Assessment of the Consequences of Dental Caries on the Body Mass Index in Children using the Pufa Index

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ABSTRACT

Introduction: Dental caries continues to exert a significant influence on children's overall health and the effect of untreated dental caries impacts dental health more than the presence of caries itself.

Aim: To investigate the effect of consequences of untreated dental caries on Body Mass Index (BMI) in children using PUFA/pufa index (pulp involvement, ulceration, fistula, and abscess).

Materials and Methods: A total of 400 school children aged 5-12 years were divided into two groups-5 to 8 years (Group 1) and 9 to 12 years (Group 2). Selected children were examined for the presence or absence of pulpal involvement, ulceration, fistula and abscess using the PUFA/pufa index, and further subdivided into with PUFA/pufa> 0 and PUFA/pufa =0. Children's BMI score

was calculated using weight in kg and height in meters. BMI scores for children with PUFA/pufa=0 and PUFA/pufa>0 were compared with independent t-test. Correlation between BMI scores and PUFA/pufa score was analysed by using Pearson's correlation coefficient for both age groups.

Results: Mean BMI score of children with PUFA/pufa>0 in both the age groups (14.69 and 14.93) was significantly lesser than the BMI score of children with PUFA/pufa=0 (21.69 and 22.57), (p<0.001). Correlation between BMI and PUFA/pufa score was highly significant in the Group 1 (r=-0.345) whereas, that in the Group 2 was significant (r=-0.234).

Conclusion: Children with the consequences of longstanding dental caries had significantly negative effect on BMI. This negative effect was higher in younger children as compared to the older age group.

INTRODUCTION

Dental caries remains the most common childhood disease despite advances in dental and medical field [1]. Recent National Oral Health Survey in India has found prevalence of caries in children to be 51.9% at the age of five years, which increases with age [2]. The worldwide prevalence of untreated dental caries is 17.5% [3]. In India, 10.7% to 65.3% of dental decay remains untreated [4-9]. Untreated dental caries is shown to affect the child's quality of life [4], nutrition [10], and educational performance [11].

Age and gender specific BMI is a reliable measure of assessing undernutrition or obesity in children [12]. Various parameters like nutrition, [13] hereditary factors [13] the anthropometric measures of early life [14] social [15], physical [16], dietary [13] and environmental factors [17] govern the increase or decrease in BMI score of an individual. Chronic malnutrition during the early years could predispose to dental caries, reduced salivary flow, calculus formation and decreased growth [18]. Numerous studies have been conducted by various researchers assessing the effect of dental caries using DMFT index on BMI of children. Some authors have reported that higher DMFT score is associated with higher BMI scores, [19-24] whereas, other studies have shown inverse relationship [25-30]. In spite of availability of considerable literature; the results remain inconclusive in this regard.

The principal limitation of the DMFT/dmft index is that this index is unsuccessful in measuring the clinical sequelae of untreated dental carious lesions such as pulpal involvement and dental sepsis [31]. The DMFT index provides the sum of decayed, missing and filled teeth present without a detailed indication of the severity of existing carious lesions. A child with higher DMFT index may not necessarily suffer the consequences of untreated dental caries than a child with a single abscessed tooth. These consequences like pulp involvement, ulceration, fistula or abscess can have more adverse effects than the presence of caries itself [6]. Thus, the PUFA index

was developed in Philippines National Oral Health Survey (2006) by Monse B et al., to address consequences of such untreated carious lesions [31]. This index showed similar reproducibility as that for DMFT/dmft indicating its reliability for use [31]. PUFA/pufa index has applicability to both primary and permanent dentition [32]. Hence the PUFA index was used in our study to assess the consequences of dental caries.

Limited research has been conducted on effects of longstanding untreated dental caries on BMI of children. Hence, this study was conducted to assess the association of consequences of untreated dental caries, as measured by using PUFA index, on BMI in children.

MATERIALS AND METHODS

This cross-sectional study was conducted between June to August 2016 in schools of Thane District, Maharashtra, India. The study was approved by the Institutional Ethical Committee. Informed consents were obtained from the parents of selected children participating in the survey. A convenience sample was used for selection of schools and stratified sampling technique was used for subject selection. A total of 800 children between age 5-12 years were examined by a single examiner under illuminated light using diagnostic instruments. A total of 400 children between the age group of 5-12 years with presence of caries were selected to participate in the study. Caries free children and children with significant systemic illnesses or nutritional deficiency were excluded.

