# Incidence of Caries in Children of Rural and Subrural Areas in Croatia

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## A B S T R A C T

*The aim of this paper was to determine certain regularities in caries incidence in children in primary and permanent dentition in respect of clinical and non-clinical variables that can be collected in everyday dental practice. This way it could be easier for the operator to adjust individual preventive therapy of patients. The study was conducted on 301 subjects, aged 3–6 (74 subjects) and 11–14 (227 subjects) inhabitants of Petrinja and Topusko, postwar rural and subrural areas in Central Croatia. Using an oral hygiene questionnaire, habits, diet and use of fluoride were assessed. The clinical finding comprised the dental status, amount of stimulated saliva, oral hygiene index and the presence of orthodontic anomaly. Children showed very high values of the dmf-t/DMF-T (decayed, missing, filled index) (7.7/6.7), dmf-s/DMF-S (16,5/11,8), and significant index of caries (SiC=10.89). The study confirmed correlation between the OHI (oral hygiene index) and dmf-t/DMF-T and dmf-s/DMF-S index, and the influence of the regularity of dental check-ups and frequency of tooth brushing on OHI. Furthermore, the children that started practicing oral hygiene later, brush their teeth irregularly, and visit dentists only when having pain. It can be concluded that Croatia is still very far from achieving the goals set by WHO concerning oral health improvement.*

*Key words: caries incidence, children, oral hygiene, caries risk assessment, postwar areas in Croatia*

## Introduction

Caries is a chronic, complex bacterial infection that results in milligram losses of minerals from the affected tooth. A multifactorial cause of an infection, with the emphasis on bacterial and nutritional factors, enables development of the disease and its identification[1]. A multifactorial cause of dental caries as an infective-nutritional disease imposes limitations on the desired method of control of carious lesion development. However, knowledge about the factors of dental caries development and about the very process of dental caries development enable comprehension of the resulting situation, and assure quick and accurate diagnosis with correct preventive and curative care in children by raising the level of oral health[2]. Frequent and often comprehensive destructive processes on hard tooth tissues result from specific conditions in connection with certain clinical findings of children patients. The incidence of caries in children is often associated with certain living habits of each individual[3]. The aim of this paper was to compare the clinical findings of dental caries intensity with dietary habits of the child, ingredients of food and drinks, maintenance of oral hygiene, visits to dentists, and the level of socio-economic status of the parents. The data collected in this way and their statistical processing and evaluation by means of certain prediction models for caries development could enable a relatively easy and accurate determination of future developments in connection with caries in the mouth of each individual[4]. Furthermore, the purpose of this paper was to determine certain regularities in caries incidence in children in primary and permanent dentition in respect of clinical and non-clinical variables that can be collected in everyday clinical work. This paper also aimed to present the overall level of oral health in children of rural and subrural population in

**TABLE 1**
VALUES OF THE dmf-t, dmf-s, QSS AND OHI INDEXES FOR CHILDREN AGED BETWEEN 3–6 YEARS

| | N | Minimum | Maximum | Mean value | Standard deviation | Skewness | Standard error |
|---|---|---|---|---|---|---|---|
| dmf-t | 74 | 0.00 | 18.00 | 7.7027 | 4.9676 | –0.073 | 0.279 |
| dmf-s | 74 | 0.00 | 58.00 | 16.4865 | 15.4035 | 0.939 | 0.279 |
| OHI | 74 | 0.83 | 2.67 | 1.7008 | 0.4047 | –0.042 | 0.279 |
| QSS | 74 | 1.00 | 6.00 | 3.0000 | 1.2003 | 0.356 | 0.279 |

dmf-t – number of decayed (d), missing (m) and filled teeth (f), dmf-s – number of decayed (d), missing (m) and filled surfaces (f), OHI – oral hygiene index, QSS – quantity of stimulated saliva

some past war areas of Croatia and to contribute to taking measures with the emphasis on the prevention of dental caries development.

