Annals Journal of Dental and Medical Assisting
2024, Volume 4, Issue 1, Page No: 24-29

Available online at: www.tsdp.net

TSDP
Turkish Specialized Dental Publication

Original Article

Studying the Relationship between Severe Dental Caries in Childhood and Body Mass Index in Children

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Received: 17 December 2023; **Revised:** 14 March 2024; **Accepted:** 18 March 2024

ABSTRACT

Severe early childhood caries (S-ECC) is an acute type of dental caries that has adverse effects on the quality of nutrition and growth of children by causing pain and discomfort. The present study was conducted to investigate the relationship between severe early childhood caries and body mass index (BMI) in children. In this descriptive study, 401 systemically healthy children were randomly selected. After completing the questionnaire, height, weight, and DMFT indices were recorded and examined in terms of the relationship between BMI and S-ECC. The chi-square test and logistic regression were used to analyze the data. In total, there were 188 people with s-ECC and 213 healthy people. In addition, in terms of body mass status, 28.1% were overweight, 38.1% were normal, 13.7% were underweight, and 19.7% were obese. The average DMFT of the statistical population was 3.5 and the average age of the statistical population was 4.7 years. Based on data analysis, the variables of age, consumption of milk at bedtime, BMI status (obesity and underweight), and consumption of snacks had a significant and direct relationship with the occurrence of s-ECC ($p < 0.001$). According to this study, there is a positive correlation between s-ECC and obesity and underweight based on the Centers for Disease Control's BMI chart.

Keywords: Dental, Children, Body mass index, DMFT indices

How to Cite This Article: Kızılcı E, Duman B, Demiroğlu C, Ayhan B. Studying the Relationship between Severe Dental Caries in Childhood and Body Mass Index in Children. Ann J Dent Med Assist. 2024;4(1):24-9.

Introduction

Early childhood caries is a special form of dental caries common in young children and causes one of the most serious dental problems in them [1]. Various definitions have been mentioned to describe this type of decay. According to the report of the American Pediatric Dental Association, the presence of one or more decayed surfaces (cavitated or non-cavitated), restored or missing (due to decay) in any of the primary teeth of a child 71 months of age or younger is defined as ECC early childhood caries [2]. Severe early childhood caries S-ECC presence of a carious smooth surface at less than three years of age, presence of one or more missing surfaces due to caries or restored surface in maxillary anterior teeth at age 3-6 years with DMFS equal to 4, 5 and 6 have been given at the ages of 3, 4 and 5 years [3-5].

The consequences of ECC include an increased risk of creating new carious lesions, increasing the time and cost of dental treatments, the need for emergency dental appointments, the development of subsequent caries in permanent teeth, increased days of absence from kindergartens, and malocclusion in some cases [6, 7]. Although ECC is not life-threatening for the child, it hurts the quality of his health and growth [8, 9]. In many developed and developing countries, there are 90% of untreated caries in preschool children.

Sleep disturbance and irritability are consequences of severe and untreated caries, which are also effective in

glucosteroid production and growth. Another mechanism is that severe caries with pulp involvement affect the secretion of cytokines and hematopoiesis [10]. The causative factors of ECC include decay-causing microorganisms, fermentable carbohydrates, and susceptible hosts have been reported [2, 11]. From an ecological point of view, dental caries, like other diseases, depends on the balance or imbalance between the invasive factors that cause the primary lesion, the acquired factors that change the resistance and susceptibility of tooth enamel, and the modulating factors that exist in the surrounding environment of the teeth, that is, it depends on plaque and saliva [12, 13]. Recently, the relationship between childhood caries and child development has been considered significantly. Body mass index (BMI) is expressed as kg/m2, ideal body mass is determined between 18.5 and 24.5, people with a body mass between 25 and 29.9 are overweight and people with a body mass above 30 are obese and people whose body mass is below 18.5 are underweight. Body mass index is a measure of body fat mass and is used for children older than 24 months [14].

