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Correlation between Body Mass Index and Dental Caries among 3 to 12 Years Old School Children in Chennai, Tamil Nadu: Cross Sectional Study

Haridoss[3] Kavitha Swaminathan[1]*, Vasanthakumari Anandan[2] and Selvakumar[3]

[1]*Associate Professor, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, Sri Ramachandra Institute of Education and Research, Chennai, India*

[2]*Professor and Head of the Department, Department of Pedodontics, Adhiparasakthi Dental College and Hospital, Melmaruvathur, India*

[3]*Associate Professor, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, Sri Ramachandra Institute of Education and Research, Chennai, India*

***Corresponding Author:** Kavitha Swaminathan, Associate Professor, Department of Pedodontics and Preventive Dentistry, Faculty of Dental Sciences, Sri Ramachandra Institute of Education and Research, Chennai, India.

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Abstract

Background: Diet is a deeply ingrained element of a person's life. Children's dietary habits are a significant contributor to obesity and dental caries. Dental caries during childhood continues to be a significant public health concern, while childhood obesity is increasingly being cited as a major public health problem. The aim of the study was to assess the correlation between body mass index and dental caries in children aged 3 to 12 years who attended both government and private schools in Chennai, Tamilnadu, India.

Materials and Methods: A Sample of 2200 children between 3 to 12 years. Dental caries was clinically recorded. The WHO diagnostic criteria for BMI percentile was used to evaluate and record the dental caries clinically.

Results: The Mann-Whitney and the Kruskal-Wallis tests were used for univariate comparisons. The mean values between overweight category and underweight category showed that there were no significant differences.

Conclusion: The findings of the study shows that there was no association could be between BMI-for-age and dental caries in children in both primary and mixed dentition. This Relationship should be investigated further by longitudinal studies.

Keywords: *Obesity; Over Weight; School Children; Dental Caries and Body Mass Index*

Abbreviations

BMI: Body Mass Index for Age

Introduction

Obesity and Dental Caries are multifactorial conditions both having a comprehensive aetiology and factors such as dietary habits and available nutrients, oral hygiene or saliva [1]. The excessive food intake or inadequate physical activity is considered as reason for obesity [2]. It has been suspected that the interaction of genetic, environmental and behavioural factors could lead to childhood obesity [3]. Changes in Diet and lifestyle such as increase in wealth and access to carbohydrate-rich high caloric food and drinks could be attributed to the increase in prevalence of both dental caries and obesity [4]. It has been shown that in developed countries there is an increase in the prevalence of obesity in magnitude from 2 - 5 times while it is up to almost 4 times in developing countries [5]. Several studies to

date have evaluated the relationship between tooth decay and obesity; however, the results have always been different and sometimes contradictory [6-9]. Though some of the studies have reported that the prevalence of obesity in India is high, its relationship with dental caries is appears to be scanty [10,11]. Hence this study assessed the correlation between Age-specific body mass index and dental caries in children aged 3 to 12 years.

Materials and Methods

A cross sectional observational study was conducted among school going children between 3 to 12 years in Chennai. Both government and private schools were chosen for the study so that children from all socioeconomic levels can be covered. The ethical Approval and safeguarded all principles of the Helsinki declaration was obtained from the Sri Ramachandra Institute of Higher Education and Research, Chennai. Written informed consent for involvement in the study was obtained from the parent or guardian.

One government and one private school were randomly selected. A pilot study was done. The prevalence of dental caries was 69% as observed in our pilot study, based on which the sample size was determined (1067) using the Epi Infoversion 6 statistical package at 95% confidence interval. Eight schools (4 Government and 4 Private Schools) were covered in the study and all the children from each class were examined. Thus, a total number of 2,200 children aged 3 to 12 years were examined. The children were then divided into two groups Based on their age as group I-Primary dentition (3 to 5 yrs) and group II- Mixed dentition (6 to 12 yrs).

Children with long standing systemic illness, physical or mental disability and children under any medication within the past 2 months were excluded from the study. A trained examiner who was qualified for clinical assessment during numerous educational and clinical sessions in the department of Pedodontics and Preventive dentistry examined the children for presence of dental caries. All the instruments were sterilized and packed in sufficient quantities for each day of work.

