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CORRELATION BETWEEN BMI, DENTAL CARIES AND SALIVARY BUFFER CAPACITY IN A SAMPLE OF CHILDREN FROM MURES COUNTY, ROMANIA

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Abstract

Both dental caries and malnutrition in children are serious public health problems with diet as a common risk factor. The aim of this study is to investigate the relationship between dental caries, Body Mass Index (BMI) and salivary buffer capacity in children. **Materials and Method**: The first part of the study was conducted on 144 children, aged between 6 and 12 years, examined in the Pediatric Dentistry Department of UMF Tirgu Mures. Nutritional status was assessed using BMI in accordance with the recommendations of the World Health Organisation. The sample was divided into four groups based on BMI: underweight, normal weight, overweight and obese for age. Dental caries were evaluated using the DMFT (Decayed Missing Filled Teeth) index for permanent dentition and dmft (decayed missing filled teeth) for deciduous dentition. Salivary buffer capacity was recorded with CRT Buffer Strips from Ivoclar Vivadent. **Results**: The mean age of the sample was 9.11 ± 0.19 years, the mean dmft was 2.58 ± 0.26 and mean DMFT 1.76 ± 0.2. The underweight group presented a significantly higher dmft index compared to the other groups. A negative correlation between the salivary buffer capacity and the caries index was found. **Conclusions**: Because the results of this preliminary study show a higher caries incidence in underweight children, the relationship between dental caries and malnutrition should be further investigated. Dentists and physicians treating children should consider malnutrition as a risk factor for dental caries.

Keywords: Dental caries, Body Mass Index, DMFT, dmft, children salivary buffer capacity

Introduction

Adequate nutrition in children is very important and can influence normal growth and development. Both dental caries and malnutrition in children are serious public health problems with diet as a common risk factor (Ribeiro et al.,2014; Panwar et al.,2014). Malnutrition is one of the most frequently reported factors that can negatively affect the physical and mental development of a child (Panwar et al.,2014). A nutritional disorder can interfere with tooth development, with affected children displaying delayed dental eruption, enamel hypoplasia, a higher incidence of caries, reduced salivary secretion, a reduced salivary buffer capacity and qualitative changes of saliva (Ribeiro et al.,2014; Alvarez et al., 1995). Nutritional deficiency can impair the formation of tooth structure, altering the properties of the enamel and increasing susceptibility to caries (Narang et al.,2012).

Dental caries represent the most frequently occurring chronic condition in children. One of the causes of dental caries is an imbalance between risk factors and the caries-protective factors, with risk factors including changes in salivary flow and buffer capacity. Although caries incidence has decreased in the last years, a high percentage of children are still affected, especially in underdeveloped countries (Shakya et al.,2013; Delgado-Angulo et al.,2009). Therefore, assessing risk factors is important in gauging a patient's risk for developing caries. Evaluation of caries risk is of particular importance in children, as this allows taking measures to improve oral health and nutrition, as well as taking other prophylactic actions to reduce the incidence of caries (Hussein et al.,2014).

The aim of this cross-sectional study was to assess the relationship between dental caries, salivary buffer capacity and nutritional status of children and to test the hypothesis that the incidence of caries is higher in underweight children compared to those with a normal weight.

Materials and methods

This study was conducted on 144 children, aged between 6 and 12 years, examined in the Pediatric Dentistry Department of UMF Tirgu Mures. All parents or guardians of the children signed an informed consent form, agreeing with the inclusion of the child in our study.

Inclusion criteria:

- children aged between 6 and 12 years
- children from Mures county
- children with signed informed consent form

Exclusion criteria:

- children with orthodontic appliances
- medically compromised children
- systemic disease that can affect growth

The measured parameters for each patient were: BMI, salivary buffer capacity, present and missing teeth, dental caries and fillings. Nutritional status was assessed using BMI in accordance with the recommendations of the World Health Organisation using the formula:

BMI = weight (kg) / height (m2)

The weight of each child, without shoes and with light clothing, was measured with a calibrated digital scale. Height was measured in cm using a ruler.

The study sample was divided into four groups according to the BMI-for-age percentile, which takes into account the heights of other children of the same age and sex category: underweight - less than the 5th percentile; healthy weight - 5th percentile up to the 85th percentile; overweight - 85th to less than the 95th percentile; and obese - equal to or greater than the 95th percentile.

Oral examination was performed by a pediatric dentist on a dental chair under good lighting, using a dental mirror and a dental probe. Dental caries presence was assessed using the DMFT index for permanent dentition and dmft index for deciduous teeth. A tooth surface was considered decayed if the dental probe was retained. White spots were not considered as caries in our study. No radiographs were used.

