

# Relationship between dental caries and body mass index in children

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Jennifer Elizabeth Aldana Salguero<sup>1\*</sup>, Ana Elizabeth Silva Menjivar<sup>2</sup>

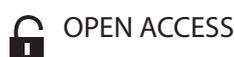
1-2. Evangelical University of El Salvador, San Salvador, El Salvador.

\*Correspondence

✉ jenni.aldana14@gmail.com

1.  0000-0002-6972-9276

2.  0000-0002-8680-0978



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The authors declare there are no conflicts of interest.

### Abstract

**Introduction.** Nutrition and oral health are topics of interest in public health, due to their high impact on the well-being and development of people. There is a high prevalence and incidence of caries and malnutrition in the first years of life. **Objective.** To determine the relationship between the dental caries index and body mass index in permanent and temporary dentition in children aged 5 to 11 years in the San Miguel Tepezontes and Panchimalco health units in 2019. **Methodology.** Quantitative research with a sample of 265 children aged 5 to 11 years. The body mass index and the caries index were evaluated. A descriptive and inferential statistical analysis was performed, using the Spearman correlation statistical test. **Results.** Findings show that the caries index is 2,11 in permanent dentition with a prevalence of 70,5 %, and the caries index is 7,02 in temporary dentition with a prevalence of 94,98 %. Spearman's correlation coefficient between body mass index and caries index in permanent dentition was 0,226, indicating a low positive correlation, and body mass index and caries index in primary dentition was -0,158, indicating a very low negative correlation. **Conclusion.** There is a relationship between caries index in both dentitions and body mass index.

### Keywords

Dental caries, body mass index, El Salvador.

### Resumen

**Introducción.** La nutrición y salud bucal son temas de interés en salud pública por su alto impacto en el bienestar y desarrollo de las personas. Existe una alta prevalencia e incidencia de caries y malnutrición en los primeros años de vida. **Objetivo.** Determinar la relación entre el índice de caries en dentición primaria y permanente e índice de masa corporal en niños de 5 a 11 años en las unidades de salud de San Miguel Tepezontes y Panchimalco en el año 2019. **Metodología.** Investigación cuantitativa con una muestra de 265 niños de 5 a 11 años. Se evaluó el índice de masa corporal y el índice de caries; se hizo un análisis estadístico descriptivo e inferencial, realizando la prueba estadística de correlación de Spearman. **Resultados.** Se encontró que el índice de caries es de 2,11 en dentición permanente con una prevalencia de 70,5 % y el índice de caries de 7,02 en dentición primaria con una prevalencia de un 94,98 %. El coeficiente de correlación de Spearman entre índice de masa corporal e índice de caries en dentición permanente fue de 0,226, que indica una correlación positiva baja y el índice de masa corporal e índice de caries en dentición primaria fue -0,158, que indica una correlación negativa muy baja. **Conclusión.** Existe relación entre el índice de caries en ambas denticiones y el índice de masa corporal.

### Palabras clave

Caries dental, índice de masa corporal, El Salvador.

## Introduction

Dental caries is an infectious-contagious disease in which modulating factors intervene that allow its presence in the oral cavity<sup>1,2</sup>, affecting children and adults<sup>3,4</sup>. Around 520 million children suffer from dental caries in primary dentition and 2

billion people suffer from dental caries in permanent dentition worldwide<sup>5</sup>. Dental caries is a disease of great importance for the stomatognathic system since its presence affects its proper functioning, being essential for optimal development and biopsychosocial well-being in humans<sup>5-7</sup>.

The type of nutrition or food that is acquired in the first years of life is essential for adequate oral health. A diet high in sugars can affect since carbohydrates are fermented by bacteria, producing acids that degrade the hard tissues of the tooth and produce dental caries<sup>8,9</sup>. It is important to consider that malnutrition can be a risk factor for causing different health problems in children, which can be cognitive, mental and neurological, in addition to chronic non-communicable diseases<sup>10,11</sup>.

