Relationship between Body mass Index, Dental caries and Socioeconomic Status in a Population of 4-14 year Old Children in Udaipur City.

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Abstract:*Dental caries and childhood obesity epidemics are multifactorial complex disease and socioeconomic status is a common etiological factor in their causation.*
Aim*- Aim of the study was to explore the relationship between body mass index, dental caries and socioeconomic status in 4 to 14 year children in udaipur city.*
Materials and Methods *– 400 children belonging to age group 4-14 years were studied. Demographic data and anthropometric measurements were taken and BMI for age was calculated. Dental examination was carried out using WHO guidelines. Socioeconomic status was determined according to Prasad's socioeconomic status scale.*
Results *- Prevalence of dental caries was found to be 76.5%.Prevalence of caries was maximum in subjects in underweight BMI category (86.43%).Prevalence of caries was maximum among subjects in lower socioeconomic classes (87.67%). Mean deft + DMFT of underweight subjects were significantly higher (p=0.01) in other weight categories thereby showing association between BMI category and mean deft+DMFT. Mean deft+DMFT of subject in lower middle class socioeconomic strata were significantly higher(p=0.05) compared to other SES class.*
Conclusion *– The study indicated an increased prevalence of caries in children who were underweight and belonged to lower socioeconomic status.*
Keywords*-Body mass index, Dental caries, Socioeconomic class.*

I. Introduction

Childhood obesity and dental caries are global health problems that have shown a rising trend over the last few decades.[1] According to WHO estimates, more than one billion people are overweight worldwide of whom almost 300 million are obese.[2] Until recently, childhood obesity was considered a problem of the affluent countries, but today the problem is starting to appear even in developing countries.[3] One of the adverse health consequences of pediatric overweight is metabolic syndrome. It is characterized by hypertension, abnormal lipid profile, obesity which is also a risk factor for cardiovascular diseases.[4]

However, malnutrition is also known to produce high morbidity and mortality and considering its effect on oral cavity, malnutrition is shown to have pre-eruptive and post eruptive effects.[5] It is also associated with enhanced susceptibility to caries because of impaired saliva secretion due to salivary glandular hypofunction and saliva compositional changes.[6]

Body mass index (BMI) is an index that measures height for weight, which is frequently used to categorize underweight, overweight, and obese individuals.[6] It is also known that a principle predictor of nutritional status and dental caries is socioeconomic status. A child's economical background is known to influence the probability of seeking dental care.[7] Both underweight/malnutrition and overweight/obesity have significant adverse implication for health.[6]India is a developing country having diversities not only in social and cultural factors but also in food habits. But due to scarce literature in this regards, this study was carried out to determine the relationship between body mass index, dental caries and socioeconomic status in children of 4-14 years of age in Udaipur city.

II. Material and Methods

A cross sectional study was conducted on 400 children belonging to age group 4-14 years. The study population included children consulting to outpatient section of department of pedodontics and preventive dentistry at Darshan Dental College and Hospital, Udaipur.

Children with following criteria were excluded from the study:
➢ Children or parents not willing to participate.
➢ Medically compromised children.
➢ Patients on long term medication.
➢ Children undergoing orthodontic treatment.

Tools for Data Collection:

Clearance from ethical committee of Darshan Dental College & Hospital was obtained. Consent was taken from parents of children accompanying their wards to the department and was duly explained about confidentiality of procedure. Demographic data including age, Sex and family income were obtained from parents prior to the anthropometric measurement.

Height and weight measurement were recorded for all the children who participated in the study. Weight of each child on barefoot was measured to the nearest 0.1 kg using a manual weighing machine. Height was measured to the nearest 0.1 cm using a stadiometer. For calculation of BMI the following formula was used: - Weight in kg/ (height in meters)[2]. The children were then classified into four categories using age and gender specific criteria recommended by Center for disease Control and prevention.[4]

1) Underweight – defined as BMI for age less than fifth percentile
2) Healthy – defined as BMI for age greater than or equal to 5th percentile and less than 85th percentile.
3) At risk of overweight – defined as BMI for age greater than or equal to 85th percentile and less than 95th percentile.
4) Overweight – defined as BMI for age greater than 95th percentile.

Socioeconomic status was determined using Prasad's classification given in 2014 which measures the per capita income of both rural and urban community.[8] Dental examination of children was done visually under natural light using plain mouth mirror and CPI probes seated upright in a chair. The instruments were sterilized by autoclave. One examiner examined all children. Diagnosis of dental caries was done by measuring DMFT and deft according to WHO guidelines (WHO, 1997). [9]

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD

III. Results

Basic Characteristic of Study Population.

