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The association between body mass index and gross dental caries in a population of 3- to 5- year-old children attending kindergartens in Rasht, Iran

Javaneh Vejdani[1]✉, Atousa Janeshin[1*], Abtin Heidarzadeh[2]✉, Khadije Mirzazadeh[3]✉

1.Assistant Professor, Dental Sciences Research Center, Department of Pediatric Dentistry, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran.
2. Associate Professor, Department of Community Medicine, Guilan University of Medical Sciences, Rasht, Iran.
3. Dentist, Rasht, Iran.

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ABSTRACT

Introduction: Dental caries as the most common childhood disease can cause pain and difficulty eating. The aim of this study was to determine the association between gross dental caries and body mass index (BMI) among children attending kindergartens in Rasht, Iran.

Materials & Methods: A descriptive-analytical cross-sectional study was carried out on 402 3- to-5-year-old children who were randomly selected from kindergartens of Rasht, Iran. All dental exams and anthropometric measurements for each child were performed by a trained examiner. The obtained data were analyzed using SPSS 19, and the Z-score index was determined. The Monte Carlo statistical method was applied to compare the relationship between dental caries and BMI. Moreover, the relationship between dental caries and other factors was evaluated using a Chi-square test and $P<0.05$ was considered significant.

Results: In this study, 43.5% of children had dental caries. Based on the results, a significant relationship was observed between dental caries and BMI-for-age, weight-for-age and weight-for-height indices ($P=0.02$, $P=0.004$ and $P=0.017$). The underweight children had higher dental caries experience. Moreover, a significant relationship was found between dental caries and parents' education level.

Conclusion: According to the findings, the underweight children had higher dental caries experience so there may be an association between low BMI and caries experience in children.

Keywords: Dental Caries, Body Mass Index, Body Weight, Body Height, Child

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* **Corresponding Author:** Atousa Janeshin, School of Dentistry, Guilan University of Medical Science, Rasht, Iran.
Tel: +981333486406
E-mail: atousa_343@yahoo.com

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Introduction

One of the major problems of developing countries that threaten children's health is the lack of proper nutrition. Nutrition is associated with children's health and psychosocial development. Dental caries and obesity as two multifactorial diseases are related to dietary habits. [1]

Early childhood caries (ECC) as a global public health concern can affect infants and preschool children. Recent studies reported a significant increase in dental caries in primary dentition [2], and most of the dental caries are not treated in preschool children, and hence affect their general health, educational performance and quality of life. [3] ECC as a specific form of severe dental caries is defined as having one or more decayed, missing, or filled tooth surfaces in any primary tooth in children aged about five years (71 months) or younger. [4]

In the assessment of the nutritional status of individuals, anthropometric measurements such as body mass index, play a very important role in the nutritional status. [5] BMI as the main indicator of nutritional status is generally applied for determining obesity because it estimates an individual's body fat based on height and weight. [6] Until now, the relationship between dental caries and BMI in children has been severally evaluated in different studies, however, discordant results have been reported. [6] Booth et al. [7] and Bailleul-Forestier et al. [8] reported a relationship between high weight and high caries in children. In contrast, Alkarimi et al. [9] demonstrated an inverse relationship, and some previous studies implied no relationship between BMI and dental caries. [10, 11]

Due to discordant opinions regarding the association between dental caries and BMI status of children and the lack of related research in the city of Rasht, this study aimed to evaluate the association between gross dental caries and body mass index among children aged 3 to 5 years attending kindergartens in Rasht, Iran.

Materials & Methods

The method of the present study was approved by the Ethics Committee of Guilan University of Medical Sciences, Rasht, Iran (Code: IR.GUMS.REC.1397.32). This study was a descriptive-analytical cross-sectional survey, which was conducted on 3-5-year-old children, attending the kindergartens in Rasht during 2016. Forty kindergartens were randomly selected among 160 kindergartens located in Rasht, Iran. A total of 402 children in the age range 3-5 years were randomly recruited from 40 kindergartens (10 boys and girls were included from each kindergarten). The estimated minimum sample size was calculated by assuming a 95% confidence level, 1.2 design effect and 10% attrition. [11] The multi-stage random cluster sampling procedure was applied for selecting the cases. In this regard, the cases randomly were selected from each kindergarten (as clusters).

