

# Influence of dietary habits on oral hygiene in children

Martina Batinić<sup>1</sup>, Rebecca Barišić<sup>2</sup>, Sanja Kolarić<sup>3</sup>, Dubravka Negovetić-Vranić<sup>4</sup>

*The objective of this study was to determine whether there was a correlation between children's oral hygiene and dietary habits, and whether this relationship changed through different age groups. Additionally, we analysed changes in dietary habits and oral hygiene index by age groups. A total of 102 children aged between 0 and 18 years participated in the study, with approximately the same ratio of female and male respondents. Children were divided into three groups according to age: preschool age children (0 to 6 years), young school-age children (7 to 10 years) and older school-age children (11 to 18 years). Two short questionnaires were prepared and participants could select only one answer to the question asked. The questionnaire on oral hygiene consisted of six questions, and the questionnaire on dietary habits of children of seven questions. In order to replace questioned parameters with one variable, we formed two variables, dietary habits (DH) and oral hygiene index (OHI). The score was calculated based on the responses from the questionnaire and children were classified into the group with either good or poor oral hygiene and in the group with either good or poor dietary habits. The results of this study showed a statistically significant difference in oral hygiene index among different age groups; it was highest in children of the youngest age (up to 6 years), and lower in children in the other two age groups. Analysis of age and dietary habits of children was related to the existence of statistically significant effects of age on dietary habits, with one becoming worse with age. No statistically significant correlation was found between the oral hygiene index and dietary habits of children. In addition, the correlation of oral hygiene and dietary habits was not connected with the age of children.*

**Key words:** DIET; ORAL HYGIENE; PEDIATRIC DENTISTRY

## INTRODUCTION

Oral health is an integral part of general, physical health (1-3). In recent years, numerous studies have investigated the association between oral health and systemic conditions such as diabetes or cardiovascular disease (4, 5). According to the World Health Organization, caries is the most widespread chronic disease worldwide and continues to be a public health problem in industrialized countries (6, 7). It affects between 60% and 90% of schoolchildren and the majority of adult population (8). The onset of childhood caries does not only affect children's life quality but also their family's quality of life (9-11). Caries is a disease that can be easily prevented, foremost by developing desirable dietary habits (DH) and maintaining proper oral hygiene (12, 13).

The first step in oral health maintenance is the presence of a satisfactory oral hygiene level. Parents play the most important role in creating and shaping children's habits associ-

ated with oral hygiene maintenance (14). Children of parents who themselves have poor oral hygiene and are unaware of its importance will have poor oral hygiene and poor oral health (15). Now it is known that brushing alone is not sufficient to completely remove plaque, especially from interdental spaces (16). Therefore, it is recommended to use

<sup>1</sup> School of Dental Medicine, University of Zagreb, Zagreb, Croatia

<sup>2</sup> Postdoctoral student, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

<sup>3</sup> Department of Paediatric Dentistry, Zagreb University Hospital Centre, Zagreb, Croatia

<sup>4</sup> Department of Paediatric Dentistry, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

### Correspondence to:

Dubravka Negovetić-Vranić, DDS, PhD, Associate Professor, Department of Paediatric Dentistry, School of Dental Medicine, University of Zagreb, Gundulićeva 5, 10000 Zagreb, Croatia, e-mail: [dnegovetic@sfzg.hr](mailto:dnegovetic@sfzg.hr)

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floss, or even better, interdental brushes (17). In addition to mechanical cleaning, numerous agents are used for chemical control of the plaque or remineralisation of dental hard tissues. Fluorides are best known and the most common caries prevention agent, they are also very accessible as they are likely to be found in toothpaste or mouthwashes and their effectiveness has been validated in numerous studies (18).

Dietary habits can greatly affect oral health. One of the most evident examples is a higher incidence of developing a clinical features of early childhood caries (ECC) in children who consume a lot of refined sugars and drink sweetened juices (19). ECC is an aggressive form of caries and its treatment is complex. Although the aetiology is multifactorial, it has been proven that counselling parents about the right diet can be a helpful prevention measure in reducing the incidence of the disease (20). Snacks should contain more foods with anticariogenic properties, such as dairy products or vegetables and fruits rich in fibres, and as little sweets as possible (21). In the last few years, numerous studies have been conducted in an attempt to resolve the dilemma of whether there is a correlation between obesity and caries incidence, but they did not provide the exact answer (22, 23). All healthcare professionals must partake in disease prevention and educate their patients about the importance of maintaining oral health (24, 25).