Stimulated saliva was collected from each patient after 5 minutes of chewing on paraffin wax. Saliva was then expectorated in a sterile container and salivary buffer capacity was estimated. We used the CRT buffer strips from Ivoclar, Vivadent. Using the manufacturer pipette, saliva was dropped on the test field of the strip. After 5 minutes, results were interpreted by comparing the color of the strip with the color chart provided in the kit: high buffer capacity - blue; medium buffer capacity – green; and low buffer capacity - yellow. (Figure 1)

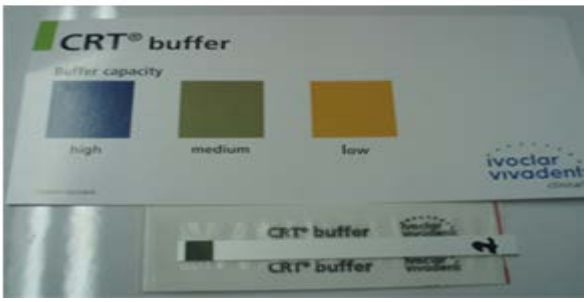


Figure 1. CRT buffer strip interpretation sample

Statistics

Continuous variables are expressed as means ± SEM and were compared using the Mann-Whitney U test. Pearson correlation tests were also conducted. A two-tailed p-value of less than 0.05 was considered statistically significant. Statistical analyses were undertaken using GraphPad Prism software (GraphPad Software; San Diego, CA).

Results

The mean age of the sample was 9.11 ± 0.19 years, the mean dmft was 2.58 ± 0.26 and mean DMFT 1.76 ± 0.2. When comparing the measured parameters between genders we found a significant difference in permanent dentition, with girls showing a higher incidence of caries (Table 1). Our findings show that 24% of the children were underweight, 46% had a normal weight, 7% were overweight and 23% were obese (Figure 2). The average age for each of the weight groups is shown in Figure 3. In our study 40.2% of the children were caries-free (Table 2).

	Girls n=76	**Boys n=68**	**p-value**
Age	9.21 ± 0.28	8.99 ± 0.26	0.44
BMI	16.17 ± 0.37	16.33 ± 0.35	0.55
dmft	2.26 ± 0.33	2.94 ± 0.40	0.09
DMFT	2.37 ± 0.33	1.09 ±0.18	**<0.01**
Buffer capacity	2.58 ± 0.06	2.5 ± 0.07	0.46

Table 1. Comparisons between girls and boys.

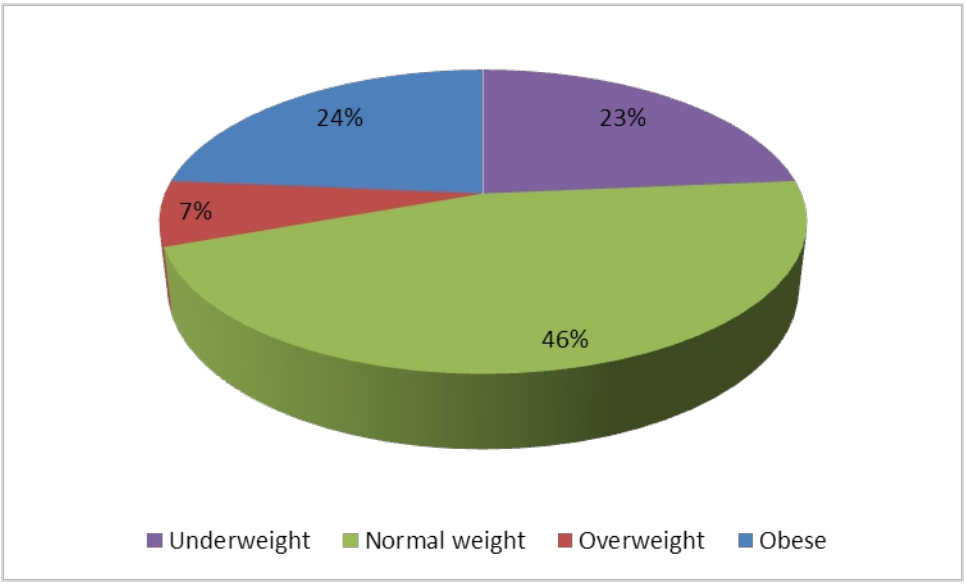


Figure 2. Distribution of study sample based on BMI.

