



Relationship Between Tooth Decay and Body Mass Index Among 6-12 Year-Old Children in Ilam During 2016-2017

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Abstract

Background: The prevalence and severity of tooth decay have shown a significant increase in the past 20 years. This study evaluated the relationship between the amount of tooth decay and body mass index (BMI) in 6-12 year-old children in Ilam during 2016-2017.

Methods: The population of this cross-sectional study consisted of 270 female and 250 male students in Ilam. Their weight and height and BMI were measured for each individual and the information on the examination of children's teeth was inserted into relevant tables. Other research data (i.e., dietary habits, oral health instruction, and socioeconomic conditions) were gathered using a valid and reliable questionnaire.

Results: There was no significant relationship between the amount of tooth decay and BMI among 6-12 children in Ilam. Except for the 11-year-old (n=86) group demonstrating an inverse relationship between dmft and BMI ($r = -0.185$), an inverse relationship was found between the decay and observation of health although there was a direct relationship between the consumption of sugar materials and tooth decay.

Conclusions: The results of the study revealed no significant relationship between the amount of tooth decay and BMI among 6-12 children in Ilam except for 9-year-old and 11-year-old groups.

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Introduction

The prevalence and severity of tooth decay have dramatically increased among the developing countries in the last 20 years, and tooth decay is the most common disease among children (1). Despite modern developments in dentistry in the recent 100 years, the decay tooth has not recovered its initial and natural state (1), and recovering the performance of initial and natural tissue is impossible. Thus, precaution is the only accurate way to cope with and prevent this disease (2).

Dental treatments include a large amount of health budget for children in most developed countries. Although various precautionary programs have caused a reduction in tooth decay, tooth decay remains a general health problem (3,4). On the other hand, obesity and gaining weight are important health indexes that have increased since two decades as a result of changes in physiologic, biochemical, metabolic, or anabolic factors (5). Based on studies in Iran, the prevalence of tooth decay is 57.8% among 12-year-old children and 22.1% of them have an extracted tooth (3,6). Meanwhile, it has been proved that obesity is a health-related problem in many societies which can result in hypertension and cardiovascular diseases. Recent research shows that there is a significant

Highlights

- ▶ No significant relationship between DMFT and BMI in children;
- ▶ No significant relationship between dmft and BMI in children;
- ▶ Significant effect of socio-economic factors on the tooth decay.

relationship between overweight and tooth decay (2,7-9). Lempert et al conducted research regarding the relationship between body mass index (BMI) and tooth decay among Danish adolescents and concluded that the number of decayed teeth among overweight students was more than that of underweight ones. Meanwhile, the decays of children/adolescents with overweight during the first examination were more in contrast to their peers with normal weight (8). In addition, Gupta et al studied the prevalence of tooth decay in relation to the BMI, daily sugar consumption, and the condition of dental health among 12-year-old children in Mathura, India. Based on their results, there was a direct relationship between the number of decayed, extracted, and milk-filled teeth and BMI. However, no relationship was found between the average decayed, extracted, and milk-filled teeth for both dental systems and the amount of daily sugar intake, as well as dental health. By analyzing the independent

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effect of BMI, dental health, and daily sugar intake on the prevalence of decay, it is evident that dental health affects the prevalence and amount of decay. Conversely, BMI and daily sugar intake did not show a certain effect on the prevalence of decay (10). Owing to the significance of this subject, the present study aimed to determine the relationship between BMI (an obesity index) and the tooth decay index among Ilami 6-12 children in 2016-2017. It should be noted that DMF/dmf was used in this study since it is one of the criteria for determining decay (2).

Materials and Methods

The current study utilized a descriptive-analytical method (cross-sectional) and the research population consisted of 6-12 year-old female and male students in Ilam. First, the list of primary schools in Ilam County was taken from the General Education Department, including 97 female and male primary schools. Four schools (two per gender) were selected by the cluster sampling method. Then, necessary privileges were taken to conduct the study, and the members were enumerated by a census. After the initial selection of samples, a letter of consent was submitted by the subjects or their parents.

