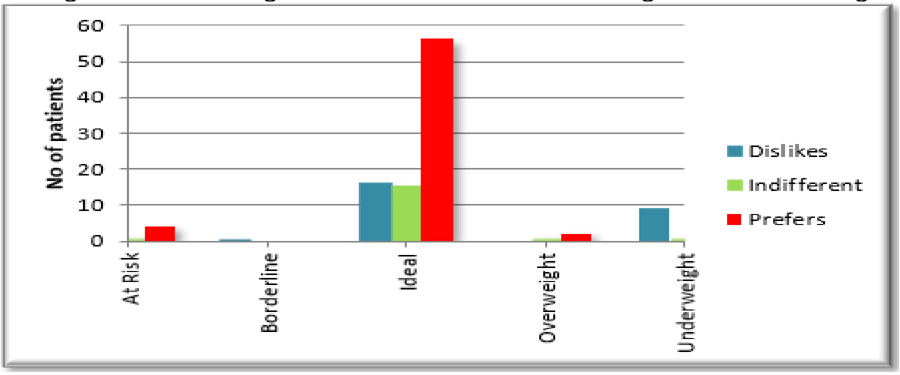

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Table 4: Distribution of MEAN DMFS Status in five BMI groups

Group	**Number**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**	**p-value**
At Risk	7	.1429	.3780	0.0000	1.0000	0.0000	0.3392
Borderline	1	.0000	.0000	0.0000	0.0000	0.0000	
Ideal	83	1.5904	2.2198	0.0000	9.0000	1.0000	
Overweight	1	3.0000	.0000	3.0000	3.0000	3.0000	
Underweight	23	1.6957	1.4904	0.0000	4.0000	2.0000	

p-value: 0.3392**, Statistically not significant**

Difference of mean DMFS between overweight and underweight was statistically significant (p=0.0035).

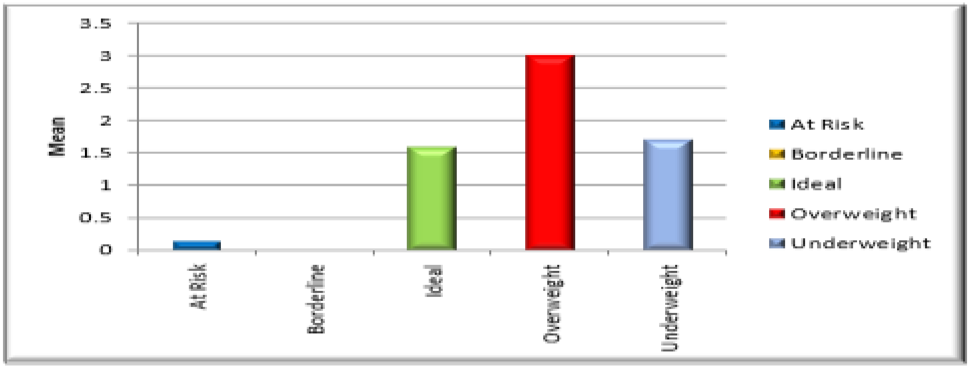

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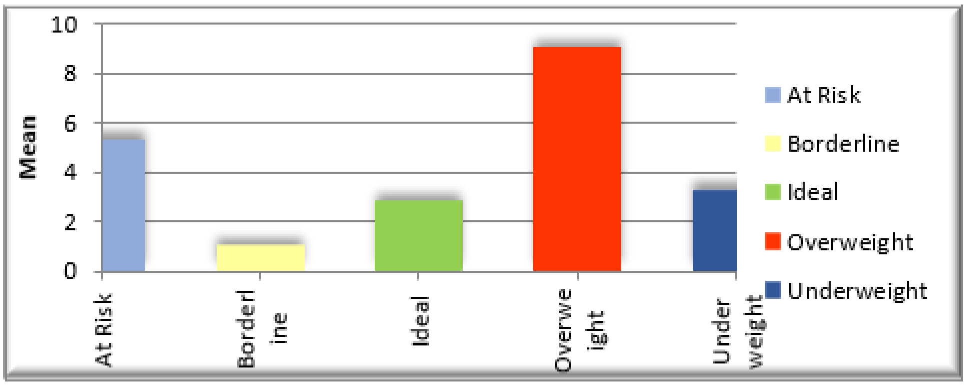
Table 30: Distribution of MEANS dmfs Status in five groups

