Health, Sports & Rehabilitation Medicine
Vol. 20, no. 2, April-June 2019, 62–65

The association between dental caries, education and body mass index in a population of Romanian schoolchildren

Cosmin Tudoroniu, Bogdana Adriana Năsui, Monica Popa
"Iuliu Hatieganu" University of Medicine and Pharmacy Cluj-Napoca, Romania

Abstract

Background. Obesity and caries are common conditions in childhood and can have significant implications in children's wellbeing. Evidence into their association remains conflicting.

Aims. The aim of this study was to assess dental caries prevalence in relation with the body mass index and dental health behaviors in a population of schoolchildren.

Methods. We used a cross-sectional study among 650 schoolchildren from Cluj-Napoca, with the mean age 15.39 ± 3.2 years. Weight and height were self-reported in the questionnaire (converted to Body Mass Index centiles, according to WHO growth charts). Caries were assessed by using the sum of the number of teeth that were decayed, missing or filled (DMFT index). A questionnaire was used to obtain information about sociodemographic characteristics of the children, oral hygiene and dietary habits. Data were analyzed by using StatsDirect v.2.7.2, T test and Mann Whitney test to compare variables. The results with $p<0.05$ were considered significant.

Results. The dmft/DMFT index was higher in rural than in urban areas (3.16±1.93 vs. 3.09±2.26, $p>0.05$). Parents of children from urban areas had a higher education than parents from rural areas ($p<0.0001$). The mean BMI was higher in children from rural areas than those from urban areas ($p=0.03$). Our results indicated that the dmft/DMFT index was not affected by the BMI index, at this age ($p>0.05$).

Conclusions. Our study highlights the need for education of schoolchildren regarding oral health, diet and lifestyle, including changes in physical activity and food quality to prevent obesity and dental caries, both in children and later in adulthood.

Key words: caries, body mass index, oral health habits.

Introduction

Oral diseases, especially dental caries, are still mainly prevalent in developing countries, affecting people irrespective of the race, socioeconomic status or age (Touger-Decker & van Loveren, 2003). Dental caries is a multifactorial disease attributed to both modifiable risk factors, such as dietary factors, water fluoride levels, tooth brushing frequency, and non-modifiable risk factors such as socioeconomic status and previous caries experience (Anil & Anand, 2017).

The literature provides evidence for the coexistence of obesity and dental caries, as they have common risk factors including consumption of free sugars and socioeconomic deprivation (Te Morenga et al., 2012; Locker, 2000). Overweight and dental caries are attributed to complex behavioral and societal factors which include the genetic component, increased media exposure through television and computer games, overall calorie intake along with increased intake of sugary foods and beverages, physical activity, habits of both oral and personal hygiene. Various literature data support evidence of the coexistence of the two conditions in the same individuals and populations, but with variations (Moynihan & Kelly, 2014).

In low-income countries, the cost of traditional restorative treatment of dental disease would probably exceed the available resources for health care. Dental health promotion and preventive strategies are clearly more affordable and sustainable. Although not life-threatening, dental diseases have a detrimental effect on quality of life through childhood to old age, having an impact on self-esteem, eating ability, nutrition and health. In modern society, a significant role of teeth is to enhance appearance.

The amount of dental decay is measured using the dmft/DMFT index, accounting for the number of teeth or tooth surfaces in a person's mouth that are decayed, missing or filled as a result of caries in primary/permanent dentition (Petersen, 2003).

Hypothesis

Literature data are contradictory regarding the relation between obesity and overweight and prevalence of dental caries, due to the same risk factors of both diseases. The objective of this study was to assess the correlation between

Received: 2019, February 25; *Accepted for publication:* 2019, March 8
Address for correspondence: "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Louis Pasteur Str. No. 6, Hygiene Discipline
E-mail: nasuibogdana@yahoo.ro
Corresponding author: Bogdana Adriana Năsui; nasuibogdana@yahoo.ro
https://doi.org/10.26659/pm3.2019.20.2.62

dental caries and modifiable risk factors, such as the body mass index in children.

Material and methods

The study was approved by the Bioethics Committee of the "Iuliu Hatieganu" University of Medicine and Pharmacy (No. 287/19.06.2017), and the children's parents agreed to fulfill the questionnaire with a view to the publication of results for scientific purposes.

Research protocol

a) Period and place of the research. In order to achieve the aim of our study, we conducted a cross-sectional study in three schools in Cluj-Napoca from March to June 2017. Cluj-Napoca is a city with about 325,000 inhabitants, situated in the North-West of Romania.

b) Subjects and groups. A total of 650 subjects, aged between 5-19 years (minimum 7 years, maximum 19 years), were selected to participate in this study.

c) Tests applied. We calculated the DMFT index of the children according to the WHO definition. Oral clinical examination was performed by a dentist according to the oral status evaluation methodology recommended by WHO. Radiographs were not taken. A dental assistant recorded the results of the dentist's examination.

