

Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania

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Key words: severe early childhood caries; dmft; toothbrushing, breast-feeding; behavioral risk factors.

Summary. The objective of the present study was to investigate the prevalence and severity of early childhood caries (ECC) and severe early childhood caries (S-ECC) in 3-year-old Lithuanian children. The impact of selected behavioral risk factors on the development of S-ECC was investigated.

Material and methods. A total of 950 children were examined in kindergartens. Diagnosis of dental caries followed the WHO criteria. Questionnaires were delivered to mothers of the children with S-ECC and caries-free children. The questions were related to the children's dietary habits, temperament, oral hygiene, and the use of fluoride toothpaste.

Results. The prevalence of ECC was 50.6% with a mean dmft of 2.1 (SD, 0.1) and a mean dmfs of 3.4 (SD, 0.2). The prevalence of S-ECC was 6.5% with a mean dmft of 7.8 (SD, 0.1) and dmfs of 18.1 (SD, 0.6). A significantly higher percentage of children developed S-ECC when they were breast-fed for a period longer than one year, were sleeping with a bottle containing carbohydrates during the night, or were allowed to sip from a bottle either going to sleep or during the day. A significantly higher percentage of mothers having caries-free children knew about risk factors of S-ECC and started tooth brushing after the eruption of the first tooth. There was no significant difference between the groups regarding the use of fluoride toothpaste.

Conclusions. Improper infant bottle-feeding habits and no tooth brushing were found to be significant for the development of S-ECC among 3-year-old Lithuanian children.

Introduction

Severe early childhood caries (S-ECC) is rampant caries affecting the primary dentition. Demineralization starts in the maxillary incisors followed by the maxillary and mandibular first molars. S-ECC has been described as nursing caries (NC) or baby bottle tooth decay (BBTD) (1). The broader term of ECC (early childhood caries) is used to describe tooth decay in preschool children and covers BBTD (2).

In 1882, nursing bottle syndrome was first described as a disorder resulting from inappropriate nursing habits, involving either breast-feeding or bottle-feeding (3). Later studies on caries etiology disclosed other important risk factors such as early colonization and high levels of cariogenic bacteria, poor oral hygiene, enamel hypoplasia, maternal flora, socioeconomic status, parental education level (4, 5).

S-ECC may have an impact on children's oral

health status throughout life. Severe dental pain affects daily life. Adult can verbalize the feeling of pain, but children often cannot. The child's immaturity, developing cognition, and dependence on adults influence interpretations of pain. This creates a problem when the need for treatment is assessed (6). Children who have caries in their primary teeth are also more likely to develop dental caries in their permanent dentition (7). Premature loss of teeth in the primary dentition may predispose to malocclusion in the permanent dentition (8). ECC was shown to adversely affect the child's development, especially body weight and height (9). Rapid caries progression usually causes complications such as pulpitis and apical periodontitis. Excessive dental treatment, often including pulp therapy and extractions, makes treatment even more difficult (10). Severe forms of ECC may require treatment under general anesthesia. The cost of

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treatment is high (11). Financing of the treatment of children with S-ECC is a challenge for the Lithuanian health care. Studies on S-ECC have not been earlier performed in Lithuania.

The aim of this study was to determine the prevalence and severity of early childhood caries (ECC), severe childhood caries (S-ECC) among Lithuanian children as well as to investigate the impact of selected behavioral risk factors such as baby bottle feeding at night, bottle content, prolonged breast-feeding, the use of a bottle during day sleeping time, the temperament of a child, the age at which tooth brushing was started and fluoride toothpaste was introduced.

Material and methods

This study was performed in 10 counties in Lithuania – Vilnius, Kaunas, Klaipėda, Šiauliai, Panevėžys, Marijampolė, Telšiai, Alytus, Utena, and Tauragė – in 2003. A total of 950 randomly selected 2.5- and 3.5-year-old children attending kindergartens were examined. There were 494 (52%) boys and 456 (48%) girls. Before the dental examination, written informed consent was obtained from the parents.