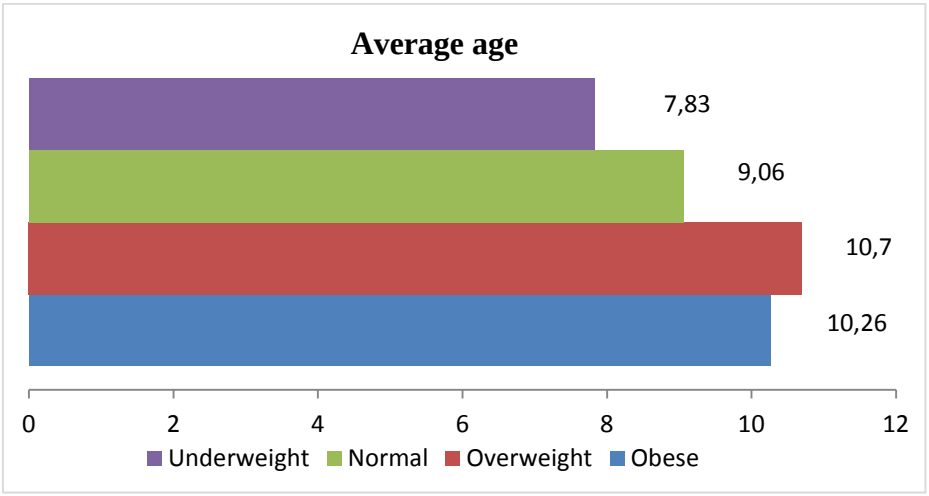
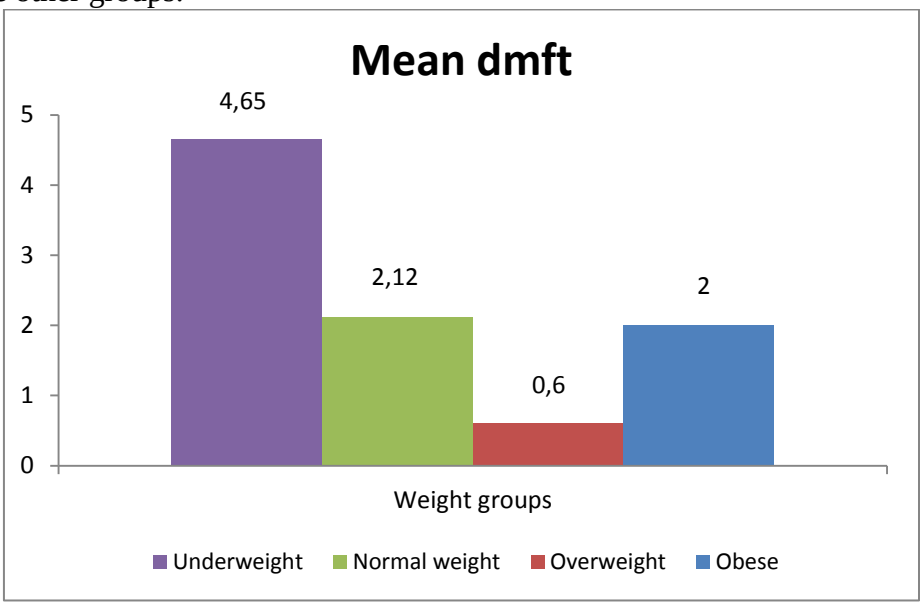


Figure 3. Average age for each weight group

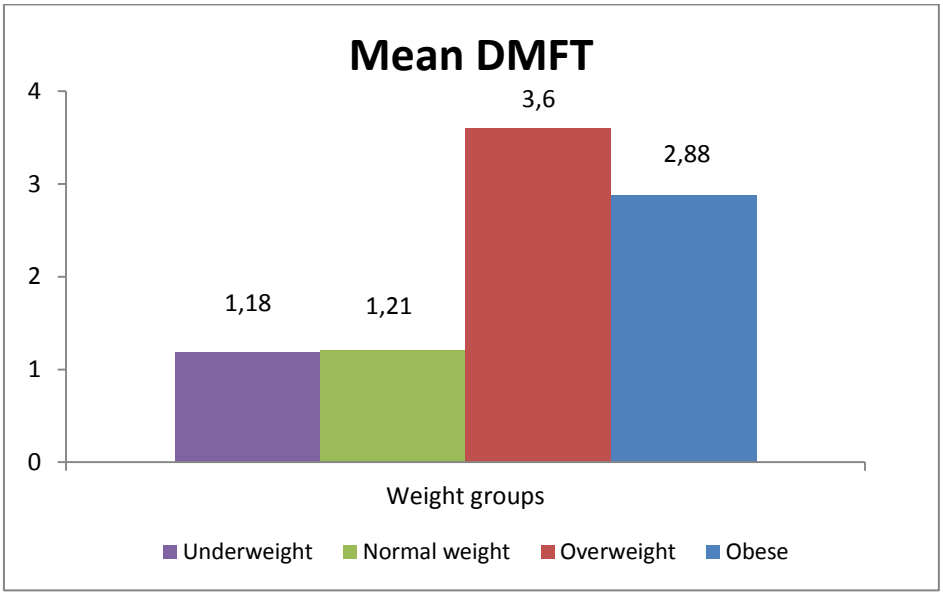
Dental caries prevalence	Frequency	Percent
No caries	58	40.2
Caries present	86	59.8
Total	144	100