The research team applied a structured questionnaire to the participants of the study. The questionnaire investigated demographic data, behavioral factors and food intake in order to determine the link between dental caries and these variables. For the group aged 5 to 14 years, the questionnaires were filled by the parents. A written informed consent was given by the parents of the children participating in the study. Students and parents were informed that the questionnaire was confidential and that participation was voluntary. The response rate was 89%. The body mass index (BMI) was calculated by the formula BMI = Weight (kg)/ Height^2 (m^2). The weight and height were self-reported in the questionnaire. We calculated the DMFT index of the children depending on the BMI categories in order to determine the relation between overweight and obesity and prevalence of dental caries.

The BMI value obtained was then plotted on age and gender specific percentile curves provided by the World Health Organization (WHO), and the children were categorized into four groups based on their BMI percentiles as follows (1):

- Underweight children group with a BMI-for-age less than the 5th percentile;
- Normoweight children group with a BMI-for-age greater than or equal to the 5th percentile and less than the 85th percentile;
- Overweight children group with a BMI-for-age greater than or equal to the 85th percentile and less than the 95th percentile;
- Obese children group with a BMI-for-age greater than or equal to the 95th percentile.

d) Statistical processing

Data were analyzed using StatsDirect v.2.7.2 software, with OpenEpi v.3.03 application and Excel (Microsoft Office 2010). Continuous variables were described using mean and standard deviation. The Chi-square test was used to compare proportions. In the case of a normal distribution of variables we used the T test, and in the case of an uneven distribution of variables we used the nonparametric Mann-Whitney (U) test. Results with $p<0.05$ were considered statistically significant.

Results

The mean age of the sample was 15.39 ± 3.2 years, with a mean age of males 13.71 ± 3.49 years, and of females 15.77±2.38 years ($p<0.001$) (data are not presented in the table). The mean DMFT index was higher in rural areas than in urban areas, but the results were not statistically significant (Table I).

Our study showed that schoolchildren from rural areas had a higher body mass index than children from urban areas. The results evidenced a high percentage of children who made an appointment to the dentist only when they were in pain; 42.38% schoolchildren from rural areas indicated that they saw the dentist only when in pain compared to 33.86% children from urban areas (data are not presented in the table). However, a great proportion of children used fluoridated toothpaste and reported tooth brushing twice per day (Table I).

Table I

Baseline characteristics of the sample

Variable		p value
Male (%)	22.5	
Female (%)	77.5	
Urban (%)	67.7	
Rural (%)	32.3	
Mean age (years)	15.39±3.2	
Mean DMFT urban	3.09±2.26	0.28
Mean DMFT rural	3.16±1.93	
Mean BMI males (kg/m^2)	20.6±4.15	0.29
Mean BMI females (kg/m^2)	20.8±3.36	
Mean BMI urban (kg/m^2)	20.56±3.69	0.03
Mean BMI rural (kg/m^2)	21.15±3.20	
Dental health and care		
Mean DMFT	3.14±2	
Mean DMFT males	3.42±1.73	0.001
Mean DMFT females	3.05±2.21	
Tooth brushing		
After every meal (%)	7.1	
2/day (%)	70.9	
1/day (%)	20.1	
Sometimes I forget (%)	1.9	
Every evening (%)	66.3	
Toothpaste with fluoride (%)	75.2	
Toothpaste without fluoride (%)	24.8	
Dentist visits		
Once every 6 months (%)	16.62	
Once/year (%)	42.77	
In pain (%)	36.62	
Never (%)	4.00	

Generally, in the urban sample of the children, most of the mothers had university studies compared to mothers from rural areas, who had high school education. Parents from urban areas had a higher education level than parents from rural areas (Chi2 $p<0.0001$, fathers - Rs = 0.19; mothers - Rs = 0.21, both $p<0.0001$) (Table II).

Table II
Parents' education

Variable	Total No. (%)	Urban No. (%)	Rural No. (%)
Age (years)	15.31 ± 2.8	15.01 ± 3.06	15.92 ± 2.04
Area of residence	650 (100)	440 (67.69)	210 (32.31)
Mother's education			
Primary	7 (1.08)	3 (0.68)	4 (1.90)
Secondary	34 (5.23)	10 (2.27)	24 (11.43)
High school	244 (37.54)	152 (34.55)	92 (43.81)
Trade school	146 (22.46)	105 (23.86)	41 (19.52)
University	219 (33.69)	170 (38.64)	49 (23.33)
Father's education			
Primary	13 (2.00)	7 (1.59)	6 (2.86)
Secondary	32 (4.92)	15 (3.41)	17 (8.10)
High school	301 (46.31)	189 (42.95)	112 (53.33)
Trade school	122 (18.77)	80 (18.18)	42 (20.00)
University	182 (28.00)	149 (33.86)	33 (15.71)

Following calculation of the DMFT index depending on BMI categories, the results of the study evidenced no differences in children's caries between urban and rural areas (Table III). We compared the results of the DMFT index of normoweight (N) children to overweight children (S), normoweight children to obese children (O) and overweight children to obese children (O) (Table III).