Children with any systemic disease and with loss of tooth either due to trauma or caries were excluded from the study. Written informed consent was obtained from all parents before data collection and examinations. A structured checklist was used for collecting the desired data. Height and weight measurements and dental exams of each child were performed by a trained examiner. All measurements and data collection were performed by the same examiner to avoid subjective errors. The questionnaire included questions of age, gender, parents' level of education, parents' smoking habits and length of stay of children in kindergarten. The weight and height of children were determined in accordance with the guidelines recommended by the World Health Organization (WHO), [12] and BMI index was determined for each child (weight (kg) divided by the square of height (m)). A portable stadiometer (Seca 213, Hamburg, Germany) was utilized to measure the height of the studied children while standing upright without shoes to the nearest 0.5 cm. A portable electronic digital scale with an accuracy of 0.5 kg (Beurer, Ulm, Germany) was used for measuring the weight of the children while they wore light clothing.

Following height and weight measurements, a final year dentistry student who was trained and calibrated by a pediatric dentist performed a dental exam to assess gross carious primary teeth. The diagnosis of caries was classified into three classes, including primary, cavitated, and gross. The severity level of carious lesions was also classified as primary for lesions within the enamel, cavities for lesions that extend to the dentin, and gross for deep cavities with the possibility of pulpal involvement. [13] Visual examination was conducted while the children were standing up in

front of the seated examiner, under portable lamplight, with the help of an intraoral mirror and gauze which was used to clean the dental surfaces of loose debris and gross caries was recorded.

In this research, national reference z-scores were utilized for the studied group. The Z-score was estimated for BMI for- age, weight- forage and height- forage indices. The obtained Z-score was divided into four groups: (<-2, -2 to 0.2, 0.2 to 2, >2).

The obtained data were analyzed using the SPSS software (version 19) for Windows (SPSS Inc., Chicago, IL, USA). Moreover, in order to compare the association between dental caries and BMI for age, weight for age and height for age, the Monte Carlo statistical method was applied. The association between dental caries and other factors was evaluated using a chi-squared test and $P < 0.05$ was considered significant.

Results

In this study, 430 children were included and all clinical examinations were conducted on them. Because of the unwillingness of some participants, 28 participants were excluded. Therefore, 402 children were enrolled in the analysis. of 402 participants, 51.5% of children were boys and 48.5% were girls. Overall, 175 (43.5%) of children had dental caries. Based on the result, in the prevalence of dental caries, no significant differences were observed caries between boys and girls (Pvalue=0.343). Nineteen children were underweight, 192 children normal weight, 162 overweight and 29 children obese. Regarding BMI for age index, 22 children (5.5%) were under -2 z-score, 183 children (45.5%) were between -2 and 0.2, 172 children (42.8%) were between 0.2 and 2 and 25 children (6.2%) were over 2 z-score. Regarding weight for age index, 15 children (3.7%) were under -2 z-score, 173 children (43%) were between -2 and 0.2, 164 children (40.8%) were between 0.2 and 2 and 50 children (12.4%) were over 2 z-score.

According to the Monte Carlo analysis, a reverse relationship was observed between dental caries and BMI for age (P value= 0.02), which implied that the increase of body mass was associated with a decrease in tooth decay in the children [Table 1]. There was also an inverse significant association between weight for age and dental caries (P value= 0.004) which suggested that an increase in weight-reduced dental caries. As can be seen in Table 2, there was no significant relationship between height-for-age and dental caries (P value= 0.09). There was an inverse significant association between weight-for-height and dental caries (P value= 0.017).

Our results showed that both mother and father's educational levels were associated with dental caries (P value= 0.012 and P value=0.003). Children with educated parents had significantly lower caries. The results showed no significant association between parents' smoking habits and length of stay of children in kindergarten and dental caries.