Current evidence suggests that severe caries are associated with malnutrition and are manifested as deviations from the average BMI [15, 16]. Some types of food and nutritional habits can increase the risk of having a disproportionate weight and the incidence of tooth decay in children [17]. BMI is a suitable screening scale, but due to the difference in fat percentage between males and females, it has comparative limitations [14].

Fortunately, the Centers for Disease Control (CDC) has prepared BMI curves based on developmental age, separated by sex [18]. These curves have removed the limitation of BMI for comparing people of different ages and genders and have done this by considering a normal limit for each age and gender so that the comparison can be done more reliably. BMI is divided into four categories: underweight, healthy, overweight, and obese. This classification has a numerical range for adults and a percentage range for children. Both ends of this range are problematic and affect health [14]. Underweight exposes children to risks such as growth disorder, weak immune system, and other frequent diseases and nutritional deficiencies [19]. Overweight and obesity in children increases the risk of type 2 diabetes, high blood pressure, cardiovascular diseases, and other chronic diseases [20, 21].

Since it is very necessary for developing countries to save money and prevent additional costs, setting priorities becomes particularly important. To know the regional and group priorities in the implementation of prevention programs, it seems necessary to examine and relate important factors such as body mass index and tooth decay. On the other hand, due to the existence of some contradictions in the field of the relationship between weight and dental caries, the present research was conducted to determine the relationship between severe childhood caries (S-ECC) and body mass index (BMI) in children.

Materials and Methods

This study is a descriptive study and its sampling was done by random selection method. 401 children aged 3-6 who did not have any genetic or congenital systemic problems were included in the study. After obtaining written consent from the parents, the questionnaire was completed by the parents and the researcher respectively. Variables of height, gender, age, weight, DMFT index, child's weight at birth, level of education and occupation of parents, how to consume milk (bottle or mother's breast) and how often it is consumed, consumption of food supplements, consumption of snacks (soft drinks, sweets, chocolate, etc.), the type of feeding in the first two years (breast milk, formula or both), the method of cleaning the teeth (brush, gauze, other) and the time of cleaning were investigated.

Dental examinations were performed using a disposable plastic probe and a disposable plastic mirror to observe the lingual surfaces of the teeth. Dental radiography was not used in this study. The examiner (final year dental student) according to the methods and standards of the World Health Organization performed these examinations. In the registered DMFT index, teeth removed due to impact were not considered missing teeth, and white spots as decayed teeth. Restored teeth that had relapsed caries were recorded as decayed in the DMFT index. Based on the decay, the data were divided into two groups: the decay-free group (DMFT = 0) and the s-ECC group.

The weight of children without shoes and with minimal clothes was measured with a digital scale with an accuracy of 100g. Children's height was recorded using a standard tape measure that was fixed on the wall without shoes and with an accuracy of ±5 mm. Body mass index (BMI) was calculated by dividing weight (in kilograms) by the square of height (in meters). For comparison, the children's growth curve standard related to the Centers for Disease Control and Prevention was used. The samples were divided into 4 groups according to BMI values: underweight (percentile below 5%), normal weight (percentile between 5% and 85%), overweight (percentile between

85 and 95%), and fat (percentile above 95%) were divided.

SPSS version 23 software was used for data analysis. In the descriptive part, one and multi-dimensional frequency tables (for grouped research variables) and descriptive statistical calculation (for quantitative variables) were used. Chi-square and logistic regression tests were used for data analysis. P<0.05 was considered as a significant level.

