RESEARCH ARTICLE

The association between decay missing filled tooth index and body mass index in a group of preschool children

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Background: Dental caries and obesity are prevalent chronic conditions across all age groups, with common multifactorial causes such as diet and socioeconomic status.

Objective: The aim of this study was to determine if there is a correlation between the decay missing filled tooth (DMFT) index and body mass index (BMI) in preschool children.

Materials and Methods: The study included 390 children aged 4 to 6 years, comprising 262 boys and 128 girls. The DMFT indices were assessed by two dentists, while anthropometric measurements were conducted by a nutritionist. BMI was calculated using the WHO Anthro-Plus application.

Results: Most children were of normal weight (332), with 28 being underweight and 30 overweight. There were no obese children. Underweight children had a mean DMFT index of 3.7 ± 3.56, significantly higher than those of normal weight (2.0 ± 1.88) and overweight children (1.9 ± 1.60).

Conclusions: This study highlighted an association between the DMFT index and BMI in preschool children, with underweight children having a higher DMFT index compared to those of normal weight and overweight.

Keywords: DMFT index, body mass index, preschool children

Introduction

Dental caries and obesity are two chronic conditions that, due to their high prevalence and incidence across all age groups and their multifactorial origins, raise global health concerns [1]. Dental caries is a progressive condition affecting both primary and permanent dentition, leading to long-term health problems in children, adolescents, and adults [2, 3]. Obesity and overweight, as defined by the World Health Organization (WHO), are characterized by abnormal and excessive fat accumulation that poses a health risk [4]. Both conditions have become more prevalent in recent decades due to lifestyle and dietary changes, particularly in developing countries, where urbanization and westernization have influenced eating habits and physical activity levels. Both conditions share common etiological factors, including diet, high intake of fast food, carbohydrate-rich products, excessive consumption of sweetened or carbonated beverages, lack of physical activity, and low socioeconomic status [5, 6]. The shift from traditional diets to high-calorie, nutrient-poor diets has contributed to both dental caries and obesity becoming widespread, particularly among children. Socioeconomic factors, such as limited access to healthcare, lower education levels, and unhealthy food environments, exacerbate the problem.

Given these shared risk factors, numerous researchers have investigated the correlation between dental caries and increased BMI in recent years. The conclusions of these studies are inconsistent; some report a positive association between increased BMI and caries incidence [7, 8], while others do not [9, 10]. Additionally, studies suggest that changes in oral flora composition and saliva properties in individuals with excessive adipose tissue contribute to the occurrence of carious lesions [11, 12]. Considering the potential impact on both oral and general health, as well as the inconsistent findings even in systematic reviews, it is imperative to conduct further research on the association between body weight and dental caries. A better understanding of this association could have significant implications for public health strategies, particularly in designing targeted preventive measures for children at risk of both obesity and dental caries.

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The objective of this study was to determine whether there is a correlation between decay missing filled tooth (DMFT) index and body mass index (BMI) in preschool children.

Materials and Methods

The study was conducted over a period of three months. The methodology and design were approved by the Ethics Committee of the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș, with the reference number 2171 on 09.03.2023. Written informed consent was obtained from the parents before the study commenced. Out of 506 children attending the selected kindergartens, 390 children aged between 4 and 6 years, both male and female, were included in the study. Non-cooperative children, those absent on the recruitment day, and those whose parents did not consent were excluded from the study.

Clinical dental examinations to record the DMFT index (the sum of decayed (d), missing (m) and filled (f) teeth (t) were conducted at the Faculty of Dental Medicine within our university, using disposable dental instruments (mirrors and dental probes) by two experienced pediatric dentists. The anthropometric measurements required to determine BMI were conducted by a nutritionist. Weight was measured with a mechanical scale with a stadiometer, and height was measured with a portable meter. BMI was calculated using the WHO AnthroPlus application for each child individually (Figure 1).

Thus, the children were categorized into underweight: weight less than 5% of children of the same age; normal weight: between 5-85% of children of the same age; overweight: weight greater than 85% but less than 95% of children of the same age; obese: weight greater than 95% of children of the same age (Figure 2).

