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Original Research Article

Relationship of dental caries and BMI among pre-school children of Bangalore city, India: a cross sectional study

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ABSTRACT

Background: Dental caries in young children is commonly untreated representing a public health problem and has also reported to affect their anthropometric outcomes, but the evidence is conflicting.
Objectives: The aim of this study was to evaluate the relationship between dental caries and BMI in pre-school children of Bangalore City.
Methods: A cross-sectional study was conducted on 208 healthy preschool children with the age range of 3-5 years recruited from nursery schools of Bangalore City. The Anthropometric measurements, weight and height were evaluated by calculating the z-scores using WHO Anthro software to elucidate the subject's status on the age- and sex-specific growth chart. Every Child who has received two Z-scores under the normal value (<-2) was considered as abnormal (deficient). The data was analyzed using Statistical Package for Social Sciences (SPSS) version 19. The statistical tests used were t-test and correlation analysis.
Results: Dental caries prevalence was 65.7% with a mean dental caries score of 2.24±2.57. Among the study participants 32.7% were underweight (WAZ score), 46.6% had height deficiency (HAZ score) and 47.6% had BMI deficiency (BAZ score). There was significant positive correlation found between dental caries experience and children's WAZ (Weight for age) [r=0.102, p=0.040] and BAZ (BMI for age) [r= 0.761, p= 0.032].
Conclusions: This study showed that lesser percentage of the participants had deficient height, weight and BMI. As the weight and BMI increased there was a significant increase in the number of caries and fillings among the participants.

Keywords: BMI, Children, Dental caries, Height, Weight

INTRODUCTION

Globally, non-communicable diseases square measure more and more recognized as a significant reason behind morbidity and mortality. The increasing burden of non-communicable diseases, particularly in developing countries of Asia including India, threatens to overwhelm already stretched health services. Among them, overweight and obesity are the foremost necessary.[1] The problem of overweight and obesity is not solely confined to adults however conjointly to children and adolescents. Various studies have also indicated that the prevalence of overweight and obesity among children of all ages is increasing in developing countries.[2,3]

This 'nutritional transition' and the lifestyle changes are becoming relevant among school children. India is also

passing through such a transitional phase of socio-economic development which has the potential of altering the nutritional status of her population groups.[4] Oral health and overall health and well-being are inseparably related. The role of nutrition in the maintenance of health, growth and also its relation to the dental caries is well known. Food choices and nutritional intake may affect the dental health. It would even be stricken by poor dental health.[5] Dental caries in young children is commonly untreated, representing a public health problem and has also reported to affect their anthropometric outcomes. Obesity and dental caries are both multi-factorial, and has an impact on children's health and psychosocial development; both conditions contribute substantially to health expenditure.[6] Due to the strong evidence, supporting the association of dental caries with irregular dietary patterns and quality and also the fact that the abnormal dietary intake has been linked to the development of obesity at a young age, a link between dental caries and weight is biologically plausible.[7]

Growth is a significant indicator of child health; World Health Organization acknowledges it as the best single measure for delineating the nutritional condition and health of children.[8] There are particular ways to follow up a child's normal growth pattern. The growth charts consist of a series of percentile curves that illustrate the distribution of selected body measurements in children. The charts designated by CDC (Center of Disease Control) and WHO growth charts are the examples.[15,17] WHO growth charts are considered as the standard charts. The growth and gender- specific differences need to be taken into account in the BMI assessment for children and teenagers. These child- specific BMI values are referred to as "BMI for age".[15-17] It is believed that dental caries may be deliberated as an imperative underlying factor for the condition of wrong dieting; it is able to influence child growth negatively.[18]

The relationship between dental caries and body mass index (BMI) in children was evaluated in different countries and the results were inconsistent. In some advanced countries, frequent and high consumption of carbohydrates were reported to be the reason of increasing obesity and dental caries.[8-10] It has been shown that diagnosis of dental caries at the cavitation level results in a significant underestimation of the actual caries experience in populations. Use of a caries diagnostic system which includes non-cavitated caries has the distinct advantage that the classical stages of lesion formation – development of cavitation through non-cavitated stages of caries – may be reflected in the recordings.[11] In 1999; Nyvad et al introduced a visual method for the classification of caries lesions according to their activity.[12]

Given that dental caries and BMI both measure diet-related health outcomes; an association between the two is not surprising. The results of a systematic review show that there is a significant disagreement as to the existence and nature of an association between dental caries and BMI. 48% of studies reviewed found no association between dental caries and BMI; 35% found a positive association while 19% found an inverse association.[1]

Many researchers have investigated the relation between BMI and dental caries, however, WHO Anthro software as a standard method of anthropometric and nutritional survey of children growth has not been used. The current study aimed to assess children with dental caries to determine whether the dental caries was associated with age-specific BMI, weight and height deficiency in a sample population of 3to 5-year-old preschool children.