Children were made to stand straight and their height and weight was recorded in light clothing without shoes. Height was measured using a standard height chart and weight using an analogue weighing scale. All the findings were entered in a data sheet for further analysis.

The Body Mass Index (BMI) was calculated using the height and weight recorded. The formula used to calculate BMI= Weight in kg/ (Height in m^2).

Children in each age group were further subdivided into four sub-groups based on their Body Mass Index. (BMI-for-age) developed by National Centre for Health Statistics in collaboration with the National Centre for Chronic Disease Prevention and Health Promotion (2000), as Underweight -- BMI-for-age less than fifth percentile, Normal-- BMI-for-age greater than or equal to fifth percentile and less than 85th percentile, At risk of overweight-- BMI-for-age greater than 85th percentile but lesser than 95th percentile, Overweight-- BMI-for-age greater than 95th percentile. None of the children in this study belonged to “at risk of overweight” category. So, this group was omitted.

The evaluation of dental caries was followed by the diagnostic criteria suggested by the World Health Organization (1997) [12]. A modified WHO profoma was used to record the data regarding the general information and Dunning type III clinical examination was used for examination [13]. Intra-oral examination was done visually with the aid of mouth mirror and probe and the findings were recorded as decayed, missing and filled using the DMFT/deft index. Since children were in different stages of the mixed dentition, naturally exfoliated primary teeth were not taken into consideration.

Kappa statistic was used to determine the Intra - examiner reproducibility and which was 0.85. The intra-examiner reproducibility was assessed by asking the teacher to randomly send any 5 students who were examined the preceding day and these children were reinspected.

Statistical analysis

The data collected was tabulated and was analysed by SPSS 13.0 Software. However, oneway analysis of variance and Kruskal-Wallis tests were used for co-relating obesity and dental caries. A level of $P < 0.05$ was considered statistically significant and $P < 0.001$ was taken as highly statistically significant.

Results

Out of the total population, 33.2% of children were between 3 - 5 years and 66.8% of children were between 6 - 12 years. Out of the total population between 3 - 5 years, 52.6% males and 47.3% females while as 51.9% of males and 48.1% of females were between 6 - 12 years. In Group I we had 45.1% of children studying in government school and 54.9% in private school and in group II 45.0% children were from government schools and 55.0% from private school (Table 1).

Group	Schools	Male	n %	Female	n%	Total	n %
Group I 3 - 5 years	Govt.	179	46.6%	150	43.4%	329	45.1%
	Private	205	53.4%	196	56.6%	401	54.9%
	Total	384	100.0%	346	100.0%	730	100.0%
Group II 6 - 12years	Govt.	351	46.0%	318	45.0%	669	45.0%
	Private	412	54.0%	389	55.0%	801	55.0%
	Total	763	100.0%	707	100.0%	1470	100.0%

Table 1: *Distribution of subjects according to gender and schools.*

Table 2 shows that among the 730 children who were between the age of 3 - 5 years, 594 (81.4%) children were under the normal weight category, 78 children (10.7%) were overweight and 58 (7.9%) were underweight. Among the 1470 children who were between 6 - 12 years, 958 children (65.2%) had a normal weight, 220 children (14.9%) were overweight and 229 children (19.9%) were underweight.

Group	BMI	Govt	n %	Private	n %	Total	n %
Group I 3 - 5 years	Over Weight	28	8.4%	50	12.5%	78	10.7%
	Normal Weight	279	84.3%	315	79.0%	594	81.4%
	Underweight	24	7.3%	34	8.5%	58	7.9%
	Total	331	100.0%	399	100.0%	730	100.0%
Group II 6 - 12 years	Over Weight	78	11.7%	142	17.7%	220	14.9%
	Normal Weight	484	72.3%	474	59.2%	958	65.2%
	Underweight	107	16%	185	23.1%	292	19.9%
	Total	669	100.0%	801	100%	1470	100.0%

Table 2: *Distribution of subjects according to body mass index and school category.*

Mean DMFT/deft value in Group I (4.26 ± 3.81) is significantly higher than the mean value in Group II (2.47 ± 2.20) ($P < 0.0001$). Mann- Whitney U- test- used to calculate the P- value (Table 3). Table 4 shows the BMI and Dental Caries in both ages group. The mean value in overweight group is significantly lower than normal weight group ($P < 0.0001$). Further, the mean value in underweight group (2.74 ± 3.92) is significantly lower than normal weight group ($P < 0.0001$). However, there is no significant difference in mean values between overweight category and underweight category ($P = 1.00$). Kruskal-Wallis One- Way ANOVA was used to calculate the P value.