The aim of this study was to determine whether there is a correlation between the children's oral hygiene index (OHI) and their DH, and whether this relationship varies among age groups. In addition, we wanted to analyse changes in OHI and DH according to children's age. The null hypothesis for this study was that OHI is not influenced by DH in children and that DH and OHI will remain the same across all age groups.

## SUBJECTS AND METHODS

This study was approved by the Ethics Committee of the School of Dental Medicine, University of Zagreb, under the number 05-PA-30-IV-2/2019. The study was conducted at the Department of Paediatric and Preventive Dentistry, School of Dental Medicine, University of Zagreb. All participants signed their informed consent before being enrolled in the study.

A total of 102 children who visited the Department Clinic for examination participated in the study. The age of the participants was between 0 and 18 years, with the female to male ratio being approximately equal. The exclusion criterion for the study was the existence of a chronic disease.

Children were divided into three groups according to age: preschool-age children (0 to 6 years), young school-age

TABLE 1. Scoring system used for creating oral hygiene index (OHI) variable

Variable in oral hygiene index questionnaire	OHI1	OHI2
1. How often the child washes teeth?		
a) never, once a month or once a week	0	0
b) once a day	1	1
c) several times a day	2	2
2. Is any additional tool used beside toothpaste and toothbrush?		
a) no	-	0
b) yes, one extra tool	-	1
c) yes, two or more extra tools	-	2
3. How often is additional tool being used?		
a) the child does not use it	-	0
b) once a week or once a month	-	1
c) every day	-	2
4. How often do you visit dentist?		
a) never or less than once a year	-	0
b) once a year	-	1
c) two times a year or more often	-	2
5. What was the cause for your last visit to dental clinic?		
a) pain	-	0
b) appointment made in advance	-	1
6. When do you seek dentist's help?		
a) never	0	-
b) when in pain, just to get medication	1	-
c) when in pain, to get proper treatment	2	-
d) for regular follow up examination	3	-

children (7 to 10 years) and older school-age children (11 to 18 years). Of the total number of children, preschool-age group had 33, younger school-age group 37 and older school-age group 32 participants.

Instructions on how to fill out questionnaire forms correctly were given to every participant before taking the survey. Parents answered questions for younger children, while older children could complete the survey alone or with parental assistance. Two questionnaires were prepared and adapted from *Lešić's* dissertation (26). The oral hygiene questionnaire (Table 1) was composed of six short questions to which participants had to select only one of the answers proposed. The DH questionnaire for children (Table 2) was composed of seven questions to which only one answer had to be selected.

Upon completion of the survey, the data collected in the study were entered into a systematization and data processing program, Microsoft Office Excel (Microsoft Corporation, Redmond, WA, USA).

TABLE 2. Scoring system used for creating dietary habits (DH) variable

Variable in dietary habits questionnaire	DH
1. How many meals the child eats during a day?	
a) one	1
b) two	2
c) three	3
2. Does the child eat snack in-between meals?	
a) yes	2
b) sometimes	1
c) no	0
3. What do snacks usually consist of?	
a) sandwich	2
b) sweets	1
c) something else (kindergarten/school canteen)	2
d) nothing	0
4. What does the child eat in school/kindergarten?	
a) sandwich	2
b) sweets	1
c) something else (kindergarten/school canteen)	2
d) nothing	0
5. How many pieces of fruit and vegetables the child usually eats <i>per</i> day?	
a) none	0
b) one	1
c) few	2
d) more than five	3
6. How often does the child eat sweets?	
a) never	2
b) sometimes	1
c) every day	0
7. Which beverage the child drinks most often?	
a) water	1
b) soda, fruit juice, ice tea, ...	0
c) milk	1

**Analysis of variables**

Several parameters examined by the questionnaire were each replaced with a single variable, two variables (DH and OHI) were formed using the scoring system described in Lešić's dissertation (26).

