

# Factors Predisposing to Early Childhood Caries (ECC) in Children of Pre-School Age in the City of Zagreb, Croatia

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## ABSTRACT

*The aim of this study was to investigate factors predisposing to early childhood caries (ECC) in pre-school children in the city of Zagreb, Croatia. The investigation was carried out on the sample of 145 children (77 boys and 68 girls) aged between 2 and 5 years, including clinical examination of dental status and survey on the habits among the parents. The overall prevalence of ECC was 30%: in girls it was 25%, and in boys 48%. The study on the risk factors was designed as a classic case-control study. The mean value of dmfs index among the cases amounted to 8.6, in comparison to 5.2 in the control group ( $p < 0.05$ ). Bottle-feeding did not represent a significant risk, but night consumption of sweet beverages after first 24 months and the lack of introduction of teeth-brushing habit after first 24 months did ( $p < 0.001$  for both predictors). The study revealed the importance of early introduction of teeth-brushing and giving up the nightly consumption of sweet beverages in prevention of ECC.*

## Introduction

Caries, the most common pathological feature in modern populations, has been reported as early as during the first several years of child's life. Early caries usually presents as a localized destruction of the firm, mineralized dental tissue which involves deciduous teeth, most commonly maxillary incisors. It is a rampant form of caries, with a very poor prognosis unless

the therapy is started during the very early stage of the pathological process<sup>1</sup>. After the year of 1994, and the conference of the Center for Disease Control (CDC), it has been recommended to designate such clinical finding as the »early childhood caries« (ECC), since many epidemiological investigations repeatedly showed that baby bottle, night-feeding and sweet beverages are not the only etiological factor predisposing to early caries in chil-

dren, which has earlier been widely accepted as a rule<sup>2</sup>. Statistical data on the prevalence of ECC indicate that in European countries it ranges between 7.3% and 12% among two-year-old children, while among three-year-olds the share increases up to 28%<sup>1,3</sup>.

The aim of this study was to investigate the prevalence of ECC among children attending one kindergarten in the city of Zagreb. The goal was to correlate the clinical findings and the intensity of dental caries with nutritional habits of investigated children, previous history of breast-feeding, level of oral hygiene and level of health education of children and their parents.

## Subjects and Methods

The investigation was carried out on the sample of 145 children (77 boys and 68 girls) aged between 2 and 5 years, all of them affiliated to the kindergarten »Srednjaci« in Zagreb, Croatia. Clinical examination included the evaluation of the dental status. The results of the intensity of caries were expressed through the Decayed, Missing and Filled Surface (dmfs) Index<sup>4</sup>. The examination was carried out using the classic dental probe and the mirror on the daily light. Two independent investigators were well-trained specialists in pedodontics and were previously calibrated. The diagnostic criterion for ECC was that at least two of four maxillary incisors had labiopalatal caries lesions progressed beyond the white or brown spots to cavitation. The data on potential risk factors for the disease were obtained through a simple survey. The control group was the only one with no ECC cases present. Each parent answered, in writing, to the open-end questions concerning the present bottle-feeding, the age at which their child gave up bottle-feeding, the present drinking of sweet beverages (milk with sugar, tea or

juice) during the night, the age at which their child gave up that habit, and the age at which their child started brushing the teeth regularly.

The study on the risk factors was designed as a classic case-control (retrospective) study. Before the statistical analysis subjects were divided in two groups: 55 with ECC, and 90 healthy control. Statistical analysis of the results included  $\chi^2$ -test with Yates correction for 2x2 cross-tabulation analysis. In the situation of small frequency (<5) in cells of table were used the Fischer's exact test. Differences between groups were established by analysis of variance (ANOVA). Differences was confirmed when p

## Results

Table 1 presents the results of the study. The prevalence of ECC in our sample of pre-school children was 30% (the figure in girls was 25%, and in boys 48%). It can be noted that several statistically very significant differences between the group of ECC cases and the control group were noted. Primarily, the mean value of dmfs index among the cases amounted to 8.6, in comparison to 5.2 in the control group ( $p < 0.05$ ). Regarding the gender-related differences, it has been shown that boys are more likely to be among the cases than controls, i.e. that the condition affects children of male gender more frequently ( $p < 0.05$ ). This effect, however, might be an indirect consequence of higher prevalence of other predisposing factors in boys, which is discussed in the last section of this paper.