Results and Discussion

In this study, 401 children aged 3-6 years were investigated, of which 188 (46.8%) were affected by s-ECC and 213 (53%) were not affected. In addition, in terms of body mass status, 38.1% were in the normal range, 28.1% in the overweight range, 19.7% in the obese range, and 13.7% in the underweight range. The average DMFT of the statistical population was 3.5 and the average age of the statistical population was 4.7 years. The prevalence of s-ECC in the studied population was 46.9%, and considering the 95% confidence interval, the prevalence of s-ECC was in the range of 41.7% to 51.5%. In general, based on the findings of this research, the variables of age, BMI status (obesity and underweight), age of teeth cleaning, mother's occupation, how to consume milk, consumption of milk while sleeping, and consumption of snacks had a significant and direct relationship with the prevalence of s-ECC (P < 0.05).

Table 1. The relationship between background variables and risk factors with the prevalence of S-ECC by univariate logistic regression test.

Variable		Regression coefficient	SE	P-value	Odds ratio	95% confidence interval
Age		0.549	0.110	< 0.001	1.732	1.40-2.15
Gender (boy)		0.459	0.202	0.023	1.583	1.07-2.35
BMI Status	Overweight	0.087	0.468	0.852	1.091	0.44-2.73
	Obesity	3.462	0.474	< 0.001	31.88	14.4-80.72
	Underweight	3.645	0.572	< 0.001	38.28	12.48-117.46
Age to start cleaning teeth		1.425	0.213	< 0.001	4.157	2.74-6.31
Birth weight		0.516	0.648	0.426	1.675	0.47-5.97
Frequency of milk consumption		-1.22	0.110	0.268	0.885	0.24-2.73
One or more children		-0.218	0.111	0.050	0.804	0.65-1.0
Mother's job (housewife)		2.995	0.269	< 0.001	19.99	11.80-33.86
Mother's education		0.062	0.215	0.773	0.940	0.70-1.62
Father's education		0.293	0.262	0.265	1.340	0.80-2.24
Type of delivery		-0.027	0.211	0.898	0.973	0.64-1.47
Feeding the first two years		0.130	0.201	0.517	0.139	0.77-1.69
Feeding while sleeping		4.39	0.334	< 0.001	80.9	41.90-155.19
How to consume milk (Powdered milk)		1.40	0.217	< 0.001	4.094	2.65-6.20
Dietary supplement use (Yes)		-0.805	0.235	< 0.001	0.447	0.28-0.71
Eating snacks (Yes)		3.91	0.341	< 0.001	55.11	25.58-97.35
How to clean teeth	With sterile gas	2.87	1.17	0.014	17.65	1.78-174.72
	With a toothbrush	-3.158	0.753	< 0.001	0.043	0.01-0.19
	Other methods	-6.708	0.937	< 0.001	0.001	0.0001-0.01
Dmfs		2.007	0.264	< 0.001	7.439	4.44-12.48
Dmft		2.000	0.223	< 0.001	7.388	4.77-11.44

Based on the information shown in **Table 1**, each year of age increased the chance of infection by 70%. The chance of getting infected in boys is 58 times higher than in girls. The chance of contracting the disease was 9 times higher in overweight children, 31 times higher in obese children, and 38 times higher in underweight children.

Each year of delay in starting teeth cleaning increased the chance of infection by four times, and the chance of infection in children whose mothers were homemakers was 20 times higher than those whose mothers were working. Drinking milk while sleeping has increased the chance of infection by 80 times, powdered milk by 4 times, nutritional supplements by 2.24 times, and snacks by 50 times.

Based on the table of the Centers for Disease Control, the BMI status was divided into four categories: normal, overweight, obese, and underweight. Examining the frequency distribution of s-ECC in these four classes showed that there was a relationship between BMI and s-ECC and the highest prevalence of s-ECC was related to the obese and underweight class. That is, with the placement of the child in the "obesity and underweight" range, an increase in DMFT was observed.