To check the validity of the questionnaires and standardize the questionnaire, some professors with previous experience in this subject analyzed previous standard questionnaires and identified the necessity of the questions of several questionnaires, and the most important questions were selected accordingly.

The examination was done by measuring the height of students with 0.5 cm approximation and their weight with 100 g approximation without shoes while with clothes. The height and weight of all subjects were taken with a tool (meter) and a digital scale, respectively. The BMI is defined as the body mass (weight) divided by the square of the body height. The dental examination includes the check-up process of all decayed, extracted, and filled deciduous (dmft) and permanent (DMFT) teeth. It is worth noting that one person conducted all examinations. The number of decayed, extracted, and milk-filled and permanent teeth was examined according to the criteria of the World Health Organization (WHO) regarding tooth decay and by means of a disposable mirror and the special examination torch. The results were logged in the prepared forms. Then, a series of questions were asked by the subjects about their diet, ways of preserving hygiene, and individual facilities in the home (to analyze the socio-economic situation) and then inserted in the forms of the questionnaire.

SPSS[®] 22 was used to analyze the obtained data. Multiple linear regression was used to investigate the effect of BMI on the amount of dmft/DMFT per age group. Further, the Pearson's correlation coefficient was utilized to evaluate the correlation of socio-economic variables, BMI, the health and diet conditions. BMI, diet, the preservation of hygiene, and the socio-economic situation were

considered as independent research variables.

Results

This research was carried out for 520 students comprised of 270 female and 250 male subjects (Figure 1).

Based on data analysis, the highest dmft and DMF were among 6- and 12-year-old children, respectively. The results indicated that DMF increases as the dmft represents a decrease (Table 1).

Multiple linear regression showed a correlation between the observed values and the values of the dependent variable predictor model. This coefficient for dmft regression was 0.177 in the 6-year-old group, indicating that about 17% of the change in dmft is defined by independent variables in the model. In other words, 17% of the BMI change justifies the dmft, and the remaining percentage depends on other variables. The related results are shown in Table 2.

The findings (Table 3) demonstrated that the relationship between BMI and dmft for 11 year-old children ($P=0.002$) was significant, and the correlation coefficient was -0.185, representing an inverse relationship between them. However, other cases showed no significant relationship between BMI and dmft/DMFT ($P>0.005$).

Discussion

Tooth decay is a chronic disease that may involve every person (10,11). The universal frequency of tooth decay shows a reduction in its incidence in several developing countries. On the other hand, the developed countries are still experiencing tooth decay as the most common childhood disease despite the general reduction of tooth decay in milk teeth (10,12). Furthermore, obesity and overweight in childhood have been increased since two decades ago (8). Obesity and tooth decay are both multi-functional diseases where diet and lifestyle play an important role in their incidence (8,9).

This study dealt with seven age groups because the children enter the milk-permanent cutting tooth period. Additionally, it analyzed the continuation of this mixed dental situation for other periods and the end of the mixed dental period at 12 years old. To observe the dispersion of samples, they were randomly selected from various areas of Ilam.

Mojarad et al investigated the relationship between

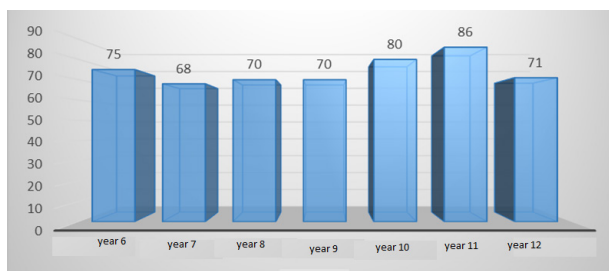


Figure 1. Age Diagram.

tooth decay and BMI among students in a primary school in Hamadan. They reported that the highest amount of decay and filling for both dental systems was related to normal-weight children while the lowest amount belonged to those who were in obesity danger and there was no statistically significant relationship between tooth decay and overweight (13). The results are in line with the analysis of our study on the 11-year-old age group and milk tooth analysis and we found an inverse relationship in this age group.