Mean age of subjects was 10.04 ± 2.84. With respect to BMI it was found that maximum number of subjects were of normal category (N= 229) and from middle class. A total of 140 subjects were categorized as underweight and 24 were at risk of overweight. While 7 were obesed. Prevalence of dental caries was found to be 76.5%.

Association of Prevalence of Caries with Different Demographic Variables.

Mean age and mean BMI of subjects with caries were lower than those without caries. Prevalence of caries was maximum in subjects in underweight BMI category. Statistically this difference was significant. ($p<0.05$). On considering socioeconomic strata prevalence of caries was maximum among lower class. Statistically this difference was significant when compared with other SES classes.

Association of DMFT+deft with different Demographic Variables.

Mean deft + DMFT of underweight subjects were significantly higher ($p=0.01$) in other weight categories thereby showing association between BMI category and mean deft+DMFT. Mean deft+DMFT of subject in lower middle class socioeconomic strata were significantly higher compared to other SES class.

Association between Caries and body Mass Index in Different SES Groups

In present study none of the socioeconomic strata, showed significant association between caries and BMI status. However in middle class and upper middle class caries prevalence was higher in all of its BMI categories. While in lower and lower middle class, higher caries prevalence was seen in underweight category.

IV. Discussion

Dental caries is a multifactorial infectious disease. Factors affecting the onset of carious lesion include oral hygiene, diet composition and frequency, socioeconomic status, salivary immunoglobulin's bacterial load and fluoride intake. This makes the study of dental caries a challenging task.[10]

Obesity and dental caries are complex condition known to involve many contributing factors including biological, genetic, environmental and behavioral factors. Dietary pattern is also known to influence both obesity and dental caries.[11] BMI is widely used as a surrogate measures for obesity because it corrects for an individual's height in relation to weight and is a commonly used indicator of nutritional status. Given that dental caries and BMI both measures diet related health outcomes with SES as principle predictor of the both an association between them is not surprising.[12]

So the aim of our study was to identify the possible association between body mass index and dental caries in 4-14 year old children and also to investigate the role of Socioeconomic status as additional contributing factor towards development of overweight and dental caries.

In this study 4-14 year old children were selected for evaluation. In this age group dentition is in a transitional stage. A continuous change in dietary needs and habits along with the amount of body fat is observed with growth in children. Both boys and girls were included to account for gender variation in the amount of body fat which can be attributed to different growth milestones, body structure and hormonal effect.[11]

In the present study the prevalence of dental caries was found to be 76.5%. Mean age of subjects with caries was lower as compared to those not having caries. Mean DMFT/deft of subjects less than 10 years of age was higher. This suggests that both the prevalence as well as severity of dental caries was greater in younger children. In the present study high prevalence of dental caries was found to be associated with subjects of underweight category (86.43%). It was statistically significant when compared with children of normal and high BMI. The mean DMFT/deft of underweight subject was higher (2.42 ± 1.76) as compared to other BMI categories.

This result were similar to the study done by Olivera *et al*,[13] Norberg *et al*,[2] Bahuguna *et al*,[11] Cameron *et at*,[14] and Benzian *et al*.[15] This can be attributed to the fact that if a child is a fussy eater and underweight, parents may coerce the child to eat or offer tempting food high in carbohydrates to make sure that the child eats thus increasing risk of dental caries.

Furthermore, Malnutrition could also predispose to dental caries; deficiencies in protein or energy foods may lead to protein-energy malnutrition, decreased salivary flow, calculus formation, high levels of caries and reduced growth. Chronic malnutrition, particularly during the early years, has been shown to increase susceptibility to dental caries in the primary dentition perhaps via enamel hypoplasia and salivary hypofunction.[12]

Alternatively both outcomes could be influenced by a third variable (or cluster of variables) such as those associated with SES. A cluster of factors such as low parental education level, ethnicity, limited access to services and support, associated with low SES, are also associated with higher caries rates.[12]

Contrary to our study Willerhausen *et al*[16] and Marshall *et al*[1] found a significant association between high weight and caries. This may be attributed to the fact that children who are overweight or obese also have relatively high levels of dental caries given that overweight children tend to consume high levels of soda and other energy-dense foods many of which are cariogenic and obesogenic. Modeer *et al*[17] suggest that obese children are at risk of dental caries because they have reduced salivary flow, something also found in underweight children and which is associated with protein-deficient malnutrition. Obese children may well suffer from protein deficient malnutrition if their energy intake is made up of high carbohydrate, highly processed foods.

While others studies done by Macek *et al,*[18] Frisbee *et al*[19] and Cereceda *et al*[20] found no significant association between BMI for age and dental caries prevalence in either of the dentition. They concluded that relationship between nutrition and dental caries is complex because it is multifactorial disease also involving oral hygiene, available nutrients, saliva and oral flora influences dental caries.