The analysis of bottle-feeding as a potential predisposing factor revealed that it was, at present, significantly more frequent in control group rather than in the group of affected children ( $p < 0.05$ ). However, due to relatively small number of children who were presently bottle-fed, the similar analysis was undertaken

**TABLE 1**  
 CASE-CONTROL ANALYSIS OF POTENTIAL RISK FACTORS PREDISPOSING TO ECC IN THE  
 SAMPLE OF 145 EXAMINEES AGED 2–5 YEARS FROM THE CITY OF ZAGREB, CROATIA.

	ECC Cases (n=55)	Controls (n=90)	$\chi^2$ of F	df	p
Dmfs index					
Mean value	8.6	5.2		1	< 0.05
Gender					
Male	36 (65.5%)	41 (45.6%)			
Female	19 (34.5%)	49 (54.4%)	5.43	1	0.020
Bottle-feeding at present:					
Yes	5 (9.1%)	21 (23.3%)			
No	50 (90.9%)	69 (76.7%)	4.71	1	0.043
Gave up bottle-feeding during the:	(n=48)	(n=59)			
First 24 months	22 (45.8%)	27 (45.8%)			
25 months or more	26 (54.2%)	32 (54.2%)	0.00		0.994
Night consumption of sweet beverages					
Yes	8 (14.5%)	7 (7.8%)			
No	47 (85.5%)	83 (92.2%)	1.69	1	0.194
Gave up night consumption of sweet beverages during the:	(n=41)	(n=46)			
First 24 months	8 (19.5%)	26 (56.5%)			
25 months or more	33 (80.5%)	20 (43.4%)	12.47	1	< 0.001
Regular teeth-brushing started during the:					
First 24 months	2 (3.6%)	41 (45.6%)			
25 months or more	53 (96.4%)	49 (54.4%)	28.76	1	< 0.001

among those who gave up the habit. It has been shown that the share of children who gave up bottle-feeding during first 24 months was almost identical in both groups (45.8%). Therefore, it is reasonable to conclude that bottle-feeding does not represent a risk for developing ECC.

The share of the children who are still consuming sweet beverages during the night is very similar in both groups, but the numbers were again too small to warrant firmer conclusions. The analysis of the time of giving up that habit showed statistically very significant difference among the groups: 56.5% of children without ECC stopped it during first 24 months, in comparison to only 19.5% of children with ECC ( $p < 0.001$ ).

Another very significant difference between the two groups was noted when analyzing the age at which the habit of

teeth-brushing was introduced and continued regularly. In the group of ECC cases, only 3.6% started brushing their teeth regularly during first 24 months of their lives. In the control group, the corresponding proportion was 45.6% ( $p < 0.001$ ).

## Discussion

ECC remains a significant problem in both industrialized and less developed countries. It is frequent among minorities and immigrants in western countries<sup>5–7</sup>. The wide spectrum of discussed predisposing factors ranges from socio-economic status of the family in which the child is being brought up, education of the parents, cultural values, ethnicity, nutritional and hygienic habits, to the number of parents raising up the child (single- or two-parent-family)<sup>8–10</sup>.

Similarly to other types of caries, ECC is caused by *Streptococcus mutans* which digests food carbohydrates and generates strong acids which reduce pH-value predisposing to destruction of firm dental tissues, especially upper incisors. The possible pathogenetic mechanism in pre-school children might involve infections with cariogenic bacteria (*Streptococcus mutans* and *Lactobacillus*), undeveloped immune system, specific nutritional habits in early childhood and introduced behavior regarding oral hygiene<sup>6,11,12</sup>.