Oral hygiene index was calculated by scoring fewer points to answers representing lower oral hygiene and scoring higher points to answers speaking in favour of better oral hygiene. Scoring of OHI for preschool-age children is shown in Table 1 as the OHI1 variable. Answer scoring for children age groups from 7 to 10 years and children from 11 to 18 years is shown as the OHI2 variable. In both cases, the mini-

mum score is 0. The maximum OHI1 score is 5 points and maximum OHI2 score is 9 points. Poor oral hygiene was considered for the total sum of 0 to 3 for OHI1 and 0 to 4 for OHI2. Good oral hygiene was indicated with scores 4 and 5 points for OHI1 and 5 to 9 points for OHI2.

Dietary habits were scored equally for every age group. Answers that were considered to indicate poor DH were scored with fewer points, whereas responses that were thought to indicate better DH were scored higher. Table 2 shows the scoring scheme that makes it possible to calculate minimum score 1 and maximum score 15. Children who had a total score below 9 were included in the group with poor DH, and children with total score above 10 were included in the group with good DH.

One-way variance analyses with age group as the independent variable and questionnaire results as the dependent variable were performed to determine age differences in DH and OHI. The analysis of dependent variables, OHI and DH, was made by linear regression analysis. The association between two continuous variables, OHI and DH, was examined using Pearson's correlation coefficient (r). All p values of 0.05 or less were considered significant. IBM SPSS Statistics version 23.0 (www.spss.com) was used on statistical analysis.

**RESULTS**

Among the children participating in the study, there were 50 girls and 52 boys. There were 33 preschool-age children, mean age 4.5±1.3 years. The majority of children, 37 of them, were aged between 7 and 10 years, mean age 8.6±1.1 years. The group of older school-age children consisted of 32 children, mean age 13.3±2.1 years.

Considering the effect of age on OHI results, this study showed a statistically significant difference among age groups: F (2/100)=22.35; p<0.001. The size effect was large, h2=0.31. Tukey's post-hoc test found a statistically significant difference between preschoolers and young school-age children and between preschoolers and older school-age children (p<0.001 both), but statistically significant difference was not determined between younger and older school-age children (p=0.28). The OHI was highest among the youngest children and lower in the remaining age groups, as illustrated in Figure 1.

Analysis of DH relation to children's age proved that there was a statistically significant influence of age on eating habits: F (2/100)=5.21; p=0.007. The size effect was mean, h2=0.09. Tukey's post-hoc test found a statistically significant difference between preschool-age and older school-age children (p=0.004), while there was no statistically significant difference between preschoolers and younger

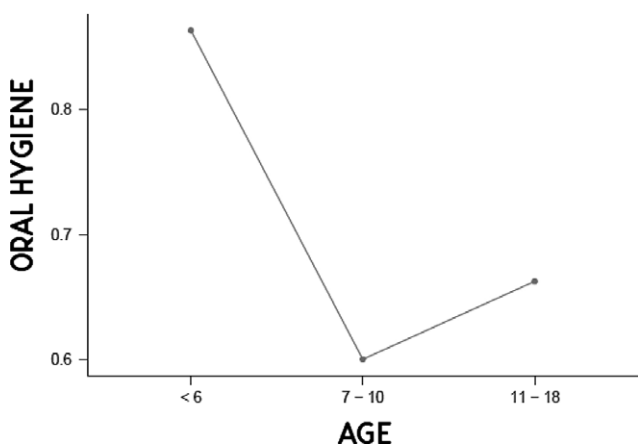


FIGURE 1. Graphic presentation of age effect on oral hygiene.

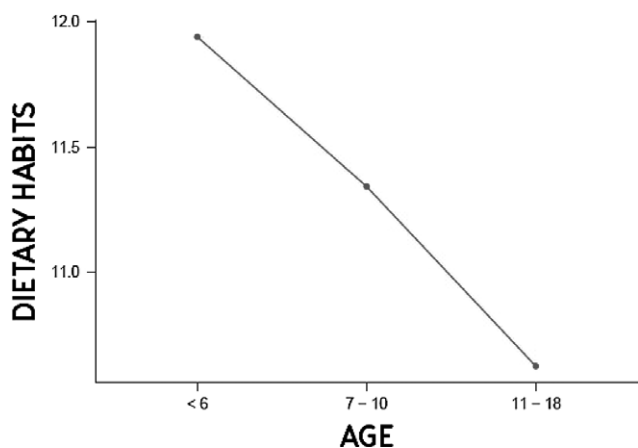


FIGURE 2. Graphic presentation of age effect on children’s dietary habits.