Substituting the values in the formula [33], a sample size of 370 was derived. However, an additional 10% were included in the study [N=407 (rounded off to 400)] in order to compensate for potential refusals. The sample size of the present study was thus estimated to be 400 at 95% confidence interval.

Calculation of PUFA/pufa

Presence of oral conditions and infections resulting from untreated caries was recorded as pufa for primary dentition and PUFA for

permanent dentition, where P/p = visible pulpal involvement; U/u = ulceration of the oral mucosa due to root fragments; F/f = fistula; A/a = abscess. The score of 1 was assigned to the tooth for presence of any of the conditions and 0 for its absence. The total score was obtained by adding the individual scores separately for primary dentition (ranging from 0 to 20) and permanent dentition (ranging from 0 to 32).

The selected children were divided in two groups; Group 1-children between 5-8 years and Group 2-children between 9-12 years. They were further subdivided into Group 1A and 2A (PUFA/pufa>0) and Group 1B and 2B (PUFA/pufa=0) [31].

Calculation of BMI

Height in metres and weight in kilograms of all selected children were measured using standardised scales. Children were lightly dressed requiring no adjustments for clothing. BMI was calculated using the following formula:

$$BMI = \text{Weight in kg}/(\text{Height in m})^2$$

BMI percentile was computed using Center for Disease Control and Prevention, Atlanta, USA (CDC) growth charts with the normal range of BMI lying between 10-85 percentile [34].

STATISTICAL ANALYSIS

Statistical analysis of collected data was performed by using statistical software SPSS statistics version 20.0 (IBM Corporation, Armonk, NY, USA). BMI scores for children with PUFA/pufa=0 and PUFA/pufa>0 were compared with independent t test separately for both age groups. Correlation between BMI scores and PUFA/pufa score was analysed by using Pearson's correlation coefficient.

RESULTS

Out of total 227 children in the Group 1, 81 (35.7%) were males and 146 (64.3%) were females. Mean age of males and females was 6.8 years and 6.9 years, respectively. Out of 173 children in Group 2, 60 (34.7%) were males and 113 (65.3%) were females. Mean age of males and females was 10.1 years and 10.3 years respectively [Table/Fig-1].

[Table/Fig-2] shows the distribution of total samples according to PUFA/pufa>0 and PUFA/pufa=0.

Groups	Males	Females	Total
Group 1 (5-8 years)			
Frequency	81 (35.7%)	146 (64.3%)	227
Age in years (mean)	6.8	6.9	
Group 2 (9-12 years)			
Frequency	60 (34.7%)	113 (65.3%)	173
Age in years (mean)	10.1	10.3	

[Table/Fig-1]: Distribution of sample by age and sex.

Age	Group 1 (n=227)		Group 2 (n=173)		Total
	PUFA>0 Group 1A	PUFA=0 Group 1 B	PUFA>0 Group 2A	PUFA=0 Group 2B	
n (%)	114 (50.2%)	113 (49.8%)	86 (49.7%)	87 (50.3%)	n=400
Age in years (mean)	6.9	6.6	10.4	10.3	8.3
Males [n(%)]	41 (18.0%)	40 (17.6%)	30 (17.3%)	30 (17.3%)	141
Females [n(%)]	73 (32.2%)	73 (32.2%)	56 (32.4%)	57(33%)	259

[Table/Fig-2]: Distribution of total sample according to PUFA/pufa>0 and PUFA/pufa=0.

[Table/Fig-3] presents distribution of each component of PUFA/pufa in children in Group 1A and 2A. In total of 114 children from Group 1A, all 114 had pufa> 0 with a mean pufa score of 2.4 and 37 children had PUFA>0 with a mean PUFA score of 1.3. In group 2A out of 86 children, 26 children had pufa>0 with mean pufa score of 2.4 and 69 children had PUFA>0 with a mean PUFA score of 2.01. Group 1B and 2B included children with PUFA/pufa=0 hence the mean PUFA/pufa score was 0.

Group	Group 1A (5-8 years) n=114			Group 2A (9-12 years) n=86		
	Frequency of children	Frequency of teeth	Mean	Frequency of children	Frequency of teeth	Mean
P	35 (30.7%)	47 (95.9%)	1.342	65 (75.6%)	135 (97.1%)	2.076
U	0	0	0	0	0	0
F	0	0	0	0	0	0
A	2 (1.8%)	2 (4%)	1	4 (4.7%)	4 (2.9%)	1
p	100 (87.7%)	263 (95.3%)	2.63	25 (29.1%)	62 (98.4%)	2.48
u	1 (0.9%)	1 (0.4%)	1	0	0	0
f	6 (5.3%)	6 (2.2%)	1	0	0	0
a	7 (6.1%)	7 (2.5%)	1	1 (1.1%)	1 (1.6%)	1
pufa	114	277	2.421	26	63	2.423
PUFA	37	49	1.324	69	139	2.014

[Table/Fig-3]: Mean PUFA or pufa experience of children with PUFA / pufa>0 in both the age groups.