Positive attributes of our study was that a relatively good representative sample of the population was selected. Limitations of the study are related to the use of cross sectional data. Future longitudinal studies could provide interesting facts to confirm cause – effect relationship between BMI and caries.

TABLES
Table 1: Showing basic characteristic of study population.

Age Group (yrs)	No. of Subjects	Percentage
4-6	57	14.25%
7-9	106	26.50%
10-12	142	35.50%
13-15	95	23.75%
BMI:		
NORMAL	229	57.25%
OBESE	7	1.75%
OVERWEIGHT	24	6.00%
UNDERWEIGHT	140	35.00%
SOCIO-ECONOMIC STATUS:		
LOWER CLASS	73	18.25%
LOWER MIDDLE CLASS	89	22.25%
MIDDLE CLASS	155	38.75%
UPPER CLASS	26	6.50%
UPPER MIDDLE CLASS	57	14.25%
WITH CARIES	306	76.5%
WITHOUT CARIES	94	23.5%

Table 2: Showing association of prevalence of caries with different demographic variables.

Variables	Without (n=94)		With caries (n=306)		P value
Mean Age	10.52 ± 2.88		9.92 ± 2.80		0.07 (NS)
Male (n=200)	49		151		0.63 (NS)
Female (n=200)	45		155		
Mean BMI	15.48 ± 2.30		14.72 ± 2.31		0.005 (S)
Normal (n=229)	65.00	28.38%	164.00	71.62%	0.003 (S)
Obese (n=7)	1.00	14.29%	6.00	85.71%	
Overweight (n=24)	9.00	37.50%	15.00	62.50%	
Underweight (n=140)	19.00	13.57%	121.00	86.43%	
SOCIOECONOMIC STATUS					
Lower class (n=73)	9.00	12.33%	64.00	87.67%	0.0007
Lower middle class (n=89)	13.00	14.61%	76.00	85.39%	(HS)
Middle class (n=155)	43.00	27.74%	112.00	72.26%	
Upper class (n=26)	12.00	46.15%	14.00	53.85%	
Upper middle class (n=57)	17.00	29.82%	40.00	70.18%	

Table 3: Showing association of DMFT+deft with different demographic variables.

Variables	Mean	SD	ANOVA (P value)
SOCIOECONOMIC STATUS:			
Lower class (n=73)	2.29	1.33	0.05 (S)
Lower middle class (n=89)	2.46	1.90	
Middle class (n=155)	2.03	1.82	
Upper class (n=26)	1.54	1.56	
Upper middle class (n=57)	1.82	1.51	
BMI:			
Normal (n=229)	2.00	1.71	0.01 (S)
Obese (n=7)	2.14	1.57	
Overweight (n=24)	1.38	1.21	
Underweight (n=140)	2.42	1.76	

Table 4: Showing association between caries and body mass index in different SES groups.

SOCIO-ECONOMIC STATUS	UNDERWEIGHT			NORMAL			OVERWEIGHT			OBESED			p-value
	T	C	%	T	C	%	T	C	%	T	C	%	
Lower Class	60	53	88.3%	13	11	84.6%	-	-	-	-	-	-	0.71
Lower Middle Class	60	54	90.0%	29	22	75.9%	-	-	-	-	-	-	0.07
Middle Class	15	11	73.3%	133	94	70.7%	6	6	100.0%	1	1	100.0%	0.41
Upper Class	1	1	100.0%	10	5	50.0%	11	5	45.5%	4	3	75.0%	0.58
Upper Middle Class	4	2	50.0%	44	32	72.7%	7	4	57.1%	2	2	100.0%	0.50

V. Conclusion

The present study show high prevalence of caries in underweight children and those from lower middle class. Family income and parent's education constitutes important determinants of socioeconomic status. It is expected that children from higher socioeconomic status usually are brought up in improved social environment are educated and maintain a healthy dietary behavior.

On other hand children from lower socioeconomic background are exposed to unhygienic environment, are of low nutritional status and do not have ready access to dental treatment. Thus they are more prone to caries and have low body mass index. Therefore the hypothesis that obesity and dental caries are interrelated does not hold true in this study.

However precise nature of these associations remains unclear, it is possible that different factors are involved in the development of caries in children with high and low BMI and in high and low socio-economic strata. Therefore further investigation of the association between the diseases and among their predictors is required. Specific attention should be given to longitudinal studies to gauge the association between early childhood caries and health outcomes in adolescence and adulthood, to the inclusion of younger children (aged 0 to 6 years) in the samples, to the perseverance of dietary and health-related behaviors developed during the preschool years, and to parental or familial influences on the development of these pattern.

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