SOCIO-BEHAVIORAL DETERMINANTS FOR SEVERE EARLY CHILDHOOD CARIES (S-ECC)

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ABSTRACT

Aim of the study The purpose of this study was to determine the prevalence of S-ECC in a group of preschool children from Romania and to evaluate the role of socio-behavioral factors in association with this condition. **Material and methods** 337 children aged between 3 and 5 years were included in this study after determining the sample size. This study was conducted as a questionnaire combined with a clinical examination which determined the DMFT index. After collecting the data from the questionnaire, the socio-behavioral factors were statistically analysed into determining which ones were associated with a high DMFT index. **Results** The prevalence of S-ECC in this group of preschool children was 31.80%. Some social and behavioral factors were significantly related to S-ECC and to a high DMFT index score such as bottle feeding (p=0.0001), frequently consumed sweet treats (p=0.0001), and irregular dentist visits (p=0.03). On the other hand, the type of toothbrush used (p=0.30), frequency of toothbrushing (p=0.68), and the usage of fluoride toothpaste (p=0.59) were not statistically associated with S-ECC. **Conclusions** The prevalence of S-ECC among Romanian preschool children is high, and its development and progression are strongly associated with different oral hygiene practices, dietary habits and preventive measures.

Key words: severe early childhood caries, socio-behavioral factors, preschool children

INTRODUCTION

Severe early childhood caries (S-ECC) is a relatively new term in pedodontics literature, adopted by the American Academy of Pediatric Dentistry (AAPD). S-ECC is described as distinct clinical characteristics of severe caries in the temporary dentition, with onset at very young age, with an atypical, progressive pattern. S-ECC is a chronic infectious disease caused by cariogenic bacteria and favoured by frequent exposure of dental surfaces to carbohydrates from milk preparations and fruit juices. Its global incidence varies between 7 and 50% in children under 5 years of age, and in Romania between 15-18% [1].

According to AAPD (2016), early childhood caries (ECC) is defined as any primary tooth in a child 71 months of age or younger having one or more carious (noncavitated or cavitated lesions), missing (cavitated), or filled tooth surface. Any indication of smooth-surfaced caries in children under three years old is indicative of S-ECC. In maxillary anterior teeth, S-ECC is defined as having one or more cavitated, missing (from caries), or smooth occluded surfaces from ages three to five, or as having

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a carious, missing, or filled DMFS index score (decayed, missing, filled surfaces) of ≥4 (age three), ≥5 (age four), or ≥6 (age five) [2, 3].

The unanimous definition of caries in the literature so far is the following: dental caries is a dynamic process of demineralization of hard dental tissues in an acidic environment, resulting from the action of dental plaque on the alimentary carbohydrate substrate. Dental caries does not only mean damage to the dental hard tissues, but also the entire process that leads to its formation, and which requires the presence of three essential elements: microbial flora, dental surface (vulnerable host) and fermentable substrate deriving out of food diet (Keyes' triad) influenced directly by the time factor [4]. Over time, the interplay of these variables leads to the formation of caries, which starts as opaque white spots without cavities on the dental surface because of tooth enamel demineralization [7]. The evolution of caries over time is towards the loss of hard tissue materialized by cavities that lead to the loss of dental contacts, occlusal interference, neuro-muscular and temporomandibular joint dysfunctions [8], therefore its treatment must be instituted as early as possible. Dental caries is, therefore, a chronic destructive process that evolves without typical inflammatory phenomena, producing necrosis of the dental tissues, infection of the pulp and the apical periodontium, with possible general repercussions [5, 6].

Numerous risk factors contribute to the onset and progression of S-ECC, such as dietary habits, behavioral, socio-economic, parental and biological factors, oral hygiene practices and preventive measures, immunologic and even genetic factors.

There is a considerable correlation between the frequency of high sugar intake (primarily sucrose) and the occurrence of caries, particularly if the contact happens between meals and while sleeping, when salivary flow is decreased [7]. The preventive action of saliva in this case is absent. The development of S-ECC in children is linked to behaviors like sleeping while being bottle fed, using nursing bottles indefinitely, and consuming produced fruit juices, sweetened teas, fermented milk, and milk containing fermentable carbohydrates like sugar and farinaceous meals. The AAPD also states that using pacifiers submerged in sugary liquids and breastfeeding on-demand following dental eruptions are risk factors for the development of caries [5, 8].