Table 2. Dental caries prevalence

The Pearson's correlation test showed a statistically significant negative correlation (r=-0.26, p=0.02) between dmft and BMI. The underweight group presented a significantly higher dmft index compared to the other groups.



When analyzing the relationship between BMI and DMFT, a positive correlation was found (r=0.30, p=0.001), suggesting that children with higher BMI tend to have more caries.



The analysis of the salivary buffer capacity showed that the majority of the participants of the study presented a medium capacity (42%), followed by 39% with high capacity and just 19% with low capacity. Although not statistically significant, a negative correlation between the salivary buffer capacity and the caries index was found. When analyzing the relationship between salivary buffer capacity and BMI we found no significant correlations for any of the weight groups.

Discussion

The relationship between dental caries and BMI has been studied by numerous authors, with often controversial and limited results (Xavier et al., 2103). Empirical findings suggest the existence of such a relationship, but very few studies to date have confirmed and characterized this relationship (Batista et al.,2007).

Similar results were found by Hilgers et al, who reported that children with increased BMI had a higher incidence of caries in permanent teeth (Sadeghi et al.,2007; Hilgers et al.,2006). Willerhausen et al found a strong positive association between obesity and caries in 1290 German children (Willerhausen et al.,2007). Shakya et al found a negative correlation between BMI and the number of dental carries in both types of dentition (Shakya et al.,2013). The findings of Mohammadi et al show a positive correlation between BMI and dental caries in 6 year old Iranian children

(Mohammadi et al.,2012). T. Ribeiro et al found a higher risk of caries in mildly and severely undernourished children (Ribeiro et al.,2014). Similar results are presented by Lueangpiansamut (Lueangpiansamut et al.,2012) and Delgado-Angulo (Delgado-Angulo et al.,2013).

The results of our study are in disagreement with some other findings discussed in the literature. Sadeghi et al found no significant association between BMI for age and decayed filled teeth for permanent/decidous dentition (DFT/dft) (Sadeghi et al.,2007). Xavier et al confirmed in their study that children with malnutrition had a 2 times higher DMFT than children with normal weight, overweight and obese children. The correlation was not significant (Xavier et al.,2013). Panwar et al found no correlation between the mean DMFT score and BMI for age. Children with normal weight had more caries compared to the other groups (Panwar et al.,2014).

Regarding the salivary buffer capacity, our results are in contrast with those of Sakeenabi et al (Sakeenabi et al.,2011) who found a highly significant correlation between mean caries score and buffer capacity. While Christoforou et al found a marginally significant correlation between BMI and salivary buffering capacity (Christoforou et al., 2007) our analysis revealed no correlation between the two parameters in any the weight groups.

The results of this study should be considered in light of several limitations, including the small sample size and the specific population – school children from Tirgu Mures, Romania. While the specific population may make it difficult to generalize these findings to other geographic regions, the present study adds to the growing body of international literature and provides initial evidence to support further research in this area.

Conclusion

Our study shows that children with lower BMI have more caries in the deciduous dentition. In contrast, in the permanent dentition obese children presented more caries.

Further investigation using a larger sample size is needed to examine the relationship between dental caries, salivary buffer capacity and BMI.

The use of salivary parameters, such as buffer capacity, is an easy and readily available method of estimating a patient's risk for caries.

The high incidence of dental caries underscores the importance for dentists and pediatricians to know the risk factors and be able to identify high risk populations. This knowledge can contribute to a timely diagnosis and appropriate preventive measures. Malnutrition could be considered a risk factor for caries and calculating BMI should be included in the examination of the pediatric patient.

School nutritional programs should be implemented in order to improve children's nutritional status and health.

Acknowledgment

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