The study design included the enrollment of 100 randomly selected children to be examined in each region. However, in the counties of Klaipėda, Šiauliai, and Telšiai, there were smaller numbers of 3-year-old children attending kindergartens.

All the children were examined with a dental mirror and a probe in nursing room of the kindergarten in daylight. All the examinations in different counties were performed at the same time of the day.

The criteria of ECC were in accordance with the recommendations proposed in 1998 by Drury et al. (12). Dental caries experience was assessed in accordance with the WHO clinical diagnostic criteria (13). Caries experience was determined by the prevalence and dmft/dmfs (number of decayed, missing, filled teeth/surfaces). No references concerning standardized diagnostic criteria for reporting “nursing caries” or “baby bottle caries” were found. Rampant, acute, progressive pattern of dental carries and baby bottle tooth decay were defined as severe early childhood caries (S-ECC) according to Hallett et al. (14). In our study, carries in children were classified as S-ECC if teeth were missing due to caries or the cavities or fillings were on smooth surfaces in primary anterior teeth or the dmfs score was more than 4 (15).

Dental health-related habits were assessed with the help of the questionnaires. They were administered to randomly selected parents (n=80). Forty parents had children with S-ECC and forty had

caries-free children. Questionnaires included questions about the number of dental health-related habits: children’s dietary habits, their oral hygiene, the temperament of the child, the time when tooth brushing was started, and the use of fluoride paste.

Statistical analysis was performed by the chi-square test. Odds ratios were calculated with 95% confidence interval (CI). The significance level was set at $P<0.05$. The intraexaminer agreement for dmft scores was measured applying the κ index. A κ value of 0.79 was considered satisfactory.

Results

The prevalence of ECC among 3-year-old children in Lithuania was 50.6% and ranged from 31.4% to 58% within different counties ($P<0.001$) (Fig.). The mean dmft of the entire sample was 2.1 (SD, 0.1), and the mean dmfs was 3.4 (SD, 0.2) showing the different values within the counties (Table 1).

The prevalence of S-ECC among 3-year-old children in Lithuania was 6.5% and ranged from 2.9% to 10% within different counties ($P<0.001$). No cases of S-ECC were found in Telšiai county (Fig.). However, it cannot be concluded that there are no children affected by S-ECC as only children attending kindergartens were examined. The mean dmft of the entire sample was 7.8 (SD, 0.1), and the mean dmfs was 18.1 (SD, 0.4).

Some infant feeding practices were associated with S-ECC pattern (Table 2). Depending on time when breast-feeding was discontinued, 25% of children with S-ECC were fed longer than one year in comparison with 2.5% of caries-free children. A significantly higher percentage of children with S-ECC were sleeping with a bottle containing carbohydrates during the night (95%) or were allowed to sip from a bottle or to sleep with it during the day (75%) in comparison with those who were not fed in this manner (Table 2). The percentage of children with S-ECC fed at night 3–4 times was significantly higher (55%) in comparison with the proportion of caries-free children (10%). Mothers having children with S-ECC more frequently reported the usage of sweetened tea in the feeding bottle than water (25% versus 2.5%). Cow’s milk in the feeding bottle was rather popular in both the children groups (60%–70%).

Mothers were asked about child’s temperament. Restless children are more active and most commonly are quieted by the sipping from the bottle. The expressed activeness was reported by 55% of mothers having children with S-ECC and only by 17.5% of mothers having caries-free children ($P<0.001$).