To obtain the most accurate results, we used the Z-score calculated by the WHO AnthroPlus application, which represents the distance of a value from the mean, expressed in standard deviations (-3, -2, -1, 0, 1, 2, 3). Graphically represented, the results take the form of a bell curve, also known as the "Gaussian Bell Curve" (Figure 3). Ideally, approximately 68% of results fall within one standard deviation (-1 to 1), and about 96% fall within two standard deviations (-2 to 2). The Gaussian Bell Curve was used to compare the measurement results obtained with those found in the specialized literature.
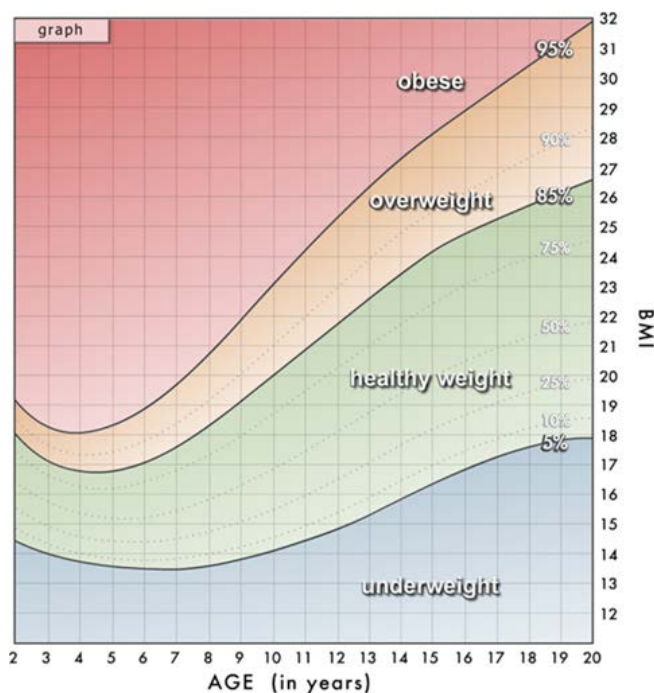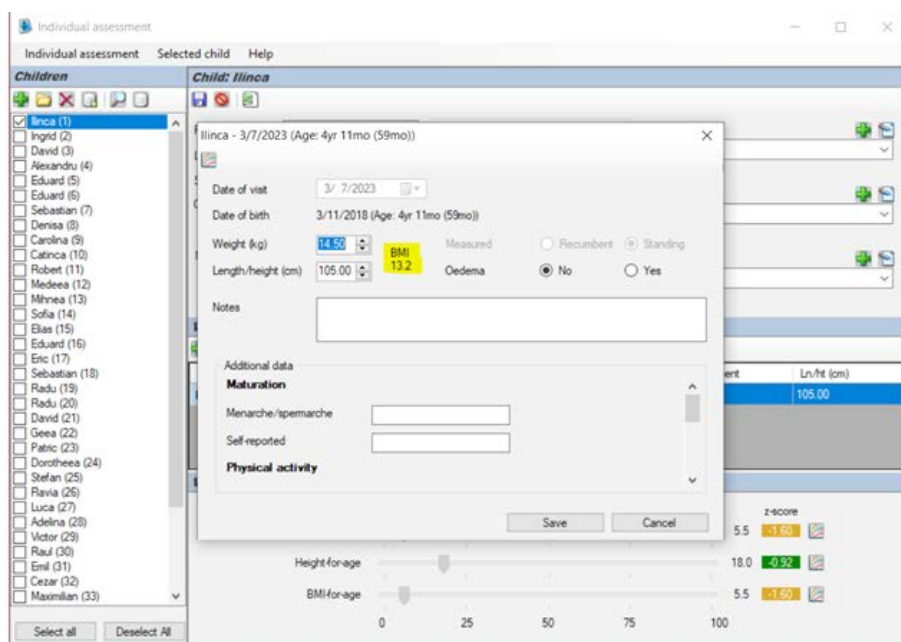

Fig. 2. Body Mass Index by Age
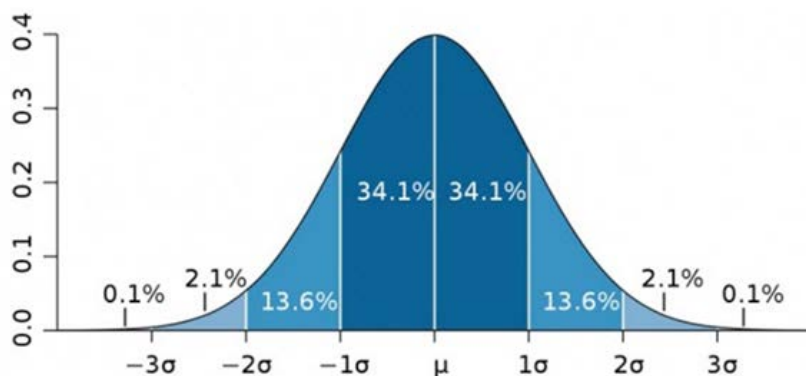

Fig. 1. WHO AnthroPlus Application

Fig. 3. Gaussian Bell Curve

Statistical Analysis

The examination results were recorded using GraphPad Prism™ V6.01 software for Windows™ 2017. Categorical data were evaluated using ANOVA test and t student test. A significance level of 0.05 was chosen, with p-values considered statistically significant when $p \leq 0.05$.