Experience with caries has long been linked to behavioral traits. It is crucial to consider the lifestyle of the children's caregivers. Maternal educational level is associated with the occurrence of dental caries, as does the educational level of fathers. Education level has been identified as a significant socioeconomic predictor. Children whose mothers took them to the dentist on a regular basis showed lower caries incidence and severity [4, 9].

All children in communities with optimal fluoridation levels and fluoridation levels below should use fluoridated toothpaste twice a day as part of the current best practice to lower the risk of the onset of S-ECC. Topical fluoride treatments administered by professionals are also effective in lowering the occurrence of S-ECC. For children under six years old who are at risk for enamel demineralization, professionally administered fluoride treatments such as 5% sodium fluoride varnish is advised [10, 11].

Genetic and immunological factors are also important in the development of enamel defects together with dietary habits or nutritional deficiencies. General health status and immunodeficiencies of children significantly affect the enamel hypomineralization process. Some mononucleotide polymorphisms can be easily

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genotyped early in a child's life and represent a valuable tool for preventing caries risk. This could allow for improved early prevention for infants and young children, who are most at risk of developing such injuries [12].

When untreated, S-ECC leads to infectious complications and premature loss of temporary teeth. This ultimately affects the quality of life of young children, with effects such as masticatory difficulties, phonetic, aesthetic disturbances and even overall growth impairment manifested by short stature and weight, smaller head circumference and iron deficiency anemias [12, 13]. The follow-up of patients with S-ECC has shown that this condition is not limited to affecting the temporary dentition but has consequences both in the permanent dentition (premature tooth eruptions, anomalies with dental crowding) and in the whole dento-maxillary system (masticatory, physiognomic and phonation disorders). Due to its increased frequency and local and general implications, S-ECC is a public health problem [14].

By focusing on prevention through proper oral hygiene, balanced nutrition, regular dental check-ups, and adequate fluoride exposure, we can reduce the incidence of S-ECC [15]. This proactive approach not only safeguards the child's oral health but also supports their general health, enhances their quality of life, and reduces the long-term healthcare costs associated with dental treatments [15, 16].

The aim of this study was to determine the prevalence of S-ECC in a group of preschool children from the Mureș County in Romania and to analyse the association of between DMFT index score and socio-behavioral risk factors.

MATERIAL AND METHODS

This study was conducted between 2nd of October 2023 and 23rd of February 2024, after receiving the approval of the Scientific Research Ethics Committee of G. E. Palade UMFST of Targu Mures, no. 2424/04.07.2023. The children enrolled in this study came from 12 different kindergartens, six from rural areas and six from urban areas of Mureș County. Before starting the study, written authorizations and written consents were obtained from participating parents and caregivers.

For the expected prevalence of 24,81%, the required sample size was 303 for the margin of error or absolute precision of +5% in estimating the prevalence with 95% confidence and considering the potential loss/attrition of 5%. This sample size was calculated using the Scalex SP calculator (Naing L, et al., 2022) after using data from Luca et al. (2001) [17, 18]. 337 children were included in this study based on the inclusion and exclusion criteria. 32 patients were either not present on the day of the oral examination or have not returned the questionnaire. The final number of children included in the study was 305.

The inclusion criteria:

-age between 3 and 5 years old;

-parents ability to understand the study;

-parents' willingness to participate and sign the informed consent.

The exclusion criteria:

-children in early mixed dentition;

-children with major systemic illnesses;

-uncooperative children at the time of clinical examination.

The study was conducted using a questionnaire accompanied by an oral examination.

A cross-sectional oral health survey was undertaken by the parents and caregivers of the children enrolled in the study. The following socio-behavioral details were included in the questionnaire: sex, age,

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ethnicity, residence, feeding history; oral hygiene practices (beginning of tooth brushing, frequency of daily brushing, parental supervision of tooth brushing, use of fluoride toothpaste); and use of a dental service (past dental visit and oral health care instruction received by parents).