Analysis of mothers’ knowledge concerning risk

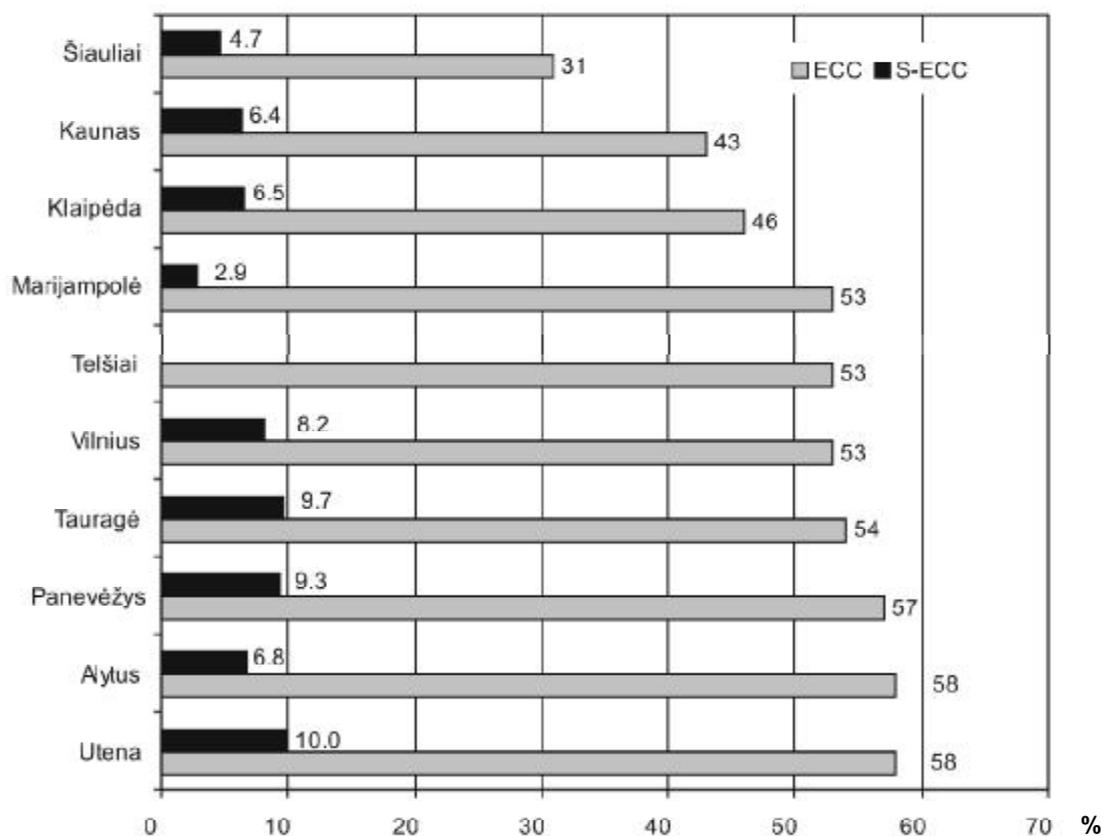


Fig. Prevalence of early childhood caries (ECC) and severe early childhood caries (S-ECC) in different counties of Lithuania. ECC, $\chi^2=27$; $df=9$; $P<0.01$. S-ECC, $\chi^2=24.2$; $df=9$; $P<0.01$.

