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ASSOCIATION OF DENTITION STATUS, TREATMENT NEEDS AND TOOTH ERUPTION SEQUENCE IN RELATION WITH BODY MASS INDEX IN SCHOOL-GOING CHILDREN OF DELHI,INDIA

Dental Science

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ABSTRACT

Aim: To determine the association of BMI(Body Mass Index) with prevalence of dental caries and with tooth eruption sequence among school going children of government and private schools in South Delhi.

Method: The study population consisted of 1603 school going children of 'just erupted' teeth aged 6-13 years from ten government and ten private schools located in South Delhi district. A tooth was recorded as emerged if any part of the crown was visible through the gingiva. Anthropometric (height in metres and weight in kilograms) and the clinical examination of the oral cavity was done to assess the relationship between BMI(Body Mass Index), prevalence of dental caries and the eruption sequence of the permanent teeth. Dental caries was recorded using WHO criterion 1997. The data obtained was subjected to statistical analysis and Pearson correlation coefficient was used to find the correlation between BMI(Body Mass Index), eruption time and sequence.

Results: Statistical analysis showed that the obese group of children had more caries than the overweight and low normal weight children as significantly higher mean DMFT(Decayed, Missing and Filled teeth) score was observed in the overweight children. Correlation analysis showed significant positive relation with BMI (Body Mass Index), decayed teeth (DT) [$p < 0.01$] and DMFT(Decayed, Missing and Filled teeth ($p < 0.05$). BMI(Body Mass Index) & eruption time were also found to be positively associated. Binomial logistic regression showed that males (Odds Ratio = 2.09), obese/overweight children (Odds Ratio = 3.68) and females (Odds Ratio = 3.13) were more likely to have high caries experience.

Conclusion: There was a significant positive association between overweight/obesity, tooth eruption and caries experience among school going children. Moreover, Obesity and dental caries have common risk determinants which requires further comprehensive multifaceted approach by healthcare professionals.

KEYWORDS

Body Mass Index; Cross-sectional study, Dental caries; DMFT; Tooth eruption sequence

INTRODUCTION

Dental research is vital to the future of the oro-dental health particularly and the general health of the population. Past discoveries have enabled people today to enjoy far better oral health than generations a century ago. However, not all people have achieved the same level of oral health and well-being. This is indeed a major issue as dental caries is a preventable disease, not an inevitable one. To this end, the need of the hour lies in the hands of public & private agencies and individuals.

To add to the above problem nowadays, childhood obesity is a significant public health problem. Dental disease and obesity are two distinct and important child health concerns that has drawn attention of researchers. Healthy People 2020 recognizes the significance of health related issues by quoting dental disease-related and obesity-related objectives for school-aged population.[1] Globally, obesity has reached epidemic proportions and contributing to the global burden of chronic disease and disability.[2] It's prevalence in developing countries like India is about 10%.[3]

In developing countries, obesity often synchronize with under-nutrition added with serious social and psychological dimensions, making it a complex condition & affecting virtually all ages and socio-economic groups.[4]

Obesity not only affects the general health but also oral health. Epidemiological studies have suggested associations between dental caries, salivary gland and altered tooth eruption.[5,6] Although studies are limited, obesity has been shown to affect the timing of tooth eruption. Eruption of Tooth, timing and sequence lay an important foundation for the understanding of biology and culture of populations and it had a great clinical significance in child health planning, diagnosis and treatment.

So, the aim of the present study, firstly to describe the possible association between prevalence of dental caries and BMI(Body Mass Index) and to explore the effect of this anthropometric indicator on tooth eruption in school children, secondly to assess the comparison among school children of government and private schools.

METHODOLOGY

Study design and the participants:

A cross-sectional study was conducted in government and private school children of South Delhi. A total of ten Government and ten private schools were randomly selected by stratified random sampling method from three zones of South Delhi district. Care was taken to include the nearest private school within the radius of 3km to the government school which was selected by convenience sampling. A total of 1603 school students aged 6-13 years from 10 government and 10 private schools that fulfilled the inclusion criteria were selected and were screened to form the study population.

Sample size calculation:

Pilot Survey

A pilot study was carried out on the selected group of 100 school children from both government and private school and were examined according to the criteria set for the study.