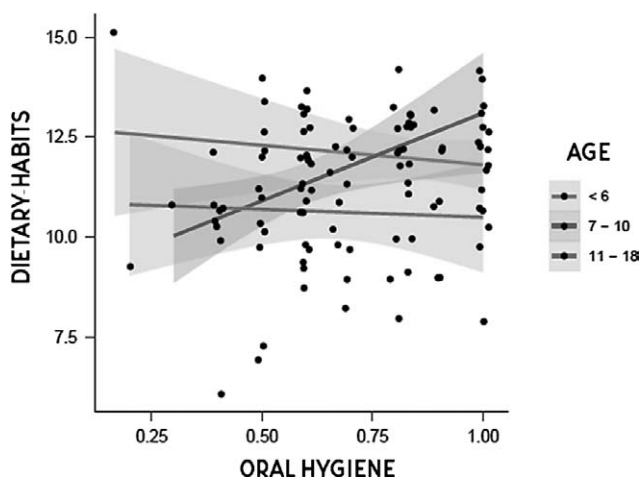


FIGURE 3. Connection of oral hygiene, dietary habits and children’s age.

school-age children ( $p=0.28$ ), or between younger and older school-age children ( $p=0.17$ ). Figure 2 is a graphic presentation of DH becoming worse with age.

Study results demonstrated that there was no statistically significant correlation between OHI and children’s DH:  $r$

(101)=0.18;  $p=0.07$ . Linear regression analysis was conducted with DH and age as predictors and oral hygiene as the criterion. To test for the interaction effect of age, two regression models were calculated, i.e. one that did not contain the interaction effect of age and DH and one that did. Then it was compared whether the model containing the interaction effect contained significantly more variance than the model that did not contain this effect. It is clear from results that this model did not explain statistically significant more variance:  $F(2/97)=2.13$ ;  $p=0.12$ . Therefore, the correlation between OHI and DH was not age-dependent, as shown in Figure 3.

DISCUSSION

The trend of decline in caries incidence is being recognized in developed countries, which emphasize the implementation of preventive measures (27). Proper oral hygiene is crucial for maintaining oral health, and according to the results of this study, the best oral hygiene was observed in the group of preschool-age children, whilst young school-age children had the lowest OHI. *Jiménez et al.* (28) observed better oral hygiene maintenance in older children, which can be connected with the results of this study, except for disagreements regarding the estimated oral hygiene in children up to 6 years of age, whose differences can be explained by differences in the way tests were conducted.

Today, along with using toothbrushes and toothpaste, it is recommended to regularly use additional products such as floss, interdental brushes and mouthwashes (29). The preventive effect of fluorides has been known for decades, and it is currently believed that its topical use is sufficient. The effectiveness of fluoride-containing toothpastes in prevention was confirmed in a literature review made by *Singh et al.* (30), and caries incidence reduction in children and adolescents who used a mouthwash with fluoride was described in a paper by *Twedman et al.* (31). Given the above, the oral hygiene questionnaire contains a question on the use of additional oral hygiene products. Only 33.33% of respondents aged 7 to 18 years answered they used another tool beside toothbrushes and toothpaste, while unfortunately only 5.79% of children confirmed using two or more additional tools. One of the questions contained in the questionnaire on DH is which beverage child consumes most. As many as 20.58% of respondents chose carbonated or fruit juice as the most common drink. Frequent consumption of carbonated beverages is proven to cause erosive lesions on deciduous and permanent teeth (32). The validated method of preventing and treating erosive lesions is topical use of fluorides, most commonly in the form of toothpaste, which is confirmed by *Assunção et al.* (33) and *Teixeira et al.* (34).

Children's DH need to be monitored for the impact they have on health in adulthood (35). The role of dentists in informing patients about proper nutrition is seen through the results of a study conducted by *Barone et al.* (36). It has been observed that patients who had repeatedly received guidelines about proper nutrition when visiting their dentist have improved their DH. Additionally, a slight but stable long-term decrease in the number of cariogenic bacteria in their saliva is noticed.