In 5-8 years group, the mean BMI score of children with PUFA/pufa>0 (14.69) was significantly lesser than the BMI score of children with PUFA/pufa=0 (21.69), (p<0.001). Similarly in 9-12 years group, the mean BMI score of children with PUFA/pufa>0 (14.93) was significantly lesser than the BMI score of children with PUFA/pufa=0 (22.57), (p<0.001), [Table/Fig-4].

Groups	N	BMI		t value	p-value
		Mean	Std. Deviation		
1A	114	14.69	1.36	29.873	<0.001**
1B	113	21.69	2.08		
2A	86	14.93	1.26	24.223	<0.001**
2B	87	22.57	2.64		

[Table/Fig-4]: Comparison of BMI scores (Mean, SD) between children with PUFA/pufa>0 and PUFA/pufa=0 in both the age groups.
(p<0.05-Significant*, p<0.001-Highly significant**)

Correlation between BMI and PUFA/pufa score was evaluated for both age groups [Table/Fig-5]. In group 1 low negative correlation was found (r=-0.345). Similarly, negligible correlation was found in group 2 (r=-0.234).

	PUFA score (5-8 years)	PUFA score (9-12 years)
r (correlation coefficient)	-0.345	-0.234
p-value	<0.001**	0.030*
Significance	Highly significant	Significant

[Table/Fig-5]: Correlation between PUFA / pufa score and BMI for both the age groups.
(p<0.05-Significant*, p<0.001-Highly significant**)

DISCUSSION

The present cross-sectional study was conducted to assess the relationship between longstanding untreated dental caries and BMI in 5 to 12 year old children.

As WHO recommends ages of 5, 12, 15 years as index ages for oral health surveys for children [35], we included children between age 5-8 years and 9-12 years. The first group corresponds to the eruption of permanent first molars and incisors along with presence of the primary dentition. Next age group corresponds to eruption

of the premolars following the loss of primary molars [36]. Also, the older age group children were considered to be more efficient in maintaining their oral hygiene as compared to those in younger age group [37].

The results of the present study revealed that, an increase in pufa/PUFA score had a significant negative impact on the BMI of children of both the age groups. This is in comparison to the study by Benzian H et al., who reported that increasing PUFA score significantly affected BMI in 12 year old children [38]. Previous research which did not show relationship between dental caries and BMI [39-41] was probably due to the use of DMFT index which only indicates the presence of caries rather than the effects of dental caries. Hence it may be recommended that the PUFA index should be used alongside the DMFT index in epidemiological studies [31].

We observed that the correlation between the BMI score and PUFA/pufa score was slightly higher in the younger age group than the older age group children. Our results are similar to the report by Dua R et al., [1]. In general, the prevalence of dental caries is also reported to be higher in younger children as compared to the older ones [42-44]. The lower manual dexterity of the younger children and increase in consumption of cariogenic food may account to increase in carious experience of the younger children [37,45].

As compared to the western countries, the awareness of parents regarding dental hygiene practices and importance of preventive dental care in India is low [45]. This leads to poor oral health of the child that subsequently affects the general health. Parental education regarding the dietary modifications, utilisation the dental services for their children, individual counselling, dental health education emphasising use of preventive strategies like fluoridated dentifrices and daily oral hygiene practices will aid in primary prevention of the disease.

At the secondary level, early diagnosis of dental caries and prompt treatment will aid in limiting the consequences of untreated caries. However, if the consequences are manifested, emergency treatment of the same and efficient rehabilitation are recommended at the tertiary level to restore the quality of life of the child [46].

LIMITATION

A stratified sampling technique could have been used instead of a convenience sampling for selection of schools. Also a follow up assessment of children one year after management of the consequences of caries and effective implementation of preventive strategies may be done. Improvement in BMI if present during the follow up would help in establishing the effect of caries on general health.

CONCLUSION

Hence we could conclude from this study that children who did not suffer from the consequences of dental caries had significantly higher BMI than children with presence of consequences of longstanding caries. Also longstanding dental caries had a significantly negative effect on BMI of younger children as compared to the older age group. The routine use of PUFA in clinical practice would help us to identify children in high risk caries group which in turn will aid in modifying the preventive and follow up strategies employed.

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