It has been shown that inadequate nutrition, accompanied by bad habits in oral hygiene, is an adjuvant factor in the appearance of dental caries, and there is a strong relationship between dental health and food. Besides, it is important to consider that malnutrition carries a greater risk for poor development of dental structures, becoming more susceptible to dental caries. Likewise, problems in oral health can generate orofacial pain, causing people not to feed properly due to discomfort at the time of chewing, affecting their nutritional status. It is necessary to address these two components together and not in isolation since one influences the other, affecting people's health<sup>12-14</sup>.

Dental caries is a public health problem in Latin American countries. In 2008, in Paraguay, 98 % of the population suffered from morbidities affecting the oral cavity and the prevalence and incidence rates of caries were high, despite improvements in the scope of health care<sup>15</sup>.

In El Salvador, the prevalence of dental caries for primary dentition is 70,5 % in children aged five to six years and 81,3 % in children aged seven to eight years. In the permanent dentition, the prevalence of caries in children aged seven to eight years is 16,6 %; it is 47,3 % in 12-year-olds and it is 65,1 % in 15-year-olds. The prevalence of dental caries in both dentitions is 70,8 %<sup>16</sup>.

According to the World Health Organization (WHO), dental caries and malnutrition are public health issues since they affect a large number of people at different stages of life. In recent years, overweight and obesity have reached epidemic figures worldwide<sup>3,17-19</sup>, so malnutrition has been considered a risk factor for dental caries<sup>20</sup>. Data from the 2014 National Health Survey indicate a reduction in chronic malnutrition of 51,7 %; however, obesity has increased by 50 % in the last five years<sup>21</sup>.

Because dental caries and nutritional status are related and have a high impact on health in children, it is necessary to characterize the nutritional and dental status of populations for the creation of preventive

measures for diseases that harm the general health of children. Research has associated dental caries and body mass index (BMI) in children. Therefore, it was considered to carry out this study, which objective is to determine the relationship between the dental caries index in primary and permanent dentition and BMI in children from 5 to 11 years at the health units of San Miguel Tepezontes and Panchimalco in 2019.

## Methodology

Quantitative, analytical, transversal research. The research hypothesis for this study was that there is a relationship between dental caries and BMI; the null hypothesis states that there is no relationship between dental caries and BMI.

The study population was composed of children aged 5 to 11 years who attended the health units of Panchimalco and San Miguel Tepezontes in 2019. Data were extracted from the dental clinical records of the selected children. The population of both cities is 5381 children aged 5 to 11 years. The sample for this research was 396, calculated by Epi Info 7 with a confidence level of 95 % and a margin of error of 0,05. The sample was proportionally divided to the population of each city: 84 % for Panchimalco and the rest for San Miguel Tepezontes. However, all the records of the children who attended the dental consultation in both health units in 2019 were reviewed; even so, the desired sample was not reached, managing to obtain at the end only 265 files that met the study variables.

Among the inclusion criteria, it was taken into account that they were children aged 5 to 11 years who attended their dental control in 2019; that the patients resided in the coverage area of Panchimalco and San Miguel Tepezontes health units; that the variables of weight, height and complete odontogram were present in the file. The information was reviewed by the researchers of the study.

The dental charts of the clinical records were checked and the odontogram was observed, where the cariogenic index of each patient was cataloged according to the DMF-T and dmf-t indexes. Also, other general data were taken from the file, such as the name of the health unit, sex, age and nutritional status of the patient. All this information was placed on the observation sheet.

In El Salvador, a BMI graph is implemented and used in children over five years of age and adolescents to obtain nutritional status. When obtaining the BMI, through the

division of the real weight in kilograms by the size in meters, this data must be located in this graph on the Y axis and intersect with age on the X axis, obtaining a nutritional diagnosis. Depending on the results obtained, it will be classified into obesity, overweight, normal, malnutrition and severe malnutrition.

The DMF-T dental caries index is obtained by performing the sum of decayed, missing and filled teeth of the permanent dentition. The dmf-t index is obtained from the sum of decayed teeth, extracted by caries and filled in the primary dentition.