Results

Out of the total 390 children included in the study, 262 were boys and 128 were girls. Using age and weight as anthropometric parameters, we found that most of the analyzed children fell within the standard distribution, with approximately 10% of children presenting a standard deviation of one unit. Additionally, by using height and weight parameters, we calculated the body mass index (BMI) of the children and obtained an average value that falls within the range of -1 and 0 standard deviations, suggesting a tendency towards underweight compared to the values recorded by the World Health Organization (Figure 4).

Compared to the reference value reported by the World Health Organization, boys showed a tendency towards the negative extreme of the body mass index, with a standard mean of -0.5 and standard deviations ranging between -1.8 and 0.6. For girls, the standard mean is -0.6, close to the WHO reference value, with standard deviations ranging between -2 and 2, compared to the WHO values of -3 and 3 (Figure 5).
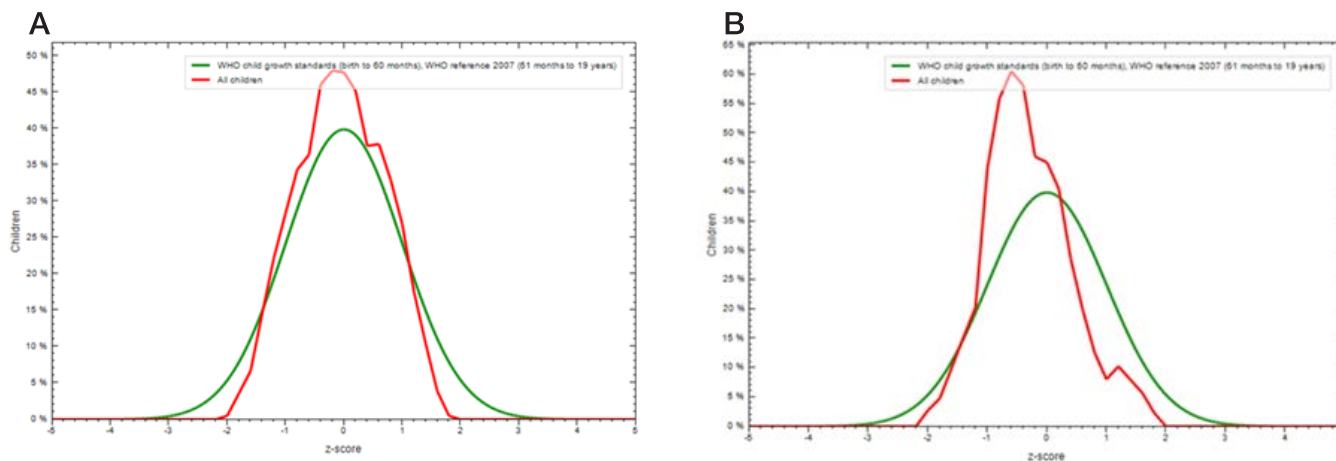

Fig. 4. Distribution of Children's Weight in Relation to Age (A) and Height (B)
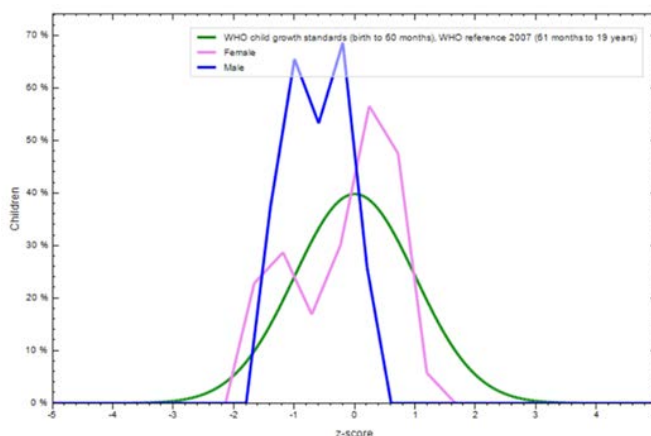

Fig. 5. Body Mass Index by Sex

The results obtained from the association between the body mass index and the DMFT index are summarized in the following table (Table I).

Discussions

This study investigated the association between the dental caries index (DMFT) and body mass index (BMI) in a group of preschool children. The distribution of children by weight categories indicated that most fell within the normal weight range (332), with 28 children classified as underweight and 30 as overweight. Notably, no children were classified as obese. These findings align with WHO standards [4], which emphasize the global trend of a majority of preschool children maintaining a normal BMI range. However, the absence of children classified as obese raises questions about the population's health status and the possibility of selection bias or unreported environmental or genetic factors influencing growth patterns in this specific group. A broader study could better capture BMI variation, including obesity, which would enable more comprehensive data analysis and generalizability.