Group	Mean ± S.D	P Value
Group I 3 - 5 years	4.26 ± 3.81	< 0.0001 (sig)
Group II 6 - 12 years	2.47 ± 2.20	< 0.0001 (sig)

Table 3: *Mean standard deviation and test of significance of mean values between group I [Age 3-5 Years] and group II [Age 6 - 12 Years].*

Group	BMI	Mean DMFT	S.D	P Value
Group I 3 - 5 years	Over Weight	1.85	2.08	<0.0001 (sig)
	Normal Weight	4.73	3.81	
	Underweight	2.74	3.92	
Group II 6 - 12 years	Over Weight	1.00	0.00	< 0.0001 (sig)
	Normal Weight	2.42	2.09	
	Underweight	4.41	3.86	

Table 4: *BMI and dental caries.*

Discussion

Childhood obesity is a public health problem which is of increasing importance in the urbanized world [14]. The children with overweight/obesity are associated with numerous health problems [15]. The studies exploring the relationship between caries experience and BMI reported conflicting results [6,7,16,17]. The objective of the study was to investigate the relationship between BMI and dental caries prevalence among schoolchildren aged 3 to 12 years.

In the present study, in both group I and group II majority of the children were in the normal weight group. In a recent obesity update 2017, the obesity percentage population of aged 15 years in India is 5% whereas in United States of America it is 38.2% [18].

It has been stated that dietary deficiency occurring early in life of a child, when the primary teeth are being formed, will enhance the occurrence of caries 3 to 4 years later [19]. The ability of the tooth to withstand caries attack has been reduced if the teeth had nutritional harm during essential stages of their growth [20]. ACS., *et al.* reported the children with early childhood caries (ECC) weighed significantly less than age and sex matched caries-free children [21]. In the present study, in Group I, the underweight children showed a mean deft value of (2.74 ± 3.92) which was significantly lower than normal weight group (4.73 ± 3.81). In Group II, underweight children had a mean value of 4.41 ± 3.86 whereas the normal weight children had a lesser DMFT value of 2.42 ± 2.09. This difference was statistically significant in both the groups.

In our study there is no difference in caries experience between the normal and overweight children. The finding of the present study is in Consistent with studies done by Tuomi [22], Chen., *et al.* [23], Patricia Vasconcelos., *et al.* [7] and Samara Pinho Assi., *et al* [24].

Contradicting to the results of our study where primary teeth had less caries experience in the underweight children than normal weight children, a study in Peruvian children reported that malnourished children have higher dental caries prevalence in primary dentition and delay in tooth eruption [25]. There was a global association between children with obesity and dental caries reported by a systematic review [26].

When considering the results presented, there are a few limitations inherent to this study. Since overweight children are not very common in India compared to Western countries, it is difficult to collect more number of children who are overweight in a particular sample population. Moreover, the BMI values which were used were not put forth based on the Indian population. This could have caused

a variation in the distribution of samples because many of the normal weight children would fall under the overweight category, if the BMI values were given specific for Indian population. Another limitation of the study, which may have underestimated caries experience, is that bitewing radiographs were not used to identify proximal caries. The initial proximal caries detected by bitewing radiographs would have altered the mean caries experience in all the groups.

Conclusion

From the findings of this study, the following conclusions can be made:

- The overall caries experience is higher in the primary dentition compared to the mixed dentition.
- Overweight children had a less caries experience than the other two sub groups in both primary and mixed dentition.
- In primary dentition, both underweight and overweight children had less caries experience than normal weight children.
- In mixed dentition, underweight children showed a greater caries experience than overweight and normal weight children.
- The results from the study confirm that there is no association could be assigned between BMI-for-age and dental caries so advance research could be essential to address factors specific to overweight in children might be preserving against dental caries in primary and mixed dentition. A study involving a larger sample size with radiographic investigations and a BMI more specific for Indian population is needed in future to evaluate the correlation between Body mass index and dental caries.

Conflict of Interest

No conflict of interest exists.

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