Table 1. The prevalence of dental caries according to BMI for age

Z score	<-2		-2- 0.2		0.2-2		>2	
Dental caries	%	N	%	N	%	N	%	N
No caries	45.4	10	51.5	94	62.2	107	64	16
With Caries	54.6	12	48.6	89	37.8	65	36	9
Total	100	22	100	172	100	183	100	25
P value	0.02							

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Table 2. The prevalence of dental caries according to weight for age, height for age and weight for height

Z Score		<-2		-2- 0.2		0.2-2		>2	
	Dental caries	%	N	%	N	%	N	%	N
	No caries	47.4	9	50.5	97	61.7	100	72.4	21
	With caries	52.6	10	49.5	95	38.3	62	27.6	8
	Total	100	29	100	192	100	162	100	29
	P value	0.004							
	Dental caries	%	N	%	N	%	N	%	N
	No caries	46.7	7	53.2	92	59.8	98	60	30
	With caries	53.3	8	46.8	81	40.2	66	40	20
	Total	100	15	100	173	100	164	100	50
		0.09							
	Dental caries	%	N	%	N	%	N	%	N
	No caries	35.7	5	52.7	106	62.3	109	58.3	7
	With caries	64.3	9	47.3	95	37.7	66	41.7	5
	Total	100	14	100	201	100	175	100	12
		0.017							

Discussion

The present study found that an increase in BMI statistically significantly reduces caries in children. Therefore, it can be found that higher tooth decay occurs among children with lower BMI. Previous studies have reported conflicting information about the relationship between BMI and dental caries among children in different countries. In some cases, a positive relationship has been identified between the BMI and dental caries. [14, 15] In contrast, some other studies reported no relationship between these factors [16] and others suggested an inverse relationship. [17-18] Sheiham reported similar findings in Brazilian children. [19] On the other hand, Edalat et al. showed that there was no significant relationship between increasing dental caries and decreasing height, weight, and BMI in Shiraz, which was inconsistent with our results, which can be due to the smaller sample size of the Shiraz study. [16] In some developed countries, frequent eating of snacks was reported to be the reason for increasing obesity and dental caries. [1, 20] Norberg et al. found that there is a statistically significant relationship between overweight (obesity) and a high prevalence of dental caries among children in Swedish. [20] In contrast, it has been shown that in developing countries like Iran, poor diet and chronic malnutrition, especially in the early years of life are associated with an increase in dental caries. [17] Similarly Bahroloomi et al; found a negative correlation between obesity and tooth decay in children attending kindergartens in Yazd. [18] This difference in findings could be due to disparity of sample size, obesity and tooth decay and other factors such as environment, behavior, and gene, which may play a role in the occurrence of these two problems.

In the present study, visual examination of the teeth was used for the diagnostic of caries. Some studies have used radiographic examination for caries detection, [1] which is an expensive method and often leads to higher levels of detection of the disease at earlier stages of cavitation. One of the heterogeneities between studies might be attributed to various indices and definitions of caries. For instance, some previous studies reported daft, whereas we reported just untreated gross caries detected by visual examination. Gross dental caries detected clinically may cause pain and decrease the ability to eat, thereby leading to poor weight gain. Moreover, severe caries which cause pain, discomfort and sleep problems, can decrease the quality of life of the children, and thereby affect their growth. [21] In this regard, low BMI in some children can be due to dental problems such as dental decay and malnutrition. Tooth problems and toothache coincident can affect appetite and finally result in weight loss and lower BMI in untreated cases. Our results

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showed no significant association between height for-age-index and dental caries that seems reasonable because height-for-age needs long-term conditions to change, unlike BMI-for-age and weight-for-age.

In our study, parents' education level showed an impact on the level of dental caries. So that a direct relationship was observed between the lower education level of parents and higher caries indices in their children which is consistent with most studies conducted in children. [20, 22, 23] It may be due to the fact that parents with higher socioeconomic status can provide better social conditions for their children and subsequently encourage young children to establish good dental health behaviors and nutrition habits.

Some limitations of the present study included a small sample size, which was not large enough like Clarke et al., study. [24] Second, there were some confounding factors such as sugary components, which excessive consumption can cause both dental caries and obesity. Moreover, no certain relationship can be made in the cross-sectional study, as dental caries might influence the BMI, due to malnutrition. Therefore, further longitudinal studies are required to confirm the results of this study. Another limitation of this study was that patients with extracted teeth were excluded from the study population.

Conclusion

According to the findings, the underweight children had higher dental caries experience so there may be an association between low BMI and caries experience in children. Further longitudinal studies are required to determine the mechanisms of the association between dental caries and BMI and to confirm the results of this study.

Conflicts of Interest

There is no conflict of interest.

Authors' Contribution

The study was designed by Javaneh and Vejdani. The study data were collected by Khadijeh Mirzazadeh. Statistical analysis and interpretation of data were performed by Abtin Heidarzadeh. Manuscript preparation was done by Atousa Janeshin.

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