## Subjects and Methods

The study was conducted on 301 subjects (142 males and 159 females), inhabitants of Petrinja and Topusko, postwar area in Central Croatia. The subjects were aged 3–6 (74 subjects) and 11–14 (227 subjects). With a questionnaire, the level and means of oral hygiene were individually examined, as well as the use of additional dental hygiene agents (antimicrobial products, fluorides), type of diet, ingredients of food and drinks, habits and socioeconomic status. The tooth deposits were colored by 1% revelator solution gentiane violet and oral hygiene index was measured according to Green-Vermillion, simplified (OHI-S)[5]. With the OHI index only soft deposits were taken into account, measured on 6 tooth surfaces, and therefore the measured OHI indicated only the DI component (soft deposits) of the index and the other component CI (hard deposits) was not included. The values of the achieved results ranged from 0 to 3. Dental status was recorded by clinical examination with the aid of a dental mirror and probe with appropriate independent source of light according to the standards of WHO for ba-

sic research in dentistry[6]. The decayed, missing, filled index of tooth or tooth surface (DMF-T, DMF-S, dmf-t, dmf-s), and significant index of caries (SiC) values were recorded and calculated also according to WHO methodology[6]. Quantity of stimulated saliva (QSS) was measured after chewing paraffin block (CRT Paraffin, Vivadent) for stimulation of salivation for one minute. Saliva was collected in special calibrated test tubes for five minutes. Quantity of stimulated saliva was divided in five and main quantity of stimulated saliva per minute was calculated. For variables with discrete values nonparametric statistics were used ($\chi^2$) and for variables with continuous values parametric statistics were used (Pearson correlation, t-test, ANOVA and Bonferroni post hoc test).

## Results

### Group Aged 3–6 Years

The dmf-t, dmf-s, QSS and OHI variables are normally distributed and continued (Table 1), which facilitates further analysis of the achieved results. Figure 1 shows a statistically significant influence of regularity of dental visits on OHI, and this difference is especially prominent between the patients that have dental check-ups once a year and those that have them twice a year. A statistically significant difference was also found be-
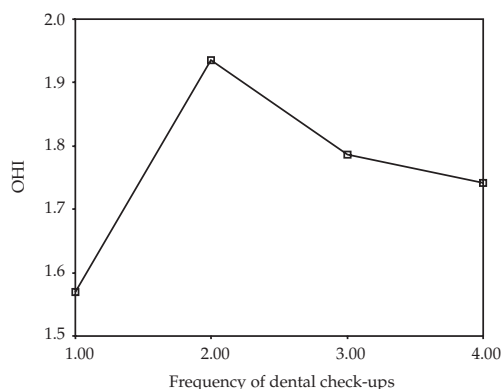


*Fig. 1. Polygonal review of the correlation between the OHI and frequency of check-ups variables for children aged between 3-6 years. 1.00 – check-ups once a year, 2.00 – check-ups twice a year, 3.00 – check-ups three times a year, 4.00- check-ups four times a year, OHI – oral hygiene index.*
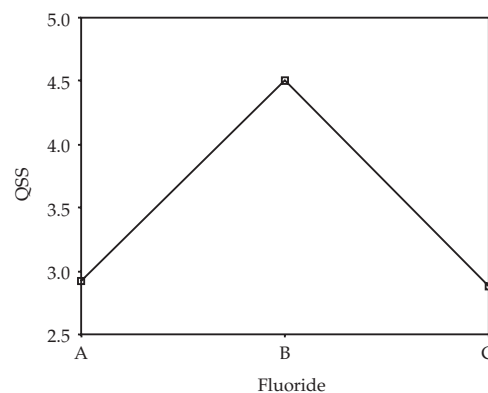


*Fig. 2. Polygonal review of the correlation between the QSS and used fluoride preparations variables for children aged between 3-6 years. QSS – quantity of stimulated saliva, A – tooth pastes, B – aminfluoride gel, C – small pills of fluoride.*

**TABLE 2**
VALUES OF THE DMFT, DMFS, OHI AND QSS VARIABLES FOR CHILDREN AGED BETWEEN 11–14 YEARS

|  | N | Minimum | Maximum | Mean value | Std. dev. | Skewness | |
|---|---|---|---|---|---|---|---|
|  | Statistics | Statistics | Statistics | Statistics | Statistics | Statistics | Std. error |
| DMF-T | 227 | 0.0 | 16.00 | 6.6784 | 3.6552 | 0.33 | 0.16 |
| DMF-S | 227 | 0.0 | 40.00 | 11.8282 | 8.0448 | 0.74 | 0.16 |
| OHI | 227 | 0.3 | 2.83 | 1.6685 | 0.485 | – | 0.16 |
| QSS | 227 | 1.25 | 12.50 | 5.7405 | 1.9576 | 0.77 | 0.16 |
| Valid | 227 | | | | | | |

DMF-T – number of decayed (D), missing (M) and filled teeth (F), DMF-S – number of decayed (D), missing (M) and filled surfaces (F), OHI – oral hygiene index, QSS – quantity of stimulated saliva

tween the children that used aminfluoride gel in relation to other children, with respect that they had a higher quantity of stimulated saliva (Figure 2).