Likewise, Hooley et al analyzed the relationship between childhood weight, tooth decay, and dietary habits among 4-8 children in Australia and showed that obesity/

overweight relates to the consumption of sweet drinks and dental problems regarding the consumption of fatty foods and sweet drinks (14). Based on the results of the present study, the number of decayed, extracted, and filled teeth increased for children who consumed more sugar materials, which is in conformity with the results of the above-mentioned study.

In another study, Shahraki et al reported no relationship between the daily sweet intake and decay and BMI. More precisely, a reduction was observed in the number of decayed and permanent filled teeth by increasing the number of tooth brushing. The mean of decayed and permanent filled teeth in obese individuals was high compared to normal and underweight ones, showing a statistically significant relationship between decay and BMI (3), which corroborates with the results of the current study.

According to the results of Gupta, there was a direct relationship between the mean of the decay index among 12 year-old children and the BMI (10). The results of this variable do not accompany those of Gupta et al (10). Chu et al concluded that younger children face a higher prevalence of milk tooth decay and pointed to the dental changing period and the less attention of parents to the oral health of their younger children (15).

Yao et al indicated that obese and overweight children

Table 1. Mean and SD for dmft/DMFT Indexes

Age	dmft		DMFT	
	Mean	SD	Mean	SD
Year 6	4.58	3.24	0.37	1
7 Year	3.38	2.64	1.41	1.86
8 Year	2.77	2.66	1.6	1.22
9 Year	3.28	2.63	1.58	1.60
10 Year	1.55	1.98	1.78	1.80
11 Year	0.43	1.09	1.55	1.78
Year 12	0.53	1.59	2.42	2.46

Note. SD: Standard deviation; DMFT: Decayed, missing, and filled teeth.

Table 2. Summary of the Regression Model in the Age Group of 6-12 Years

Age	DMFT/dmft	Standard Deviation of Multiple Linear Regression	Modified Multiple Linear Regression	Multiple Linear Regression
6 year	Dmft	3.509	0.118	0.177
	DMFT	0.410	0.015	0.076
7 year	Dmft	2.41	0.191	0.096
	DMFT	0.318	0.021	0.059
8 year	Dmft	1.84	0.176	0.054
	DMFT	0.212	0.017	0.023
9 year	Dmft	2.13	0.114	0.041
	DMFT	0.301	0.021	0.037
10 year	Dmft	3.07	0.119	0.036
	DMFT	0.206	0.044	0.019
11 year	Dmft	0.508	0.035	0.094
	DMFT	1.65	0.011	0.054
12 year	dmft	0.705	0.029	0.086
	DMFT	2.122	0.042	0.071

Note. DMFT: Decayed, missing, and filled teeth.

Table 3. Results of Correlation Test for BMI and dmft/DMFT Variables in Various Age Groups

Age	Year 6		Year 7		Year 8		Year 9		Year 10		Year 11		Year 12	
	dmft	DMFT	dmft	DMFT	dmft	DMFT	dmft	DMFT	dmft	DMFT	dmft	DMFT	dmft	DMFT
Correlation	-0.089	-0.003	-0.091	-0.013	-0.019	0.042	0.041	-0.11	-0.0151	0.132	-0.185	0.025	0.144	0.093
P value	0.16	0.846	0.191	0.631	0.011	0.214	0.03	0.081	0.0151	0.112	0.002	0.597	0.36	0.061
Total views	75	75	68	68	70	70	70	70	80	80	86	86	71	71

Note. BMI: Body mass index; DMFT: Decayed, missing, and filled teeth.

have more tooth decay in contrast to underweight or normal-weight children so that obesity can have a specific effect on the prevalence of tooth decay among pre-school children (11). In the current study, no significant relationship was observed between the amount of decay and BMI except for the 9 year-old age group, revealing a direct relationship between dmft and BMI and an inverse relationship between the BMI and dmft for the 11 year-old age group.

Additionally, Costa et al conducted research on pre-term childhood decay and BMI among children with low family incomes in Brazil (16). Based on their results, there was no specific relationship between BMI and tooth decay, which contradicts our findings. Meanwhile, high family incomes significantly were related to the lack of tooth decay among children, and a similar result was reported in the present study.