The data collected from the odontogram and the observation sheet were tabulated in the Windows Excel, creating a database coded with each of the variables. A complete statistical analysis was performed, in which descriptive statistics were used since the means of the dental caries indexes and BMI were compared. Inferential statistics were used for the association of variables and the Spearman correlation statistical test was performed since the distribution of the data was not normal. The analyses were performed in the Statistical Package for the Social Sciences (SPSS), version 23.

The research was evaluated by the Ethics Committee of the Evangelical University of El Salvador for its authorization. Likewise, letters of authorization were obtained from the directors of both health units to carry out the research and have access to the clinical records.

## Results

265 children aged 5 to 11 years from the Panchimalco and San Miguel Tepezontes health units in El Salvador were observed. 51,3 % of the population was female. In

terms of geographical location, 70,9 % of the children were from the city of Panchimalco, in the department of San Salvador; the rest, from the city of San Miguel Tepezontes, La Paz.

The DMF-T index in children aged 5 to 11 years in the cities of Panchimalco and San Miguel Tepezontes is 2,11, considered as a low cariogenic index in the permanent dentition. However, the prevalence of the disease in the permanent dentition in children is 70,5 %. The dmf-t index is 7,0, considered as a very high index of caries in the primary dentition. The prevalence of caries in this type of dentition is 94,9 % (Table 1).

The ceo-d index for San Miguel Tepezontes was 5,45 and it was 7,62 for Panchimalco. The prevalence of caries in San Miguel Tepezontes in the permanent dentition was 62,07 % and 91,55 % was the primary dentition. For the Panchimalco health unit, caries in permanent dentition has a prevalence of 75,51 % and 96,27 % in primary dentition (Table 2).

When comparing the classification according to the BMI of boys and girls aged 5 to 11 years of the cities of Panchimalco and San Miguel Tepezontes, it is observed that Panchimalco has the largest number of children with normal weight, registering 74 % of the total population of both cities, being evident the difference with San Miguel Tepezontes. However, in the case of overweight and obesity it is also the city with the highest number, registering 77 % of overweight children and 56 % with obesity, compared the group of San Miguel Tepezontes (Figure 1).

The calculated value of  $r_s=0,226$  is less than the critical Spearman value, at a significance level of  $\alpha=0,05$ , so the null hypothesis is rejected. Therefore, it

**Table 1.** Index of dental caries of children aged 5 to 11 years

Caries index	Mean	Minimum	Maximum	Standard deviation	Mode	25 %	Median	75 %	Prevalence
DMF-T	2,1	0,0	12	2,0	0	0,0	2,0	4,0	70,5 %
dmf-t	7,0	0,0	17	3,5	8	4,0	7,0	9,0	94,9 %

**Table 2.** Index of dental caries of children aged 5 to 11 years at the health units of Panchimalco and San Miguel Tepezontes in 2019

Caries index	Mean	Minimum	Maximum	Standard deviation	Mode	25 %	Median	75 %	Prevalence
DMF-T Panchimalco	2,14	0,0	6,0	1,74	0,0	1,0	2,0	4,0	75,51 %
DMF-T San Miguel Tepezontes	2,06	0,0	12,0	2,56	0,0	0,0	1,0	3,0	62,07 %
dmf-t Panchimalco	7,62	0,0	17,0	3,43	8,0	6,0	8,0	10,0	96,27 %
dmf-t San Miguel Tepezontes	5,45	0,0	15,0	3,36	4,0	3,0	5,0	8,0	91,55 %

is concluded that the two variables are considerably correlated with a low positive correlation; that is, as BMI increases, so does the rate of caries in permanent dentition.

Spearman's correlation between BMI and children's dmft index shows a value of  $r_s = -0,158$ , which is lower than Spearman's critical value. The p-value obtained was 0,01, so the null hypothesis is rejected. The two variables are considerably correlated with a very low negative correlation between them. This indicates that as BMI decreases, the index of dental caries increases.