Table III
The mean DMFT according to BMI categories

	DMFT	Mean ±SD	p	
	Normoweight (N)	3.15±2.09	N-S	0.99
Sample	Overweight (S)	2.99±1.65	N-O	0.45
	Obese (O)	3.38±1.69	S-O	0.38
	Normoweight	3.19±1.97	N-S	0.51
Urban	Overweight	2.93±1.67	N-O	0.81
	Obese	3.14±1.68	S-O	0.57
	Normoweight	3.08±2.33	N-S	0.41
Rural	Overweight (S)	3.08±1.64	N-O	0.19
	Obese	5.00±0	S-O	0.56
	Normoweight	3.62±1.71	N-S	0.05
Male	Overweight (S)	2.38±1.46	N-O	0.17
	Obese	2.33±1.15	S-O	0.89
	Normoweight	3.02±2.17	N-S	0.14
Female	Overweight (S)	3.24±1.66	N-O	0.11
	Obese	4.00±1.73	S-O	0.21

On the other hand, our study evidenced that the majority of the children (87.69%) had the body mass index included in the normoweight category according to WHO growth charts (Table IV).

Table IV
Distribution of the sample depending on body weight

Variable	Normoweight (No/percentage)	Overweight (No/percentage)	Obese (No/percentage)
Female	448 (68.92%)	51 (7.85%)	5 (0.77%)
Male	122 (18.77%)	21 (3.23%)	3 (0.46%)
Total	570 (87.69%)	72 (11.08%)	8 (1.23%)

Discussion

Dental diseases considerably impact self–esteem and the quality of life and are expensive to treat. The objective of this study was to determine the DMFT index in the children population of Cluj-Napoca and to characterize the factors that can have possible effects on DMFT.

The WHO and FDI global oral health goals for the year 2000 were to lower DMFT in children aged 12 years below 3 (Petersen, 2003). In Romania, the DMFT index in 1995 was 3.8 compared to 5 in 1985. The findings of our study showed a moderate DMFT index in the selected sample, taking into account the fact that the children live in a region of Romania with high access to dental services. Despite this access, the results showed that a great proportion of the selected children visit the dentist only when in pain (36.62%). This behavior would lead to severe dental disease and an increase in the risk of painful symptomatology.

Dental caries is a chronic condition that is strongly associated with socioeconomic status. Socioeconomic status includes the educational background, income and the residence area, and is considered to be one of the strongest determinants of caries in children (Chi et al., 2014; Koksal et al., 2011). Educational level, as a traditional SES variable, affects the type of job and income, and consequently, access to preventive measures such as tooth cleaning, health service use and a low-carbohydrate diet (Engelmann et al., 2016). Like other studies, the present study evidenced differences in education between parents from urban and rural areas (Funieru et al., 2014; Borges et al., 2012). This will affect the related attitude towards oral health, including appointments to the dentist.

On the other hand, socioeconomic status is a predictor of obesity. This is in agreement with many studies showing that children in deprived areas are more likely to be obese than their peers in less deprived areas (Paisi et al., 2008). The lack of money means that parents opt to purchase cheaper food for their children that tends to be higher in fat and sugar than more expensive food (Granville-Garcia et al., 2008; Reilly et al., 2009; Timonen et al., 2010; Modeer et al., 2010).

Like other studies (Alswat et al., 2016; Shivakumar et al., 2014; Chen et al., 2018), the results of our study do not support the relation between overweight and obesity and prevalence of dental caries in the selected sample. Given the progressive nature of obesity and caries, it is possible that an association between the two does not manifest until later in life. Thus, the young age of the participants in this study may have contributed to the lack of an observed association between the two conditions.

Limitations

The present study was limited by its cross-sectional design. The second potential limitation of our study may be the reported biases in the questionnaire, which may have influenced our findings. The third limitation may be the selection of the sample from a developed area of the country with a high income and educational level, and opportunities to address to a school dental practice. This access to dental services may improve the oral health status of the children.

Conclusions

1. The findings of our study evidenced the need for better education of parents and children regarding behaviors related to dental health in order to reduce dental caries prevalence.

2. There is also a need for education regarding diet and lifestyle, including changes in physical activity and food quality to prevent obesity and dental caries, both in children and later in adulthood.