Children's DH change as they grow up, which was confirmed by the results of this study; preschool children had the best dietary habits, while we detected the worst results in children between the age of 11 and 18. Similar to the results of this study, *Mariscal-Arcas et al.* (37) presented higher quality of younger children's diet and it was more in accordance with recommendations than adolescent nutrition. *Gonçalves et al.* (38) observed a correlation between DH, oral hygiene and caries incidence across multiple generations in the same family, and concluded that children who ate more fruits and vegetables had a reduced tendency to develop caries, whilst children whose parents frequently consumed sugar between meals and rarely visited their dentist showed a higher tendency to tooth decay.

According to the findings of this study, DH and oral hygiene are not connected. Also, the correlation between DH and OHI was not changed with children's age. *Lešić* presented similar results in her dissertation (26). Numerous studies tried to establish a relation between obesity and oral hygiene, which can be linked to the topic of this research. *Vallogini et al.* (39) did not find a connection between obesity and oral health; on the contrary, obese adolescents had better oral hygiene and periodontal health and fewer teeth affected by caries. *Costacurta et al.* (40) associated certain eating habits such as increased sugar intake with obesity and an increase in DMFT index, but found no significant difference in oral hygiene between normal and overweight children.

As we used questionnaires in this study, limitations primarily related to the lack of quantification of the parameters analysed, such as measuring nutrition quality index or one of periodontal indexes. Notwithstanding the foregoing, usage of this research results is possible for education of both patients and dental practitioners, and for further development of prevention programmes.

## CONCLUSION

To conclude, this study showed that OHI was highest among the youngest children (up to 6 years) and lowest among children aged between 7 and 10 years. Children's DH were significantly changed throughout age groups,

they worsened as children became older. Oral hygiene and DH were not connected and the correlation between OHI and DH was not dependent of children's age.

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## SAŽETAK

# Utjecaj prehrambenih navika na stupanj oralne higijene u djece

*Martina Batinić, Rebecca Bašić, Sanja Kolarić, Dubravka Negovetić-Vranić*

*Cilj ovog istraživanja bio je utvrditi postoji li povezanost stupnja oralne higijene djece s njihovim prehrambenim navikama te mijenja li se taj odnos kroz različite dobne skupine. Uz navedeno, analizirane su promjene prehrambenih navika djece prema njihovoj dobi i stupnja oralne higijene po dobnim skupinama ispitanika.*

*U istraživanju je anketirano ukupno 102-je ispitanika u dobi između 0 i 18 godina, pri čemu je omjer ženskih i muških ispitanika bio približno jednak. Na temelju dobi ispitanici su razdijeljeni u tri skupine; djeca predškolske dobi (0 do 6 godina), djeca mlađe školske dobi (7 do 10 godina) i ona starije školske dobi (11 do 18 godina). Pripremljena su dva kratka upitnika u kojima je bilo potrebno odabrati jedan od ponuđenih odgovora na postavljeno pitanje. Upitnik o oralnoj higijeni sastojao se od šest pitanja, a upitnik o prehrambenim navikama djece sadržavao je sedam pitanja. Kako bi više parametara ispitanih u svakom upitniku bilo zamijenjeno samo jednom varijablom, formirane su dvije varijable, prehrambene navike (DH) i indeks oralne higijene (OHI). Na temelju bodovanja odgovora iz upitnika ispitanici su svrstani u skupinu s dobrom ili lošom oralnom higijenom te u skupinu s dobrim ili lošim prehrambenim navikama.*

*Rezultatima istraživanja potvrđeno je postojanje statistički značajne razlike u stupnju oralne higijene djece različitih dobnih skupina: najviša je kod djece u najmlađoj dobnj skupini, do 6 godina, dok je niža kod djece mlađe i starije školske dobi. Analizom povezanosti dobi i prehrambenih navika djece uočeno je postojanje statistički značajnog utjecaja dobi na prehrambene navike, pri čemu one postaju lošije s porastom dobi.*

*Statistički značajna povezanost OHI i prehrambenih navika djece nije utvrđena. Uz navedeno, povezanost oralne higijene i prehrambenih navika ne ovisi o dobnj skupini.*

**Ključne riječi:** PREHRANA; ORALNA HIGIJENA; DJEČJA STOMATOLOGIJA