Table 1. Dental status of 3-year-old children in Lithuania

County	Boys			Girls			Total		
	n	mean dmft (SD)	mean dmfs (SD)	n	mean dmft (SD)	mean dmfs (SD)	n	mean dmft (SD)	mean dmfs (SD)
Šiauliai	44	1.0 (0.3)	1.1 (0.4)	44	1.0 (0.3)	1.6 (0.7)	88	1.0 (0.2)	1.4 (0.4)
Kaunas	57	1.6 (0.3)	2.0 (0.4)	43	1.6 (0.4)	1.8 (0.5)	100	1.6 (0.3)	1.9 (0.3)
Telšiai	54	1.9 (0.4)	2.5 (0.5)	38	1.2 (0.2)	1.4 (0.3)	92	1.6 (0.2)	2.0 (0.3)
Alytus	52	2.0 (0.4)	3.2 (0.9)	48	2.5 (0.4)	3.7 (0.9)	100	2.2 (0.3)	3.4 (0.6)
Marijampolė	51	2.1 (0.3)	3.0 (0.6)	49	2.1 (0.4)	2.9 (0.6)	100	2.1 (0.3)	2.9 (0.4)
Tauragė	49	2.3 (0.5)	4.7 (1.5)	51	2.7 (0.4)	4.3 (0.9)	100	2.5 (0.4)	4.5 (0.8)
Klaipėda	41	2.3 (0.6)	4.4 (1.8)	39	2.0 (0.5)	2.6 (0.9)	80	2.1 (0.4)	3.5 (1.0)
Panevėžys	38	2.4 (0.5)	3.6 (0.9)	59	2.1 (0.4)	3.2 (0.8)	97	2.2 (0.3)	3.4 (0.6)
Utena	47	3.4 (0.6)	7.6 (1.8)	53	2.6 (0.5)	3.4 (0.8)	100	3.0 (0.4)	5.4 (1.0)
Vilnius	49	3.8 (2.1)	4.0 (0.9)	44	1.4 (0.8)	1.9 (0.4)	93	2.8 (0.3)	5.2 (1.5)
Total	481	2.2 (0.2)	3.7 (0.4)	469	2.0 (0.1)	2.9 (0.3)	950	2.1 (0.1)	3.4 (0.2)
		$F=4.3$	$F=4.9$		$F=1.9$	NS		$F=4.5$	$F=4.8$
		$df=9$	$df=9$		$df=9$			$df=9$	$df=9$
		$P<0.001$	$P<0.001$		$P=0.06$			$P<0.001$	$P<0.001$

factors and prevention of S-ECC showed a significant difference comparing the children with S-ECC and their counterparts (Table 2). More than half (62.5%) of the parents having caries-free children started to brush teeth of their children after eruption of the first tooth. Even 52.5% of the parents having children with

S-ECC did not brush their children's teeth at all. The answer that a child brushes teeth by himself/herself should be considered as non-brushing teeth. In respect of the fluoride toothpaste using, there was no significant difference between caries-free children (52.5%) and children with S-ECC (57.5%).

Table 2. Comparison of children's feeding habits, tooth brushing patterns between caries-free children and children with severe early childhood caries (S-ECC)

Component	Caries-free children, %	Children with S-ECC, %	OR (95% CI)
Age when breast-feeding was discontinued			
≤12 months	97.5	75	1
>13 months	2.5	25	10.0 (1.28–78.117)
Frequency of bottle use at night			
Do not use	37.5	5	1
1–2 times/night	52.5	40	5.714 (1.139–28.656)
3–4 times/night	10	55	41.25 (6.685–254.547)
Sip and sleep with a bottle at daytime			
Yes	32.5	75	1
No	67.5	25	6.231 (2.351–16.513)
Daily bottle contents			
Water	37.5	2.5	1
Milk	60	72.5	15.0 (1.833–122.717)
Sweetened tea	2.5	25	225.0 (12.851–3939.507)
Child's temperament			
Easy	82.5	45	1
Difficult	17.5	55	5.762 (2.065–16.079)
Do you know about risk factors of baby bottle tooth decay?			
Yes	70	22.5	1
No	30	77.5	8.037 (2.945–21.935)
Tooth brushing was started			
When the first tooth erupted	62.5	15	1
From 2.5 years of age	30	32.5	4.514 (1.377–14.797)
Do not brush	7.5	52.5	29.167 (6.492–191.035)
Do you use fluoride toothpaste?			
Yes	52.5	57.5	1
No	47.5	42.5	0.895 (0.465–1.721)

Discussion

Dental caries among preschool children is still a concern in Lithuania. The results of our study showed that half (50.6%) of 3-year-old children had dmft of >0. According to reported findings of other studies, the prevalence of ECC varies from 1% in Australia (16) to 70% in developing countries or in deprived groups in developed countries (17). The wide variation in prevalence may be due to the different caries recording criteria, such as recording only cavitated lesions or both cavitated and noncavitated lesions, location of lesions, number of teeth involved in the process, age of examined population (only 3-year-old or preschool-aged), significant cultural and ethnic differences in feeding practices. These factors also explain the difficulty of standardizing and optimizing diagnostic and epidemiological criteria for ECC (15). The obscure or insufficient data concerning dental status among 3-year olds might be explained by a young patient's age, which makes dental examination complicated. To our knowledge, there are no studies

describing oral health status among 3-year-old Lithuanian children. Results of the study by Milčiuvienė et al. (18) showed that the prevalence of dental caries increased with the age of the children ranging from 20.6% among 7-year olds to 95.9% among 15-year olds.