METHODS

The present cross sectional study was conducted to assess the association between dental caries experience with age-specific BMI in a sample population of 3 to 5 year-old preschool children in Bangalore city over a period of 2 months. The study proposal was submitted for approval and clearance was obtained from the ethical review board of Bangalore Institute of Dental Sciences & Hospital & Post Graduate research centre. Prior to study, permission was obtained from the Principals of the various schools to conduct the study. Before any clinical examinations, consent was obtained from the parents to include their children in the study.

Schools children in the age group of 3-5yrs who cooperated for oral examination were included in the study. Those who had systemic diseases or were on medication were not included in the study. Convenience sampling was done. 10 students were examined per day. Keeping this in mind and excluding public holidays, we were able to collect from 208 preschool children aged 3-5 yrs in the duration of 2 months. A pilot study was conducted before the main study to check for the feasibility and validity of the study.

A structured and validated proforma (record form) was used to collect and record the data. The proforma included the details of demographic characteristics (name, age, date of birth and gender), weight (kgs), height (cms) and dental chart to record data. Weight and height of the children were recorded with the help of pre-calibrated weighing machine corrected for zero error and with least measurement up to 0.1 kg and height recorded with Self-retracting tape measure and scale with least measurement of 0.1 cm. Measurements for height and weight were made to the nearest 0.1 cm and 0.1 kg, respectively. The weight and height of each child were measured according to World Health Organization (WHO) guidelines, and the values were recorded. The values of height and weight of each child was transferred to WHO Anthro software version 3.2.2 (*www.who.int/ childgrowth /software / en /index. html*). World health organization advocated this software to elucidate the subject's status on the age- and sex-specific growth chart,

BMI and also to recognize the status of health and fitness of children.

Height and weight were assessed by using the z scores of height-for-age (HAZ), weight-for-age (WAZ), and BAZ. This software enables the calculation of growth reference data for children and adolescents by generating Z-scores and percentile curves and cut-offs based on the standard deviations (SD) from the median. Every Child who had received two z-scores under the normal value (<-2) was considered as abnormal.

Oral examinations were conducted in school premises. All subjects were examined in the supine position under adequate light. Sterilized instruments including intraoral no. 5 mouth mirror & no. 23 explorer were used for examination. Dental caries experience was assessed using Nyvad's criteria.[12]The relationship between dental caries experience and BMI was then investigated.

Statistical analysis

The data was entered in Microsoft Excel sheet and the data analysis was done using statistical software SPSS version 19. Descriptive statistics, Mann Whitney U test and Spearson correlation coefficient was used for analysis. P value was set up at 0.05 which was statistically significant.

RESULTS

Out of the 208 study subjects who participated in the study, majority of the participants (65.4%) were 4 years old with a mean age was 3.74± SD 0.47 years. Majority (61.5%) were males while 38.5% were females. In our study 47.6% of participants had BMI deficiency (Table 1) It was also observed that a higher incidence of overweight was among boys (61.5%) than in girls (38.5%). Dental caries prevalence was 65.7% with a mean dental caries score of 2.24±2.57 (Table 2).

Table 1: Distribution of study participants.

	No. of participants	Percentage (%)
Age (years)		
3	60	28.8
4	136	65.4
5	12	5.8
Gender		
Males	128	61.5
Females	80	38.5
Weight for age		
<- 2 WAZ group	68	32.7
≥-2 WAZ group	140	67.3
Height for age		
<- 2 HAZ group	97	46.6
≥-2 HAZ group	111	53.4
BMI for age		
<- 2 BAZ group	99	47.6
≥-2 BAZ group	109	52.4

Table 2: Mean dental caries in WAZ, HAZ and BAZ groups.

		<- 2 z score [Mean (±SD)]	≥-2 z score [Mean (±SD)]	z	p
Dental caries experience	**WAZ**	2.19 (±2.23)	2.39 (±2.73)	-0.205	0.016*
	HAZ	2.08 (±2.17)	2.38 (±2.88)	-1.488	0.480
	BAZ	1.74 (±1.788)	2.70 (±2.61)	-2.788	0.006*

* Correlation significant at 0.05 level.

There was significant positive correlation found between dental caries experience and children's WAZ (Weight for age) [r=0.102, p=0.040] and BAZ (BMI for age) [r= 0.761, p= 0.032] (Table 3).

Table 3: Correlation among HAZ, WAZ, BAZ and dental caries experience.

	r	p
WAZ* dental caries experience	0.102	0.040*
HAZ* dental caries experience	0.012	0.862
BAZ* dental caries experience	0.761	0.032*

*Correlation significant at 0.05 level

DISCUSSION

Current researches in dental public health try to explore the link between oral health and general health as an effective way of underscoring the public health impact of oral care and influencing health care policy. The present study was conducted to show a relationship between the dental caries and BMI among a group of pre-school children (3-5yrs) in Bangalore city. Existence of a link between growth and oral health in children is controversial and it has been investigated by many researchers throughout the world.