Conflicts of interest

There are no conflicts of interest.

Acknowledgements

The article uses results from the first author's doctoral thesis, which is in progress at the "Iuliu Hatieganu" University of Medicine and Pharmacy in Cluj-Napoca.

References

Alswat K, Mohamed WS, Wahab MA, Aboelil AA. The Association Between Body Mass Index and Dental Caries: Cross-Sectional Study. J Clin Med Res. 2016;8(2):147-152. doi: http://dx.doi.org/10.14740/jocmr2433w.

Anil S, Anand PS. Early Childhood Caries: Prevalence, Risk Factors and Prevention. Front Pediatr. 2017;5:157-164. doi: 10.3389/fped.2017.00157.

Borges HC, Garbín CA, Saliba O, Saliba NA, Moimaz SA. Socio-behavioral factors influence prevalence and severity of dental caries in children with primary dentition. Braz Oral Res. 2012;26(6):564-570.

Chen D, Zhi Q, Zhou Y, Tao Y, Wu L, Lin H. Association between Dental Caries and BMI in Children: A Systematic Review and Meta-Analysis. Caries Res. 2018; 52(3):230-245. doi: 10.1159/000484988.

Chi DL, Masterson EE, Carle AC, Mancl LA, Coldwell SE. Socioeconomic status, food security, and dental caries in US children: mediation analyses of data from the National Health and Nutrition Examination Survey, 2007-2008. Am J Public Health. 2014;104(5):860-864. doi: 10.2105/AJPH.2013.301699.

Engelmann JL, Tomazoni, Oliveira F, Marta Dutra Machado MD, Thiago A M.. Association between Dental Caries and Socioeconomic Factors in Schoolchildren - A Multilevel Analysis. Brazilian Dental Journal, 2016;27(1):72-78. doi: 10.1590/0103-6440201600435

Funieru C, Twetman S, Funieru E, Dumitrache AM, Sfeatcu RI, Baicus C. Caries experience in schoolchildren in Bucharest, Romania: The PAROGIM study. J Public Health Dent. 2014; 74(2):153-158. https://doi.org/10.1111/jphd.12039.

Granville-Garcia AF, de Menezes VA, de Lira PI, Ferreira JM, Leite-Cavalcanti A. Obesity and Dental caries among preschool children in Brazil. Rev Salud Publica. 2008;10(5):788-795.

Koksal E, Tekcicek M, Yalcin SS, Tugrul B, Yalcin S, Pekcan G. Association Between anthropometric measurements and dental caries in Turkish school children. Cent Eur J Public Health. 2011; 19(3):147-151. doi: 10.21101/cejph.a3648.

Locker D. Deprivation and oral health: a review. Community Dent Oral Epidemiol. 2000;28(3):161-169.

Modeer T, Blomberg CC, Wondimu B, Julihn A, Marcus C. Association between obesity, flow rate of whole saliva, and dental caries in adolescents. Obesity (Silver Spring). 2010;18(12):2367-2373. doi: 10.1038/oby.2010.63.

Moynihan PJ, Kelly SA. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. J Dent Res. 2014;93(1):8-18. doi: 10.1177/0022034513508954.

Paisi M, Kay E, Kaimi I, Witton R, Nelder R, Potterton R, Lapthorne D. Obesity and caries in four-to-six year old English children: a cross-sectional study. BMC Public Health. 2018;18(1):267. doi: 10.1186/s12889-018-5156-8.

Petersen PE. The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century – the approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol. 2003;31(Suppl 1):3-24.

Reilly D, Boyle CA, Craig DC. Obesity and dentistry: a growing problem. Br Dent J. 2009;207(4):171-175. doi: 10.1038/sj.bdj.2009.717.

Shivakumar S, Srivastava A, Shivakumar G. Body Mass Index and Dental Caries: A Systematic Review. Int J Clin Pediatr Dent. 2018;11(3):228-232. doi: 10.5005/jp-journals-10005-1516..

Te Morenga L, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analysis of randomised controlled trials and cohort studies. BMJ. 2012;346:e7492. doi: 10.1136/bmj.e7492.

Timonen P, Niskanen M, Suominen-Taipale L, Jula A, Knuuttila M, Ylostalo P. Metabolic syndrome, periodontal infection, and dental caries. J Dent Res. 2010;89(10):1068-1073. doi: 10.1177/0022034510376542.

Touger-Decker R, van Loveren C. Sugars and dental caries. Am J Clin Nutr. 2003;78(4):881S-892S. doi:10.1093/ajcn/78.4.881S.

Websites

(1) The WHO Child growth charts. Available from: https://www.who.int/childgrowth/standards/en/. Accessed online: 22 January 2019.