The prevalence of S-ECC was 6.5% in the group of examined children with ECC. However, it is worth mentioning that the prevalence of S-ECC may also vary due to case definitions. Studies in different countries among 3-year olds using the S-ECC definition based on primary maxillary anterior teeth only have reported the prevalence of S-ECC to be 6.5% in Italy (19), 20% in England (20), 32.6% in Saudi Arabia (21).

The mean dmft in our study was 2.11 (SD, 0.1) showing no gender difference. Some studies showed that boys had a higher mean dmft than girls (11, 19). The mean dmft in different studies among 3-year olds was found to be from 5.2 in some Canadian populations (11) and 6.2 in Turkey (23) to 7.4 in Philippines

(22). The mean dmfs in Sweden was found to be 0.2 (24). Despite the fact that dental health among Scandinavian preschool children is extremely good, a significant problem for some individuals still exists (25).

It is well known that dental caries is a multifactorial disease. Severe caries in preschool children has long been considered a distinct clinical entity described previously as “nursing caries” or “bottle caries” and attributed to prolonged bottle-feeding with sweetened liquids (26).

The relationship between breast-feeding and dental caries is likely to be complex and confounded by many biological variables, such as mutans streptococci, enamel hypoplasia, intake of sugars, as well as social variables, such as parental education and socioeconomic status, which may affect oral health (4). The prolonged breast-feeding (longer than one year) as a possible risk factor in the development of S-ECC was analyzed. Prolonged or breast-feeding on demand has been implicated in the development of ECC (26). Parents should be convinced that natural feeding is very important, but not a tool to eliminate psychological discomfort. Our study showed the association between defined risk factors on the development of S-ECC.

Improper feeding habits such as night feeding or sipping from the bottle during the day and high frequency of sugar intake are the most significant risk factors of S-ECC (26, 27). Most of children in our study were fed with a bottle, but only a few had S-ECC.

Frequent night feeding may have an impact on caries development. Low salivary flow rate during sleep time in infants decreases oral clearance and increases contact time of plaque and substrates, thus increasing the cariogenicity of the substrate significantly (28). Increased frequency of sugar consumption increases the risk of enamel demineralization and decreases time for remineralization by saliva, and then demineralization becomes predominating process. The results of our study showed that frequent feeding during night is one of the risk factors leading to the development of S-ECC. Sipping from a bottle during daytime is an adverse feeding habit, which is a potential risk factor for caries development. A significant difference comparing children with S-ECC (75%) and caries-free children (52.5%) gives an idea that sipping from a bottle or even sleeping with a bottle during daytime may have a potential risk in S-ECC development.

A bottle with carbohydrates is well-known risk factor in caries development. Majority of the participants in both the groups were drinking cow's milk; however, the percentage of children drinking cow's

milk was higher among children with S-ECC (Table 2). These findings are not surprising, whereas there is no evidence that cow's milk is cariogenic although it contains 3% of lactose. However, the frequent usage of a bottle with milk may increase S-ECC risk (26, 29). A significant difference was found comparing the proportions of sugar-sweetened tea consumers: it was used by 25% of children with S-ECC versus 2.5% caries-free children ($P < 0.001$). Sucrose is most cariogenic in the group of the carbohydrates, and possibly it is the main sugar associated with infant caries.