Deficient weight for age z score (underweight) was seen in 68 (32.7%) of the study participants, 46.6% (97 study participants) were deficient height for age z score and 99 of participants (47.6%) had a deficient BMI for age z score when their BMI z scores were compared to WHO standard for the same age. A similar German study of 1290 children of elementary schools showed 31.6% of the children were underweight, 46.8% had a normal weight, 11.9% were overweight, and 9.7% were obese. This is also in accordance to studies conducted in Bareilly, Shiraz & Bangalore.[3,8,14] But was found to be lower than that reported in Brazil.[18] These differences among the reports might be related to diversity of study subjects. Indeed, different studies used a variety of standard BMI reference for comparing the growth data. However, there is no National standard chart for growth of Indian children and it may show some variation in growth pattern of the children with WHO standard. Therefore, our findings should be interpreted cautiously.

The mean deft (Nyvad's criteria) score of the study subjects was 2.24±2.57. It is higher than the results of Oral health survey in 2011 which was 1.23±2.051 for this age group in Bangalore district.[21] However, it was lower than study conducted in Sweden (3.20±5.16), Kerman (4.70±3.4).[9,13] However; it is still high from public health perspective.

An association between dental caries and growth in children has been proposed by some preliminary and population-based studies. Our findings showed a positive correlation between BMI score and dental caries in 3-5 years old children, which confirms some previous studies. Studies done in United States and Iran showed similar results.[22,23]A cohort study conducted in Mexico among 4-5 yrs old children in Mexico showed that overweight and at-risk overweight children had higher caries prevalence than children who were not overweight and caries was also associated with sugar consumption, bottle feeding, smoking at home and tooth brushing ≤ once per day.[25] Another study conducted in Manitoba showed that significantly more children with S-ECC had significantly higher mean BMI z-scores than caries-free children (0.78 ± 1.26 vs. 0.22 ± 1.36, $p = 0.002$).[34]

Also, there were many studies with no statistically significant association between dental caries and different categories of BMI i.e. either in normal, underweight, overweight and obese category.[26-30] A study conducted in Chile showed no significant difference was found among normal weight, overweight, and obese children in relation to caries history in deciduous (P=0.837).[35] However, a number of studies did not find a positive relationship between growth factors and caries experiences.[31-33] A study among was conducted among 5 years old children in Taiwan which showed that higher def was associated with lower BMI.[24]

The reason could be the multi-factorial nature of caries causation. Also, the relationship between childhood growth and dental caries is complex and varies depending on many factors, such as age, gender, race, and other social factors and most of the published literature represented diverse populations. Factors that were found to be associated with caries were ethnicity, low parental education achievement, poverty/lower socioeconomic level, higher SES level, female gender not eating breakfast daily, eating fewer than five servings of fruit and vegetables daily, attending public school, school absenteeism, soft drink consumption and low health attitude. Also, in preschool children, their height and weight change rapidly at this stage, so obesity or being overweight is apparent in a short period of time. In addition, obesity and being overweight can be due to an increased intake of dietary fats. A diet high in fat has less influence on the development of caries than a diet high in sugar. This could be a possible explanation for the lack of association between obesity and dental caries.

Low BMI and high dental caries are still two public health problems which some studies showed might be associated. Growth and dental caries could be associated through some dietary pattern and also some metabolic mechanism. High sugar diet intake could result in obesity and dental caries. On the other hand, metabolic factors form dental pain and infection could be a reason for poor growth. In this study about 40% of underweight children were in very high caries group who need special attention from both aspects. They might need intervention for oral rehabilitation which may tend to weight gain on them. Some clinical studies showed improvement in growth indicators after dental rehabilitation especially in undergrowth group.[10-14] This needs to be investigated in Iranian children and at a community level in further researches.

Undeniably, it is likely that not a single common risk factor but rather a complex interface of diet, health behaviours, social elements and genetic aspects that determine both caries and alterations in BMI. Also, a small sample was used.

Hence generalisibilty of the study would be difficult. Indeed, this study had a cross-sectional design, which limits the ability to identify causality. Therefore, a longitudinal design would be needed to reveal cause and affect relationships in this regard.

In terms of future research, longitudinal studies are needed to determine whether there is a cause-and-effect relationship between caries levels and poor growth. Such a study would benefit from adequate adjustment for confounding variables and from the use of continuous outcomes in addition to categories of malnutrition. Also, continuous education and motivation of parents and children can help to some extent to improve their health status.

Government-led regulations can help the framework of society to be changed to a "healthier environment", even though many conflicts of interest can be expected. Long-term population-level strategies, as well as strategies for individuals at risk, are needed in this perspective. The present study emphasises the need for multi-level approaches. This means that health professionals should work in a multidisciplinary manner with these patients with the aim of establishing a healthy lifestyle including good dietary habits.

The dentists can play an important role in promoting good nutrition with the aim of establishing a healthy lifestyle for the children. This can be done by educating their parents and caregivers about importance of integrating healthy snacks and meal patterns in their diet which can help in reduction of dental caries in school children.

CONCLUSION

The present study showed a positive graded association between the BMI and caries levels in 3-5 years old pre-school children. A lesser percentage of the participants had deficient height, weight and BMI. As the weight and BMI increased there was a significant increase in the number of caries and fillings among the participants. Future longitudinal studies can help determine whether there is a cause-and-effect relationship between caries levels and poor growth.

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