The clinical part of this study consisted of the children being examined by two calibrated dental practitioners (T.D. and A.P.L.) in the Pedodontics Department of the Faculty of Dental Medicine, G.E. Palade UMFST of Targu Mures. The examination was performed under natural light using disposable dental mirrors and explorers. No radiographs were taken. The DMFT index according to the AAPD 2016 criteria was calculated. Calculations excluded teeth lost to trauma or primary teeth lost to exfoliation. S-ECC was defined as ≥1 decayed, missing or filled smooth surfaces in the primary maxillary anterior teeth or a DMFT score ≥ 4 (age 3), ≥5 (age 4), or ≥6 (age 5).

All data was collected in Microsoft Excel work sheets (Microsoft Corporation, Washington DC, USA, 2018). The statistical analysis was carried out in GraphPad Prism version 10.2.3 for Windows (GraphPad Software, San Diego, California USA). For each group of data, descriptive statistics such as mean and standard deviation were assessed. Data normality was determined using the Kolmogorov–Smirnov test. The association between socio-behavioral factors and the DMFT score was determined using the t-student and ANOVA tests. The chosen significance level was set at 0.05.

RESULTS AND DISCUSSIONS

Out of the 305 children who participated in this study, 31,80% (n=98) were diagnosed with S-ECC. 144 (47.21%) of the patients were male and 161 (52.78%) were female. According to age, the patients' distribution was as follows: 15.08% age 3, 57.7% age 4, and 27.21% age 5. As for ethnicity, 188 patients (61.63%) were Romanians, 95 (31.14%) were Hungarians, and 22 (7.21%) were Roma. Sociodemographic data is presented in **Table 1**.

Out of the 98 patients diagnosed with S-ECC, 58.16% were boys and 41.83% were girls. 43.87% of the children were from urban areas and 56.12% were from the rural areas of Mures County. Therefore, S-ECC had a slightly higher prevalence in boys than in girls. The same can be said about children from rural areas.

The dietary habits prevalence and hygiene practices for children diagnosed with S-ECC are reported in **Tables 2** and **3**.

Most children diagnosed with S-ECC were bottle fed, prefer sweet snacks in between meals and consume sugar daily. These are all factors that contribute to the onset and progression of S-ECC. More than half of the children with S-ECC only brush once a day, use toothpaste without Fluoride and visit the dentist's office once a year.

Table 1. Sociodemographic data of the patients included in the study

Variables	Total (n)	Total (%)	No caries (n)	S-ECC (n)

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Sex				
Male	144	47.21	87	57
Female	161	52.78	124	37
Region				
Urban	154	50.49	111	43
Rural	151	49.5	100	51
Age				
3 years	46	15.08	41	5
4 years	173	57.7	112	61
5 years	86	27.21	58	28
Ethnicity				
Romanian	188	61.63	132	56
Hungarian	95	31.14	66	29
Roma	22	7.21	13	9

Table 2. Prevalence of S-ECC based on dietary habits

Variable	n	%
Feeding habit		
Breastfeeding	18	18.36
Bottle	44	44.89
Combined	36	36.73
Snacking preferences		
Sweets	16	16.32
Fruits	7	7.14
Salty snacks	1	1.02
Sweets and fruits combined	74	75.51
Sugar consumption between meals		
Daily	58	59.18
3-4 times/week	32	32.65
1-2 times/week	7	7.14
Once every few weeks	1	1.02
Frequency of brushing		
Twice a day	35	35.71
Once a day	51	52.04
3-4 times/week	7	7.14
Once a week	5	5.14
Brush type		
Manual	63	64.28
Electric	31	31.6
Both	4	4.08
Fluoride toothpaste		
Yes	43	43.87
No	55	59.18
Dental check-ups		
Twice a year	18	18.36
Once a year	53	54.08
Once every few years	11	11.22
Never	16	16.32

Table 3. Prevalence of S-ECC according to oral hygiene practice

Variable	n	%

The mean DMFT score for children with S-ECC was 5.6±2.1, result similar to those found in Quatar, Lithuania and Italy [19, 20, 21].