## Discussion

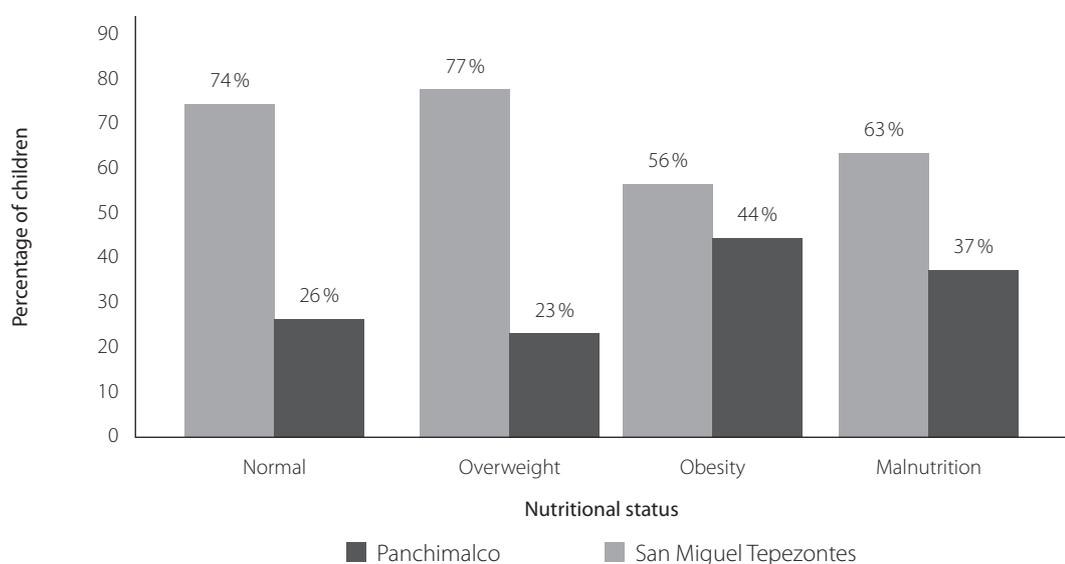
This study shows that there is a relationship between dental caries in both dentitions and BMI. The ratio of BMI and DMF-T in the study population was 0,226 with a p-value of 0,005. This indicates a low positive correlation similar to a study conducted in an educational center in Peru in 2017, which confirmed the relationship between BMI and the dental caries index since the group with normal BMI, the dmft index was low in contrast to the groups with malnutrition, overweight and obesity, in which the dmft index was moderate to high<sup>22</sup>.

Likewise, there is a correlation between BMI and dmft in children in the cities of Panchimalco and San Miguel Tepezontes, since  $r_s = -0,158$  indicates that there is a very low negative correlation. Some studies mention that there is a relationship; however, further research is needed on this public health issue<sup>23</sup>. Nevertheless, authors such as Shen, indicate that underweight children seem to be more susceptible to dental caries since the formation of dental

structures is more deficient, making them more susceptible<sup>24</sup>.

According to the WHO, the prevalence of caries is 60 to 90 % in the school population<sup>25</sup>. In the present study it was determined that the prevalence of caries for permanent dentition is 70,5 % and 94,9 % in the primary dentition of children in the cities of Panchimalco and San Miguel Tepezontes, which is consistent with the WHO prevalence estimate. Also, the prevalences found are similar to studies carried out in Latin American countries, where there are high prevalences of caries<sup>26</sup>. In children, this can be determined by modulating factors such as parental education, the economy of cities and the influence of health services<sup>1,2</sup>.

According to the Oral Health Diagnosis of El Salvador, the prevalence of dental caries for primary dentition is 70,5 % in children aged five to six years and it is 81,3 % in children aged seven to eight years<sup>16</sup>. This differs with the results of the population studied for the present research, since the prevalence in primary dentition in children aged five to six years in the population of Panchimalco and San Miguel Tepezontes is 93 %; and those aged seven to eight years is 98,9 %, these being higher than those described in the diagnosis<sup>16</sup>. Similarly, permanent dentition has a prevalence of caries of 16,6 % in children aged seven to eight years according to the diagnosis; in children aged 12 years it is 47,3 %, which differs with the data found in this research, since children aged seven to eight years have a prevalence of caries in permanent dentition of 87,5 % and 80 % in children of 11 years old, being the prevalences found in both dentitions higher than those shown in said report<sup>16</sup>.