Some very thorough and in-depth studies that correlated nutritional habits and the development of ECC in children up to 3 years of age showed the smaller prevalence of the condition in children that started taking salty food at the age of 7 months. Similar observations were noted among children consuming milk with no sugar<sup>11,13</sup>. Furthermore, prolonged breast-feeding seems to represent an additional important predisposing factor, which is often neglected<sup>14</sup>. Many of the mothers having children with this type of caries report a history of breast-feeding longer than two years, often even three years, allowing the feeding in duration of several hours, especially at night, which accelerates the implantation of *Streptococcus mutans* and the development of caries. The carbohydrate lactose (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>), main nutritious component during breast-feeding years, represents the most prominent predisposing factor for ECC in such cases.

When analyzing the problem of ECC in children, it is important to note that the education of the parents can be very important. Pregnant women can begin with dispositional prophylaxis, by taking care of well-balanced nutrition rich in minerals, which are necessary for endogenous mineralization of the teeth. It is also helpful to both parents to learn more about cariogenic agents, how to fight them, to find out the scientific facts on the formation of the plaque, predisposing

sites, its visualization through the use of relevators, the choice of methods for the right implementation of oral hygiene, the importance of periodontal status and the possible consequences of inadequate oral hygiene<sup>13,15–18</sup>.

The results of our study have shown that the prevalence of ECC in this sample amounts to 30%, which is the figure similar to those found in other studies<sup>19</sup>. The values of dmfs index were relatively high in both ECC cases and the control group, which indicates that there is still a need for substantial improvement of nutritional habits and oral hygiene in all pre-school children in Zagreb. The analysis of our data showed that the share of the examinees with completely intact teeth amounted to 38% in girls, and 27% in boys. The corresponding percentages from the world literature range from 16% (Cape Town) to 83% (Oslo), which classifies our results among the lowest third of countries with reported data<sup>20</sup>. Still, an improvement was observed in comparison to Zagreb data from 1987, when the share of caries free children was only 12.5%<sup>21</sup>.

Our study did not confirm the impact of baby-bottle feeding on the development of ECC. That is in line with the recent findings from developing countries, where ECC is also a considerable problem in children up to 4 years of age, and where baby-bottle is very rarely used<sup>5</sup>.

Our study confirmed the role of two very significant predisposing factors for development of ECC: prolonged consumption of sweet beverages and late introduction of teeth-brushing habit. It appears that male gender is only an indirect predisposing factor, since the correction for the first two factors did not confirm the statistical significance that was found initially. Many studies point out that boys are less likely to begin brushing the teeth early, and more likely to consume sweet beverages during the night for a very prolonged period of time<sup>19,22–26</sup>. We may con-

clude that this study revealed and confirmed the importance of early introduction of teeth-brushing and giving up the

nightly consumption of sweet beverages in prevention of ECC.

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## ČIMBENICI KOJI PREDISPONIRAJU RAZVOJU KARIJESA BOČICE U DJECE PREŠKOLSKE DOBI U ZAGREBU

### SAŽETAK

Cilj ove studije bio je istražiti čimbenike koji predisponiraju razvoju tzv. karijesa bočice u djece pretškolske dobi u Zagrebu. Studija je provedena na uzorku 145 djece (77 dječaka i 68 djevojčica) u dobi između 2 i 5 godina, uključujući klinički pregled dentalnog statusa i anketu o navikama djece provedenu među roditeljima. Ukupna prevalencija karijesa bočice iznosila je 30%: u djevojčica 25%, a u dječaka 48%. Istraživanje rizičnih čimbenika provedeno je klasičnom retrospektivnom studijom. Prosječna vrijednost Kp indeksa među zahvaćenim slučajevima iznosila je 8,6, u usporedbi s 5,2 u kontrolnoj skupini ( $p < 0.05$ ). Hranjenje na bočicu nije predstavljalo značajan rizik, ali

su to bili noćna konzumacija slatkih pića nakon navršena 24 mjeseca života, te izostanak usvajanja navike četkanja zubi nakon navršena 24 mjeseca života ( $p < 0.001$ ). Studija je ukazala na važnost ranog započinjanja četkanja zubi te što ranijeg odvikavanja od noćnog konzumiranja slatkih napitaka u prevenciji karijesa bočice.