Analyzing the DMFT index in relation to children's BMI categories, we observed that overweight children did not have higher DMFT indices compared to those of normal weight, indicating they did not have a higher number of carious lesions, even though diet is a common risk factor for both conditions. A possible explanation for our results is that, in addition to the importance of diet as an etiological factor in the occurrence of dental caries, the etiology of caries is very complex, influenced by numerous other fac-

tors such as oral hygiene, fluoride exposure, regular dental check-ups, and socio-economic status [13]. These factors may have played a protective role in this group, compensating for any potential dietary risks. Additionally, the relatively young age of the children may have limited their exposure to cariogenic diets or lifestyles, potentially delaying the manifestation of a significant BMI-caries correlation. In the literature, there are studies that also found no correlation between increased BMI and a higher number of carious lesions in children with primary and mixed dentition, this correlation becoming evident only in permanent dentition, i.e., after the age of 12 [14]. Another important consideration is the absence of children classified as obese, which could have influenced the overall findings.

Unexpectedly, in our study, we found that underweight children had a higher average DMFT index (3.7 ± 3.56) compared to those of normal weight (2.0 ± 1.88) and those overweight (1.9 ± 1.60), suggesting they might be at a higher risk for developing dental caries. The results align with some existing studies in the literature, which suggest that underweight children are usually malnourished and that this could also compromise oral health [15,16]. Thus, enamel hypoplasia, salivary gland hypofunction, and changes in saliva composition could be mechanisms through which malnutrition is associated with dental caries [17]. Furthermore, malnutrition can compromise immune function, leaving children more vulnerable to oral infections and reducing their ability to fight off caries-causing bacteria. Another explanation for these findings, is that untreated caries could cause severe pain and discomfort in children, leading to reduced food intake. Additionally, other caries-induced symptoms, including infections, irritability, and sleep disturbances, can affect children's quality of life and, therefore, their growth [18]. When analyzing by sex, we found that this result is statistically significant only in females, which might reflect different health practices, dietary patterns, and possibly different biological susceptibilities between boys and girls [19, 20].

The mixed results reported in the existing literature regarding the relationship between BMI and dental caries highlight the complexity of this association. Some studies suggest that overweight children have a higher risk of dental caries due to their dietary habits, while others, like our study, report no such relationship in younger age groups [7, 9]. This inconsistency across studies may reflect varying methodologies, population characteristics, and confounding factors, including socio-economic status, access to dental care, and parental influence on diet and hygiene practices. Furthermore, it underscores the multifactorial nature of dental caries, where BMI is only one of many factors that can influence oral health outcomes. These findings suggest that this relationship is far from straightforward and may be influenced by a complex interplay of nutritional status, oral hygiene practices, socio-economic context, and general health behaviors.

Table I. The association between the body mass index and the DMFT index.

BMI Categories	Number	DMFT + standard deviation	P-value
BMI-Boys			
Normal weight	228	2.4 ± 1.89	-
Underweight	8	2 ± 0	0.05994
BMI-Girls			
Normal weight	104	1.2 ± 1.59	-
Underweight	20	4.4 ± 3.98	0.01275
BMI-Total			
Normal weight	336	2.0 ± 1.88	-
Underweight	30	3.7 ± 3.56	0.03778
BMI-Boys			
Normal weight	228	2.4 ± 1.89	-
Overweight	26	2.2 ± 1.74	0.05944
BMI-Girls			
Normal weight	104	1.2 ± 1.59	-
Overweight	4	1 ± 0	0.05998
BMI-Total			
Normal weight	336	2.0 ± 1.88	-
Overweight	34	1.9 ± 1.60	0.05888
BMI-Boys			
Underweight	8	2 ± 0	-
Overweight	26	2.2 ± 1.74	0.05921
BMI-Girls			
Underweight	20	4.4 ± 3.98	-
Overweight	4	1 ± 0	0.01268
BMI-Total			
Underweight	30	3.7 ± 3.56	-
Overweight	34	1.9 ± 1.60	0.03777

Limitations of the Study: It is important to note the study's limitations, including the small sample size and the specificity of the population (preschool children from Târgu Mureş), which may affect the generalizability of the results.

Conclusion

The results of this study highlighted an association between decay missing filled tooth (DMFT) index and body mass index (BMI) in preschool children, with underweight children having a higher DMFT index compared to those of normal and overweight, suggesting they might be more prone to dental caries. To address this, regular dental check-ups with oral hygiene education, nutritional counseling, and fluoride treatments should be prioritized for underweight children to reduce their caries risk and improve overall dental health

Authors' contribution

LB - Conceptualization and design, systematic literature research, data analysis and interpretation, investigation, writing – original draft, writing – review & editing. DO - Data curation, statistical analysis, writing – review & editing. FR - Conceptualization and design, systematic literature research, investigation, data analysis and interpretation, writing – review & editing. RS - Investigation, data curation, funding acquisition. AMS- Formal analysis, methodology, writing – review & editing. All authors approved the final version of the manuscript.

Conflict of interest

None to declare.

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