Children with S-ECC often are characterized as active, restless, nervous, and having complicated behavior. Carey (30), who developed the questionnaire for the assessment of child temperament, states that temperament may play a role in etiology, outcome, or management of variety of illnesses, reactions to pain, allergic disorders, and dental management. Crying and nervous children very often are calmed by the sipping from the bottle. Later on, they realize that crying is pushing parents to give a bottle containing carbohydrates. Our findings showed that this was a risk factor of S-ECC (Table 2).

Proper oral hygiene and usage of fluoride toothpaste are the most important factors in caries prevention. Children under the age of 8 are not able to brush teeth by themselves. Therefore, proper oral hygiene is parents' responsibility. The results from our study showed the relation between tooth brushing and development of S-ECC; however, no relation was found between usage of fluoride toothpaste and S-ECC development. Parents were not asked when fluoride toothpaste was started to use. It might have some influence on results. The use of a pea size of adapted toothpaste, low in fluoride concentration (<500 ppm), is recommended by the European Academy of Pediatric Dentistry (31). Knowledge about risk factors and prevention of S-ECC are very important for parents. The first visit to a dentist gives this information. Less than two-thirds (70%) of mothers having caries-free children knew about S-ECC and its prevention, while only 22.5% of mothers having children with S-ECC were aware of this problem ($P < 0.001$).

Conclusions

The prevalence of early childhood caries and severe early childhood caries among Lithuanian 3-year-old children is 50.6 and 6.5%, respectively. Improper infant bottle-feeding habits, no tooth brushing were significant determinants for the development of severe early childhood caries. Although severe early childhood caries is a multifactorial disease, it is preventable by well-organized prevention program.

Dauginis ankstyvasis trimečių vaikų dantų ėduonis ir jo rizikos veiksniai

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Raktažodžiai: dauginis ankstyvasis vaikų dantų ėduonis, kpi-d, dantų valymas, maitinimas krūtimi, elgesio rizikos veiksniai.

Santrauka. *Tyrimo tikslas.* Ištirti dauginio ankstyvojo vaikų dantų ėduonies (buteliuko ėduonies) paplitimą ir intensyvumą tarp trimečių Lietuvos vaikų. Taip pat tirta rizikos veiksnių reikšmė šios ligos atsiradimui.

Tyrimo medžiaga ir metodai. Ištirta 950 vaikų, lankančių darželius dešimtyje Lietuvos miestų. Ėduonis buvo diagnozuojamas pagal PSO kriterijus. Vaikų, sergančių dauginiu ankstyvu dantų ėduonimi, ir sveikų vaikų mamos užpildė pateiktus klausimynus. Juose buvo pateikti klausimai apie vaikų mitybą, temperamentą, burnos higieną ir dantų pastos su fluoru vartojimą.

Rezultatai. Vaikų pieninių dantų ėduonies paplitimas buvo 50,6 proc., kpi-d vidurkis – 2,1±0,1, kpi-p – 3,4±0,2. Dauginio ankstyvojo ėduonies paplitimas buvo 6,5 proc., kpi-d vidurkis – 7,8±0,1, kpi-p – 18,1±0,6. Nustatyta, kad ankstyvu dantų ėduonimi statistiškai reikšmingai dažniau sergo tie vaikai, kurie buvo maitinami krūtimi ilgiau nei vienerius metus, arba gėrė iš buteliuko saldžius gėrimus prieš užmigdami, nakties metu, taip pat dieną. Remiantis apklausos duomenimis, sveikų vaikų motinos, lyginant su sergančiųjų motinomis, daugiau žinojo apie dauginio ankstyvojo ėduonies (buteliuko ėduonies) rizikos veiksnius ir pradėjo valyti vaikų dantis išdygus pirmajam dantukui. Nenustatyta statistiškai reikšmingo skirtumo tarp tirtųjų grupių, vartojusių ir nevartojusių dantų pastą su fluoru.

Išvada. Netaisyklinga vaikų mityba ir dantų nevalymas buvo svarbiausi rizikos veiksniai, sąlygojantys dauginio dantų ėduonies atsiradimą trimečiams vaikams.

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