Group	**Number**	**Mean**	**SD**	**Minimum**	**Maximum**	**Median**	**p-value**
At Risk	7	5.2857	4.3861	2.0000	13.0000	3.0000	0.0351
Borderline	1	1.0000	.0000	1.0000	1.0000	1.0000	
Ideal	71	2.8028	3.2099	0.0000	11.0000	1.0000	
Overweight	2	9.0000	.0000	9.0000	9.0000	9.0000	
Underweight	17	3.2353	2.9692	0.0000	9.0000	2.0000	

p-value: 0.0351**, Statistically significant**

Difference of mean dmfs between overweight and underweight was found to be statistically highly significant (p=0.0001).



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DISCUSSION:

A number of single nucleotide polymorphisms (SNPs) have been identified in T1Rs genes. Some of these have been linked to variation in taste perception of both umami and sweet tastes. Recent studies suggested that two C/T SNPs within the promoter regions of the T1R3 gene (situated at position 1266 and 1572) were associated with sweetness perception (**Fushan et al., 2009**)[3]. Variations of the T2R38 gene were associated with a nutrient intake pattern indicative of healthy eating, or rather fiber consumption and intakes of thiamine, vitamin B6 and folate (**Feeney et al., 2011**)[4].
The risk of developing dental caries, presumably as consequence of higher preference for sugar-containing foods, was linked to variations in bitter perception (**Lin, 2003; Wendell et al., 2010**)[5,6].

In this study 66.7% of overweight children were found to prefer sweets and high sugar diet whereas, 37.5% underweight children were found to be sweet dislikers. The finding was is coherence with the following studies. Habitual consumption of sugars was documented to result in overweight and obesity in individuals (**Eny et al., 2010**)[7]. Caries development (**Kulkarni et al., 2013**)[8] and body mass index, was observed in obese children (**Donaldson et al., 2009**)[9]. Common variants in the CD36 gene have been associated with fat preferences for added fats and oils, with individuals with higher sensitivity to fat perception showing greater liking of these foods (**Keller et al., 2012**)[10].

In the present study difference of mean DMFS between overweight and underweight was 3 and 1.7 which was found to be statistically highly significant (p=0.0035). Difference of mean dmfs 9 and 3.2 between overweight and underweight was statistically highly significant (p=0.0001). Thus, as per the present study dental caries is positively correlated with Body Mass Index when comparing Overweight and underweight children. Though, statistical significance was not observed when all subgroups of population were analyzed based upon BMI. **ALM et al. (2008)**[11] reported in a longitudinal study three main patterns of relationships between dental caries and BMI: 23 of the 48 studies found no association between BMI and dental caries, 17 found a positive relationship between BMI and dental caries, and nine found an inverse relationship. One additional study found dental caries was associated with both high- and low- BMI; that is, a U-shaped pattern, and another found inconsistent patterns across age cohorts; specifically, an association between lower dental caries and high BMI in two age cohorts, and no association in four cohorts. In order to explore possible explanations for these differences in patterns, the results of the 48 studies were septed and evaluated on the basis of the nature of the relationship between caries and BMI.

CONCLUSION:

Knowledge of the genetic predisposition to dental caries can be utilized to allow for prophylactic treatment for patients. Within the study limitations, results from this analysis of a small sample of school children suggest a complex multi-factorial relationship between taste perception, dental caries and other factors like salivary pH, rate of flow of unstimulated saliva, fungiform papillae density, taste preferences and Body Mass Index.

ETHICAL CLEARANCE:

The ethical committee of the institution had approved the thesis proposal. It is hereby declared that all applicable institutional and governmental regulations concerning the ethical use of human volunteers have been followed during this research.

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