## Group Aged 11–14 Years

The DMF-T, DMF-S, QSS and OHI variables are normally distributed and continued (Table 2). By means of Pearson's correlation, exceptionally strong statistical correlation between the DMF-T and DMF-S index was found, which is normal. A correlation was also found between the OHI and DMF-T index, and the OHI and DMF-S. Both correlations are positive and faintly strong. Consequently, the higher the OHI index, the DMF-T and DMF-S indexes are also higher. The correlation between QSS and other variables is not statistically significant (Table 3). There is a statistically significant correlation between taking sweets and OHI (Figure 3). Consequently, a significant difference was found between the group that rarely takes sweets and the one that has a better OHI. There is also a statistically significant correlation between the start of oral hygiene regime and OHI index (Figure 4). A significant difference is especially noticeable between the groups that started practicing regular oral hygiene before the second year of life and those that started practicing oral hygiene after the third year of life. There is also a statistically significant correlation be-

tween the frequency of dental check-ups and the OHI index (Figure 5). The differences are significant in the following combinations: (a) between the patients that have dental check-ups once a year and those that have dental check-ups every three months; (b) between the patients that have dental check-ups twice a year and those that
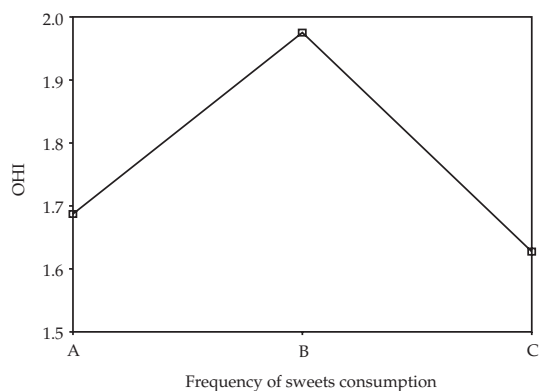


Fig. 4. *Polygonal review of the correlation between the start of oral hygiene regime and OHI in children aged between 11–14 years. OHI – oral hygiene index, A – before the 2nd year of life, B – between the 2nd and 3rd year of life, C – after the 3rd year of life.*



Fig. 3. *Polygonal review of the correlation between taking sweets and the OHI index in children aged between 11–14 years. OHI – oral hygiene index; SWEETS A – a lot, B – little, C – sometimes.*
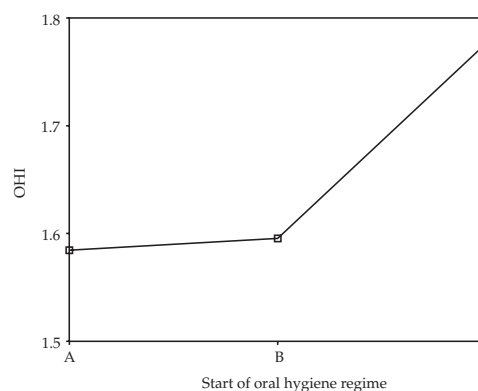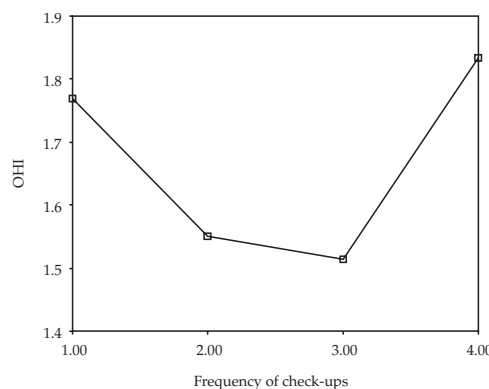


Fig. 5. *Polygonal review of the correlation between the frequency of dental check-ups and the OHI index in children aged between 11–14 years. 1 – once a year, 2 – twice a year, 3 – every 3 months, 4 – only when having pain.*