**Figure 1.** Nutritional status of children aged 5 to 11 years at the health units of Panchimalco and San Miguel Tepezontes in 2019

This study shows that the DMF-T index is 2,1, cataloged according to the WHO as a low cariogenic index in the permanent dentition, which agrees with studies of countries such as Chile, where the cariogenic index is 1,9, classifying it as a low index of caries. However, it differs with other studies such as one conducted in Peru, which has a DMF-T index of 5,8, being a high index of caries<sup>26</sup> with respect to the dmf-t index, which is seven. This is a very high cariogenic index for the primary dentition, becoming a risk factor for permanent teeth, which begin their eruption at six years of age. That is why the presence of dental caries at an early age can be influenced.

According to this study, the female sex is the one with the highest percentage of overweight and malnutrition. According to the ages, there is an increase in overweight from the age of seven, which is consistent with a study in Spain, in which it was found that overweight in schoolchildren is more frequent in the female sex and that this health problem increases at an older age<sup>27</sup>. This can be influenced from an early age, since the female sex has a higher percentage of body fat compared to men, in addition to a poor diet with high sugar and fat content, which may be contributing to the increase in overweight.

Also, according to the study carried out, there is an increase in malnutrition from the age of six years compared to the age of five years. There is a 6 % of severe malnutrition, which indicates that the necessary actions are not carried out by the multidisciplinary team of the different health units, who focus attention especially on the first five years of life to prevent malnutrition, neglecting the actions in the following years, among which are the home visit, preventive consultation in the different areas, surveillance of food and nutritional security, education on habits and oral health care in the family, school and community, among others. This allows for an increase in malnutrition and the risk of it becoming severe malnutrition.

74 % of the children of Panchimalco and 26 % of those of San Miguel Tepezontes, have a normal weight. However, these figures could change according to what is observed in the clinical record, since many children are barely within the limits. If they are not cared for in a timely and comprehensive manner, taking into account their specific needs, they could go to the extreme of overweight or malnutrition.

It is very important to consider that although San Miguel Tepezontes presented the lower percentages in overweight, obesity and malnutrition, they have a lower popula-

tion than Panchimalco. Therefore, they are worrying and very significant data for the city of San Miguel Tepezontes, taking into account that it belongs to the department of La Paz, which is considered one of the departments at the national level with the highest poverty, registering 26,2 % of households in a situation of food insecurity, remaining in the category of severe, according to national results<sup>21</sup>. Thus, the results obtained in the study become relevant, since it contributes to the risk of incidence and prevalence of malnutrition and dental caries.

Within the limitations of the study, it was not possible to reach the established sample, since most of the records did not have the complete study variables, due to the poor registration of data in the clinical records, lack of multidisciplinary follow-up and the patients left without receiving care.

According to the results of the study, a balanced and nutritious diet, low in sugar and carbohydrates, should be encouraged in children through their families to prevent the incidence and prevalence of malnutrition and caries<sup>8,9</sup>. Likewise, oral education actions must be carried out for a correct brushing technique in an integral way and in different scenarios such as school, home, health units promoting in turn the importance of preventive and timely visits to the dentist and different health professionals for an early diagnosis, contributing to preserve and improve health. Moreover, it is necessary to consider that there are modulating factors for the appearance of caries<sup>1</sup> and some of them can be addressed through oral health education.

It is necessary to strengthen oral health education programs and strategies in pregnant women, since poor oral health can lead to premature births and babies with low birth weight, which also increases the risk of the development of early dental caries in children<sup>28,29</sup>. Also, it is important that child health programs continue to be strengthened to provide follow-up and timely care. The approach to health must be carried out holistically<sup>30</sup> in the care centers since this will allow a comprehensive approach to the general well-being of the person.

## Conclusions

There is a relationship between caries in both dentitions and BMI in children aged 5 to 11 years, affecting the female sex more and increasing at an older age. The prevalence of caries in primary and permanent teething in children in both municipalities is currently high.

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