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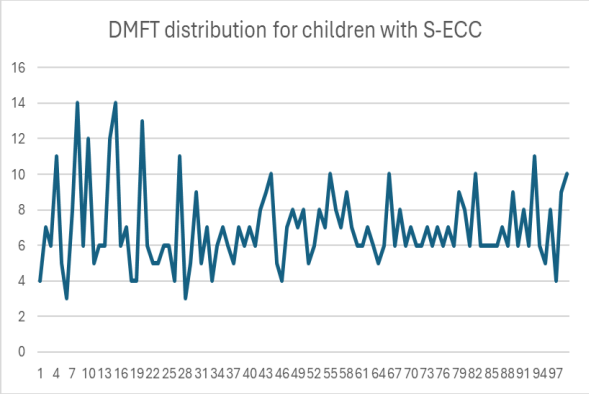


Figure 1. DMFT distribution for children diagnosed with S-ECC

The mean age for starting dental hygiene for children with S-ECC was 2.1±1.3 as represented in **Figure 1**. Children without S-ECC had a mean age of starting brushing of 1.7±0.8. Therefore, healthy children started oral hygiene earlier than children with S-ECC. According to current recommendations, toothbrushing should start with the eruption of first primary tooth, that can be anywhere between the age of 5 months and 1 year. Recent data from a Norwegian birth cohort have confirmed the importance of an early start and twice daily brushing with fluoride toothpaste to reduce the development of dental caries from 2 to 5 years of age [22]. Similar results to our study were observed in papers from Turkey and China [23, 24]. On the other hand, some studies report that oral hygiene was started a lot earlier in children's lives, at the age of 1, 1.5 and even at 8 months old (Sweden) [9, 15, 25].

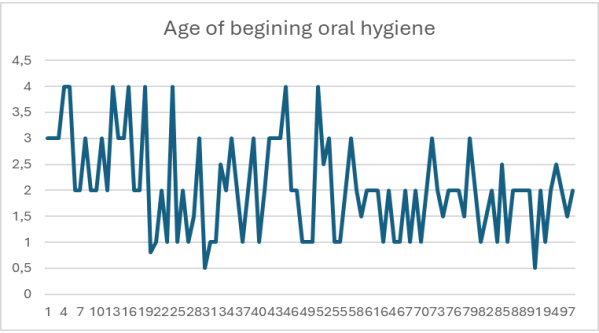


Figure 2. Age of beginning oral hygiene for children diagnosed with S-ECC.

Regarding the feeding practices of the children included in the study, a high DMFT score was associated with bottle feeding (p<0.0001) (**Figure 3**).

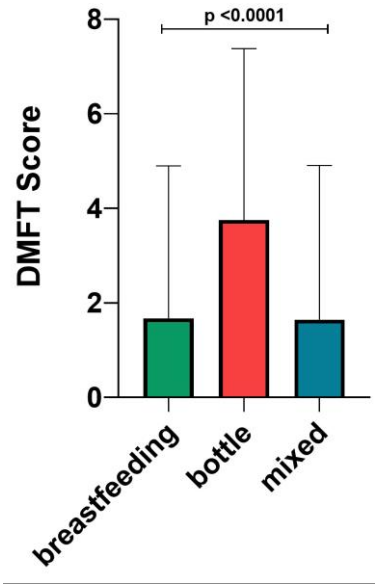
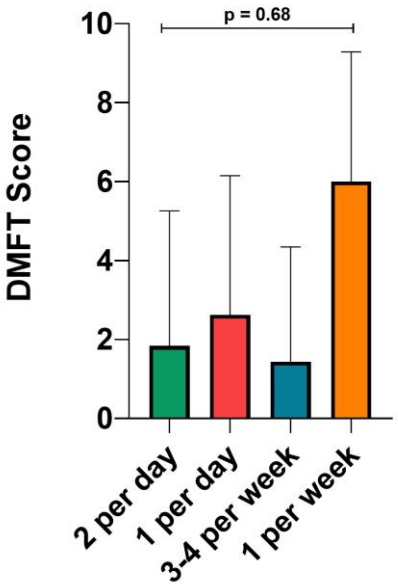


Figure 3. DMFT score associated with feeding habits

Also, high DMFT score was associated with sweet snacking preferences (p=0.034). The ANOVA test showed a significant association of daily snacking (mostly sweets) and a high DMFT score (p<0.0001).