Sample size estimation:

The sample size was determined based on the results of the pilot study using the formula- $4pq/L^2$

Where p = prevalence rate which was estimated to be 52.3% after the pilot study

q = 1-p

L = Least permissible error which was taken at 5%

Using the above formula, the sample size was estimated to be 1428 but to have uniformity for comparison between government and private school children, approximately the total of 1600 was taken.

Data Collection

The forms were arranged in serial number and stacked together in bundles. The data obtained was compiled systematically, transformed from a precoded proforma to a computer and a master table was prepared. The total data was distributed meaningfully and presented as individual tables along with graphs.

Outcome Variable:

Dentition Status, Treatment Needs and Tooth Eruption Sequence whether associated with Body Mass Index in School-going Children and to establish the possible risk factors as the outcome variable for prevalence of caries.

Explanatory Variable:

The independent variables for the study were demographic characteristics (age, gender, type of school, type of tooth). The Dependent variable would be caries experiences by school children of Government and Private Schools and the tooth eruption sequence and pattern that how it is affected in relation to BMI.

For each child, the data was collected on a special peer reviewed & validated proforma. Clinical assessment of dental caries was done with standardized mouth mirror and CPI probe (Hu-Friedy). Caries was recorded using Dentition Status and Treatment Needs (WHO 1997).[7] For BMI, height was recorded in metres and weight was measured in Kgs using standardized graduated means and then BMI was calculated using a formula = weight (kg) / [height $(m)^2$]. Height and weight measurements were taken for each school child dressed in light clothes and no shoes. Height was measured using non-stretchable inch tape with a least count of 0.005 meter and weight was measured using standard digital weighing machine with a least count of 0.1 kg. BMI status of the participant was evaluated using IOTF (International Obesity Task Force)[8] guidelines and the children are classified into various categories as follows:

1. Underweight < 18.5(kg/m^2)
2. Normal ≤25(kg/m^2)
3. Overweight ≤30(kg/m^2)
4. Obese ≥35(kg/m^2)

Dental age is based on the formation or eruption of the teeth. The criteria of the newly erupted teeth has been defined as a tooth seemed to have emerged if any part of it was visible in the mouth. The dental age has been assessed on the basis of the number of teeth at each chronological age. Assuming that the age of tooth eruption is normally distributed, the median age is equal to the mean age. The sequence of tooth eruption was determined by referring to the median/mean age of tooth eruption of individual teeth. The date of birth was obtained from the school records to know the chronological age.

Inclusion criteria:

1. All the subjects in the age group of 6 to 13 years in both genders.
2. Students who were willing to participate.
3. Students who obtained the consent form signed from the Parents or Guardians.

Exclusion criteria:

1. Subjects with history of Chronic Infectious Diseases.
2. Subjects with Endocrine Disorders which may relate to weight gain.
3. Subjects undergoing Orthodontic treatment.
4. Subjects who were absent on the day of examination.
5. Subjects with unsigned consent forms.

Ethical Committee Approval

Prior to the conduct of the study, the ethical clearance was obtained from the Ethical Committee of S.G.T Dental College, Hospital and Research Institute, Gurgaon. Written informed consent was obtained from the principal of every school after explaining the purpose and objective of the study. The clinical examination of the subjects were carried out by a single trained & calibrated investigator throughout the study to avoid inter-examiner variability. The intra-examiner reliability for Dentition Status and Treatment Needs was assessed using Kappa statistics which was found to be 90%.

Data Management and Statistical Analysis

The data was analyzed using SPSS version 20. Spearman's correlation test was applied to evaluate the association between two variables (BMI & caries) . Multiple Linear Regression analysis was done to assess the caries risk predictors. Pearson correlation was utilized to correlate BMI with eruption. For all tests, confidence interval and p-value were set at 95% and ≤ 0.05 respectively.

RESULTS

A total of 1603 children (864 = government and 739 = private school) aged 6-13 years were screened for dental caries, BMI(Body Mass Index) and eruption time.