**TABLE 3**

CORRELATION BETWEEN THE DMF-T, DMF-S, OHI AND QSS VARIABLES FOR CHILDREN AGED BETWEEN 11–14 YEARS

| Correlations (** P<0.01) | | DMF-T | DMF-S | OHI | QSS |
|---|---|---|---|---|---|
| DMF-T | Pearson's correlation | 1.000 | 0.847(**) | 0.258(**) | 0.064 |
| | Sig. (2-tailed) | . | .000 | .000 | 0.336 |
| DMF-S | Pearson's correlation | 0.847(**) | 1.000 | 0.309(**) | 0.061 |
| | Sig. (2-tailed) | .000 | . | .000 | 0.360 |
| OHI | Pearson's correlation | 0.258(**) | .309(**) | 1.000 | 0.005 |
| | Sig. (2-tailed) | .000 | .000 | . | 0.938 |
| QSS | Pearson's correlation | 0.064 | 0.061 | 0.005 | 1.000 |
| | Sig. (2-tailed) | 0.336 | 0.360 | 0.938 | . |
| | N | 227 | 227 | 227 | 227 |

QSS – quantity of stimulated saliva, DMF-T – number of decayed (D), missing (M) and filled teeth (F), DMF-S – number of decayed (D), missing (M) and filled surfaces (F), OHI – oral hygiene index, QSS – quantity of stimulated saliva
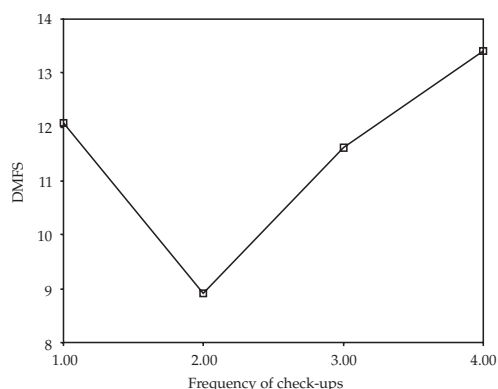


*Fig. 6. Polygonal review of the correlation between the frequency of check-ups and the DMFS index in children aged between 11-14 years. 1 – once a year, 2 – twice a year, 3 – every 3 months, 4 – only when having pain.*

visit dentists only when having pain and (c) between the patients that have dental check-ups every three months and those that visit dentists only when having pain. There is a statistically significant difference also between the frequency of dental check-ups and the DMF-S index (Figure 6). The difference is significant between the groups that visit dentists every three months and the ones that visit dentists only when having pain. This figure shows that the DMF-S and OHI indexes are highest in children that visit dentists only when having pain, followed by the ones that have dental check-ups once a year, etc. It is obvious that dental visits have a positive effect on the OHI and DMF-S. The achieved value of the SiC index was 10.89.

## Discussion

The awareness of a different socio-economic level of the society as well as of each individual is very important for getting the general idea of the frequency of dental caries in a population. It has been proved that the countries in socio-economic transition have the highest values of the DMF-T index[7], and Croatia also experiences such a transition. Unemployment, inflation, low family income and privatization of dental profession leads to the situation in which the individual is responsible for organizing the use of oral health services based on his conscience and ability, and the first victims of such socio-economic situation are children[8]. According to the data on Croatia from as far back as 1968, twelve-year-olds were found to have the DMF-T index of 7, it declined gradually from year to year with an increasing number of caries free children up to 14.9% and the DMF-T index of 3.5, which are the results of the research carried out in 1999[9]. However, studies like this in postwar areas indicate a far worse level of oral health today. The main value of the DMF-T index in the examined sample of children amounted to 6.67, and the SiC 10.89, which supports the idea of necessity to take more intensive and targeted preventive measures and dental care for individuals in certain parts of the country. As a comparison with our achieved results the DMFT index in 1991 amounted to 2.6 and in 1999 3.5. The situation in European countries is different, e.g. in 1978 Austria had the DMF-T index of 3.0 and in 1997 1.7, in 1937 the DMF-T index in Sweden amounted to 7.8, and in 2001 0.9[10]. The values of the SiC index in certain countries of the world were the following: Jamaica 2.8 in 1995, Mexico 5.0 in 1997 and USA 3.6 in 1988–91[10]. Despite great changes in the incidence of caries in the last couple of decades, the possibility of predicting caries in primary dentition remains rather stable[11]. The value of the dmf-t index in six-year-olds is a better indicator of caries experience for the age range from 7–13 than caries on the first permanent molars[12]. In developed countries in the last thirty years there was a tendency of decline in the prevalence and incidence of caries, but in some parts of the world caries is still a large public health problem. Prevention is considered as the most humane and economical way of health care organization if preventive