Since the study concluded 6-12 age groups, high BMI was related to the age increase. This problem is due to the physical and physiological growth of the body and is followed by increasing age and reaching puberty periods. The results of the study by Chu et al (15) also represented such a relationship and reported that BMI increases by age, and physiological growth increases, confirming the results of the present study.

In their study, Lempert et al analyzed the effect of socio-economic factors as the strong point. They found that it can affect the relationship between BMI and decay. Despite posing the question of children/adolescents' diet condition, its effect has not been investigated on decay and obesity (8). However, the present study evaluated the effect of socio-economic factors on tooth decay and its effect was statistically significant.

Gerdin et al showed that the prevalence of decay reduces by increasing socio-economic conditions (17), which is in line with the results of the present research. They further found a direct relationship between decay and BMI, which matches the result of our study in the 11-year-old group while not being true for other age groups.

Gerdin et al and Poulton et al reported an inverse relationship between the amount of decay and socio-economic situations. They found that a decrease in the socio-economic level leads to an increase in the amount of decay. They also argued that the reduction in the socio-economic level decreases the levels of oral health and its problems (17,18). Since the research community was extremely large, their results can be more reliable and conform to those of our study.

According to the results of the present study, children's tooth decay index has an inverse relationship with the number of daily tooth brushing while it has a direct relationship with the consumption of sweet drinks, cake, chocolate, toffee, and other sticky foods.

In this respect, Shahraki et al (3), Creske et al (19), and Hooley et al (14) used these health and nutritional factors to analyze their effects on the amount of tooth decay.

In another study, Vania et al showed that the amount of tooth decay directly relates to the consumption of sugar drinks and stated that increasing decay can prevent a child from not chewing the hard and solid foods and prefer soup and liquid foods that need less chewing and tooth. Considering that chewing reduces the viscosity of materials to the teeth and more nutrients are absorbed into the body, tooth decay increases and is followed by the undernourishment (20). In other words, both problems can exacerbate each other and manifest a direct relationship.

Hooley et al refers to the same results and knows the reason more because of the parents' unawareness of consuming these types of sweet drinks (9). Based on the results, consuming sweets and sugar drinks such as industrial juice and soda poses more threats to the teeth to be decayed because of having sugar.

On the other hand, it is expected that preserving hygiene and tooth brushing to reduce the prevalence of decay, an inverse relationship is considered between both variables. Similarly, Shahraki et al found an inverse relationship between the number of tooth brushing and the amount of tooth decay and mentioned that tooth brushing is the most effective precautionary method of tooth decay (3).

In our study, there was a direct relationship between the decay index and the amount of consuming solid and sticky foods. Vania et al showed the same relationship and justified that the child moves toward the fat and high carbohydrate foods, as well as low protein foods because of the inability to chew the food, and the teeth will be decayed. Additionally, they further tend to use sweet meals which creates a vicious cycle and increases the decay (20). On the one hand, it is known that consuming sticky foods such as jelly candies remains for a longer time in connection with the tooth surface and increases the probability of decay because they are sticky and include sugar.

Based on his results, Hooley et al stated that decay has a direct relationship with sticky foods because they stick to the tooth surface and convert to the dental plaque, leading to the production of acid and the dissolution of tooth surface in a longer period (9).

The limitations of this study include the small number of samples and the low geographical dispersion of the studied samples.

Conclusions

Generally, there was not a significant relationship between the BMI and the amount of decay among the 6-12 year-old children in Ilam except for the 11 year-old age group that represented an inverse relationship between BMI and dmft.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

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Ethical Statement

The present study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (Thesis number: 310329).

Authors' Contribution

AV: Concepts, design, definition of intellectual content, clinical studies, experimental studies, data acquisition, data analysis, statistical analysis, and manuscript review; ZJA: Concepts, design, definition of intellectual content, and manuscript review; AD: Concepts, definition of intellectual content, literature search, clinical studies, experimental studies, data acquisition, data analysis, and manuscript review; MRHK: Definition of intellectual content, literature search, manuscript preparation, manuscript editing, manuscript review, and a guarantor. All authors read and approved the manuscript.

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