Table I : Dental Caries Prevalence among school children:

		Type Of School		Total
		Government	Private	
Dental caries	No	421(48.7%)	323(43.7%)	744(46.4%)
	Yes	443(51.3%)	416(56.3%)	859(53.6%)
Total		864	739	1603

***chi-square test applied**

The overall caries prevalence was recorded as 51.3% in government school children and 56.3% in private school children (Table I).

Table II: Caries experiences among BMI scores

Dependent Variable	(I) Bmigroups2	(J) Bmigroups 2	Mean Difference (I-J)	Sig.
DECAYED	Underweight (<18.5)	18.5-24.99	-.156	.663
		25-29.99	-1.179(*)	<0.001*
		>30	-.257	.951
	Normal (18.5-24.99)	<18.5	.156	.663
		25-29.99	-1.023(*)	.001*
		>30	-.101	.997
	At risk of overweight (25-29.99)	<18.5	1.179(*)	<0.001*
		18.5-24.99	1.023(*)	.001*
		>30	.922	.314
	Obese (>30)	<18.5	.257	.951
		18.5-24.99	.101	.997
		25-29.99	-.922	.314

* p<.0.01,***p<.0.001
*Post hoc Tukey's test applied

Post hoc Tukey's test showed that overweight children had more caries than the underweight and normal weight children.

Table III: Correlation analysis between BMI and DMFT

Variable	Spearman's Correlation coefficient				
		DT	MT	FT	DMFT
BMI		0.456**	.002	-.013	0.429**
	p-value	.009*	.934	.604	.012*
	n	1603	1603	1603	1603

*Spearman's Correlation test applied

Correlation analysis showed a significant positive relation between BMI and DT (Decayed teeth) (p<0.01) and BMI and DMFT (Decayed,Missing and Filled Teeth) (p<0.05)(Table III).

Table IV:Multivariate analysis to determine possible risk factors for caries experience

Dental Caries			p-value	Odds ratio
Present	Intercept		.951	
	Age	6yrs to 10yrs	.280	.892
		>10 yrs	.	.
	Gender	Male	.003*	1.366
		Female	.	.
	School	Government	.161	1.169
		Private	.	.
	BMI	Normal (18.5-24.99)	.434	1.100
		At risk of overweight (25-29.99)	<0.001*	2.834
		Obese (>30)	.120	1.977
		Underweight (<18.5)	.	.

* Logistic regression test applied

Logistic regression showed that among all variables, gender and BMI proved to be a possible risk factors for caries experiences in the school children (p<0.01)(Table IV).

Table V: Correlation between BMI and eruption time for maxillary arch

BMI			
Tooth Number	Pearson Correlation	p value	N
17	.247(**)	0	386
16	.174(**)	0	1496
15	.220(**)	0	806
14	-.228(**)	0	806
13	.247(**)	0	707
12	0.03	0.236	1422
11	0.03	0.236	1422
21	-0.041	0.101	1420
22	-.054(*)	0.03	1417
23	.235(**)	0	806
24	-.227(**)	0	238
25	.242(**)	0	805
26	.206(**)	0	1492
27	.227(**)	0	401

Table VI : Correlation between BMI and eruption time for mandibular arch

BMI			
Tooth Number	Pearson Correlation	p value	N
37	.242(**)	0	476
36	.174(**)	0	1500
35	.215(**)	0	690
34	.220(**)	0	805
33	0.03	0.236	1006
32	-0.041	0.102	1426
31	.195(**)	0	1603
41	.139(**)	0	1603
42	-0.041	0.101	1426
43	.221(**)	0	1007
44	.237(**)	0	800
45	.197(**)	0	700
46	.170(**)	0	1515
47	.242(**)	0	475

* p<.0.01, ***p<.0.001
*Pearson Correlation test applied

The Significant correlation between the eruption time and Body Mass Index (BMI) were shown by canines, premolars and molars (Table V and VI).