In a study conducted by Willershausen *et al*. on the relationship between body mass index and severe caries in childhood in Germany [22], a positive relationship between obesity and caries was shown, which is consistent with the findings of the present study. The review article by Hooley *et al*. showed that 35% of studies in the field of obesity and caries identified such a relationship [23]. These studies were mainly obtained in developed countries with high living standards and high access to public health programs, such as the use of fluoride. Another common aspect of these studies is the use of more accurate methods that allow the detection of even early decays. The reason for such a positive relationship is the common risk factor in both diseases. Consuming more soda or foods with high carbohydrate content, highly processed foods, or other energy-rich foods that are accompanied by a decrease in saliva flow, are both fattening and anti-decay. Some studies also show an inverse relationship between BMI and S-ECC [24-26]. The reason for this relationship is that the pain and infection caused by tooth decay is an obstacle for the child to eat and gain weight, and the proof of this claim is that with the reconstruction of the oral cavity of these children, the process of gaining weight is slow The deck is restarted It has been The results of some studies show that decay decreases with increasing obesity. The logic of these studies is that the relationship between weight gain and caries in children is much more complicated than it can be explained by the consumption of carbohydrates alone. Increased sugar consumption, which leads to tooth decay, may not be the primary cause of obesity. However, some others express the issue that there is no connection between these two [3, 27-30]. This group of studies argues that the presence of obesity and tooth decay during childhood was a random finding, which is probably caused by common distorting risk factors such as frequent consumption of decaying foods and oral hygiene is weak [31].

Regarding the reason for the diversity and sometimes the contradiction that exists because of our study with these studies, several things can be presented. Although the relationship between dental caries and children's growth has been proposed by some primary and population-based studies [32], due to the multifactorial nature of caries and obesity, the relationship between these two is complicated because it depends on many factors such as age, gender, race, and others. It has environmental, genetic, behavioral, and social factors [33]. In addition, BMI is an index whose use as a growth index is debatable, although it is widely used in the dental field, especially in studies on the relationship between obesity and tooth decay. Another reason was the diversity in the re-evaluation of the studied individuals, while our study only included a certain age group. In addition, the difference in the method of dental examination and the demographic characteristics of the samples is another reason for the difference in the results [23, 34, 35].

Considering that healthy and appropriate nutrition is one of the main factors of body health, including mouth and teeth health, this is of particular importance in children. Because children in preschool and primary school age have, an urgent and continuous need for healthy and sufficient nutrition for their physical growth and development. Establishing proper eating habits from the beginning of life not only improves the child's physical growth and development but also provides a suitable environment for optimal oral health. Therefore, due to the importance of milk teeth in children's general health and nutrition and the low awareness of parents regarding the maintenance of milk teeth, it is necessary to educate parents and children in society [36, 37]. As a result, we hope that by increasing the level of awareness of the parents of infant children, as well as taking preventive and therapeutic measures, we will be able to see a decrease in caries in our society.

One of the limitations of this study is its cross-sectional nature. In this type of study, the relationship between different variables is obtained in an exploratory manner, and therefore, the cause and disability relationship cannot be deduced from the results of this study. It is suggested to use prospective studies to obtain the cause-effect relationship between body mass index and dental caries. In addition, in all the studies that are used to collect data from the questionnaire,

there is a possibility of error in remembering. The present study is not an exception to this rule, although an effort was made to make the questionnaire refer to issues that would minimize this error.

Conclusion

In the studied population, the frequency of s-ECC patients was 46.8% and its prevalence was 46.9%, considering the 95% confidence interval, the degree of freedom of s-ECC prevalence was between 41.7 and 51.5. The variables of age, BMI status (obesity and underweight), consumption of milk at bedtime, and consumption of snacks had a significant and direct relationship with the prevalence of s-ECC. So the chance of obesity in children is 9.5 times higher than children with normal BMI and it is 12.5 times higher in underweight children than children with normal BMI. Consuming snacks up to 90 times and consuming milk while sleeping increased the chance of being infected up to 80 times. In addition, for every one-year increase in age, the chance of infection increased 2.6 times. According to this study, there is a positive correlation between s-ECC and obesity and underweight based on the Centers for Disease Control's BMI chart.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

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