programs are specifically targeted at the factors of disease development[13,14]. The values of the OHI, QSS and especially dmf-t and dmf-s, i.e. DMF-T and DMF-S indexes are important variables that can identify a weak spot of the individual in defense against new carious lesions and that can predict caries development in the mouth[15]. Analysis of the achieved data showed that children that use aminofluoride gel have somewhat higher values of QSS. The average dmft value of 7.7 and dmfs value of 16.49 indicate a very low level of oral health in children with primary dentition. Based on the results for the older age group, with the achieved values of the DMF-T index of 6.67 and DMF-S of 11.82, which are rather worrying, it can be concluded that the factors that lead to dental caries development are to a certain degree also present in permanent dentition, which is indicated by a very poor level of oral health of the examined group of children. The number of children without caries is low, in the younger group aged between 3 to 6 years it amounted to 13.51%, and in the older group aged between 11 to 14 years only 4.85% children had no caries. The main values of the OHI index were almost equal, for the younger group the OHI index was 1.7 and for older 1.65 on a scale from 0 to 3, which indicated poor oral hygiene in children of both age groups.

## Conclusion

The study confirmed a logical correlation between the OHI and dmf-t/DMF-T index, i.e. dmf-s/DMF-S, and the influence of the regularity of dental check-ups on OHI and frequency of tooth brushing on OHI. The children with higher values of the dmf-t/DMF-T and dmf-s/DMF-S index, and a higher OHI index rarely visit dentists, and their irregular tooth brushing is also noticeable. The ones with poor oral hygiene rarely brush their teeth, and visit dentists only when having pain, while the children with good oral hygiene brush their teeth more often and visit dentists regularly. Furthermore, the children that start practicing oral hygiene later brush their teeth irregularly, and visit dentists only when having pain. Additionally, these children are also afraid of dental treatment, and a »vicious circle« of lack of oral health care is formed. Fear of dental treatment becomes the only cause, because children mainly visit dentists when having severe pain, and do not have regular check-ups, and oral hygiene is very poor, which all together results in a very poor dental status. The influence of taking sugar on an increased DMF-S index was found in the older age group, but only in the children that brush their teeth rarely or never. At the end it can be concluded that Croatia is still very far from achieving the goals set by WHO concerning oral health improvement.

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## POJAVNOST KARIJESA U DJECE RURALNOG I SUBRURALNOG PODRUČJA HRVATSKE

## S A Ž E T A K

Cilj ovog rada bio je odrediti određene pravilnosti u incidenciji karijesa kod djece u mliječnoj i trajnoj denticiji s obzirom na kliničke i nekliničke varijable koje se mogu prikupiti u svakodnevnom radu. Na taj način terapeut si olakšava prilagođavanje individualne preventivne terapije kod pacijenta. Istraživanje je provedeno na 301 ispitaniku, stanovnicima Petrinje i Topuskog. Dob ispitanika bila je od 3 do 6 godina i 11 do 14 godina. U mlađoj dobnoj skupini sudjelovalo je 74 ispitanika, a u starijoj 227. Svaki od ispitanika bio je podvrgnut istom postupku. Upitnikom se pojedinačno istražila razina i način provođenja oralne higijene, način prehrane, sastav namirnica, navike, uporaba fluorida. Klinički

nalaz obuhvaćao je dentalni status, određivanje količine stimulirane sline i procjena indeksa oralne higijene te postojanje ortodontske anomalije. Prema prikupljenim i statistički obrađenim podacima djeca ruralnog i subruralnog dijela naše zemlje, a naročito na poslijeratnom području, pokazuju vrlo visoke vrijednosti dmf-t/DMF-T (7,7/6,7) i dmf-s/DMF-S indeksa (16,5/11,8) dok je SiC indeks iznosio 10.89. Ispitivanje je potvrdilo korelaciju između OHI i dmf-t/DMF-T kao i dmfs/DMFS indeksa. Isto tako potvrđena je i pozitivna korelacija redovitih kontrolnih pregleda s učestalošću četkanja i OHI indeksa. Nadalje, djeca koja su počela četkati kasnije iskazuju neredovitost četkanja i odlaze stomatologu samo kada ih boli. Na temelju dobivenih rezultata može se zaključiti da je Hrvatska još jako daleko od postavljenih ciljeva WHO i FDI za unapređenje oralnog zdravlja.