DISCUSSION

The traditional treatment-centric concept of health has been replaced by the concept of general well being of individuals, communities and populations on the whole. The goals among the Global goals for oral health 2020,[9] as drafted by Joint Working Group including representatives of FDI, WHO and IADR from different regions of the world, is "to minimize the impact of diseases of oral and craniofacial origin on health and psycho-social development" and "to minimize the impact of oral and craniofacial manifestations of systemic diseases on individuals and society, and to use these manifestations for early diagnosis, prevention and effective management of systemic diseases". Dental caries has been described as a 'pandemic disease' due to its globally high prevalence especially among children.[10] In India an increase in dental caries may be due to unhealthy dietary habits, limited use of fluoride and poor access to oral health services. Most of our treatment procedures are targeted to provide symptomatic treatment with little priority given to preservation, conservative management and prevention. Thus, the study of dental caries and factors related to it, remains a challenging task to the healthcare professional due to its multifactorial nature. Moreover, a plausible biological gradient between obesity and dental caries had been stated in the literature.[11,12]

Comparison of Prevalence of dental caries among school children

The prevalence of dental caries in the present study was 53.6%. This is in accordance to study done among the urban school children of Delhi by Grewal H[10] where she reported a prevalence rate of 52.5% and the National Oral Health Survey[12] in India reported a prevalence of 53.8%.

In this present study, the students belonging to different socioeconomic strata of both government as well as the private schools were included. Overall caries experience was more in private school children maybe due to urbanisation and adoption of Western lifestyles and the absence of public prevention programmes. The socioeconomic conditions definitely influence the preventive and health care seeking behavior.

Obesity and children

Prevalence of overweight and obesity has increased markedly among population but especially among children due to westernization of eating habits in most Asian countries. A similar nutritional transition is underway in India as well.

In present study showed that majority of the children (65.25%) among both male and females were underweight, 6.05% were overweight and 1.05% obese, similar findings were reported by Thippeswamy HM etal.[13] The prevalence of Dental caries was significantly more in overweight group($p \leq 0.001$). This is in accordance to study reported by Thippeswamy HM,[13] Marshall TA,[14] Sabharwal R et al[15] and Cantekin K et al. [16]

Association between BMI and dental caries among children

However, exploration of link between BMI and oral health in children has always been controversial. There were few studies which reported little or no association between BMI and caries scores like done by Granville-Garcia AF,[17] Macek MD,[18] Pinto A[19] and by Alswat K[20] whereas negative association was reported by Chatterjee M[21] and by Chauhan A[22] where underweights were associated with increase in dental caries.

The mean caries values in weight classes increased from the underweight children to those with normal weight or overweight up to those suffering from obesity in our study, which was in accordance to the study conducted by Willershausen B[23] that showed a significant correlation between BMI and caries frequency. The possible reasons for such findings in our study include individuals with increased BMI showing early eruption of teeth and for any given age, teeth that emerged earlier were exposed to oral cavity environment for greater period of time thus increasing the prevalence of caries in those individuals and also children with increased BMI generally had increased frequency of snacking leading to increased caries prevalence.

BMI and eruption timing of teeth

In present study children with a high BMI had higher eruption rates. This finding is consistent with the results of a study conducted by Must A[24] and by Macek MD[18] in the USA, in which overweight children had a larger number of erupted teeth.

However, the present study observed early eruption of teeth in which may be due to early loss of deciduous molars or caries experience and high caries prevalence is associated with increase in BMI. Elevated BMI is considered to be the most common cause of accelerated growth. There is evidence suggesting that over-nutrition during childhood causes hyperinsulinemia and may also increase insulin-like growth factor-1 (IGF-1) secretion and growth hormone receptors.[25] In addition, after controlling for sex and pubertal stage, a significant correlation was found between BMI and IGF1-Standard Deviation Scores in obese children, suggesting that this hormone may play a key role in the acceleration of bone maturation.[26] Hormonal changes in the obese patient may affect mineral metabolism.[27] Lower levels of serum calcium and phosphate were observed in obese children during a glucose tolerance test, and serum parathyroid hormone and calcitonin levels showed smaller increases in obese children compared with their non-obese counterparts.[28] It is likely that the metabolic changes caused by obesity that have an impact on bone growth also affect tooth eruption. However, more studies are required to identify the specific mechanism involved in tooth eruption timing that is affected by high body fat content in children and adolescents.

CONCLUSION

Prevalence of overweight children was higher in private schools than

public schools and BMI was positively associated with caries and tooth eruption. The findings support the urgent need for National preventive programme for childhood obesity and targeted interventions tailored to multifactorial aetiology of obesity with meaningful involvement of masses to stop the global epidemic.

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