These findings are in accordance with other studies which also report that frequent sweet treats in between meals are an important factor that causes and aggravates this condition [3, 25, 26].



Oral hyg

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iene practices for children diagnosed with S-ECC were also analysed. Most children with S-ECC (52.04%) only brush once a day, but there was no statically significant difference between the frequency of brushing associated to the DMFT score (p=0.68) (**Figure 4**).

Figure 4. DMFT score associated with oral brushing frequency

According to a study done in Shandong, China, children with S-ECC typically had bad brushing practices. Just 8.8% of the kids in the research were aware that they were using fluoride toothpaste, and only around half of them had regular brushing practices. Furthermore, there was no correlation found between the frequency of toothbrushing and an increased incidence of caries, indicating that other factors like brushing technique and parental engagement may be important in avoiding caries [27].

Brushing less than twice a day during preschool years dramatically raised the risk of caries by age five, according to a different study done on Swedish preschoolers. The study emphasized the value of using fluoride toothpaste twice a day and the necessity for parents to help their kids brush properly [25].

Many parents overestimate the efficacy of their children's toothbrushing habits, according to a cross-sectional study. Even though a sizable portion of parents said they helped their kids brush, observational data revealed variations in the length of time spent brushing and the quantity of toothpaste applied, suggesting the need for greater instruction and participation in kids' oral hygiene routines [28]. These studies highlight the value of regular, good toothbrushing habits and parental engagement in lowering children's risk of S-ECC.

The majority of the children included in the current study prefer a manual brush against an electric one, which may contribute to the progression of S-ECC as some studies have shown. There was no statically significant difference between the association of DMFT score and toothbrush type (p=0.30) (**Figure 5**).

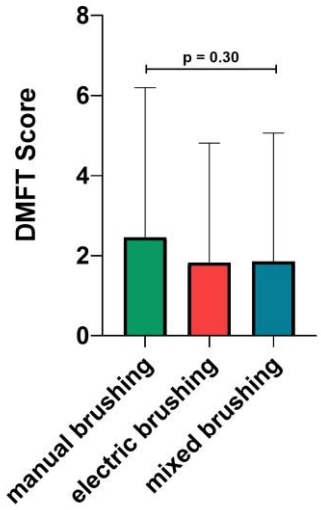

Figure 5. DMFT score associated with toothbrush type

Interestingly, there was no association found between a high DMFT score and the use of nonfluorinated toothpaste (59.18% of the children diagnosed with S-ECC) in this sample (p=0.59) (**Figure 6**).

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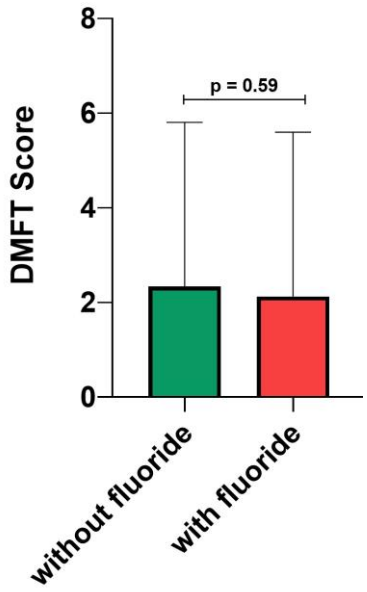

Figure 6. DMFT score associated with the use of fluoride/non-fluoride toothpaste

Several studies reported that fluorides are very effective in preventing dental caries, including fluoride mouth rinse, water fluoridation, fluoride toothpaste, and professional topical fluoride application, primarily by inhibiting mineral loss from the tooth. Some products are more effective than others, for example, fluoride varnish applications in the dentist's office are more effective than just using a fluoride toothpaste at home [29].

Frequent dental check-ups (once or twice a year) are associated with low DMFT scores, while children who visit the dental office only once every few years (11.22%) or have never been to the dentist (16.02%) are associated with a high DMFT score which has been statistically significant (p=0.03). Regular dental checkups have been shown to have a considerable impact on the prevalence of caries, according to a study from China. S-ECC was more common in children who had already visited the dentist, indicating that those who have already had dental caries are more likely to seek treatment. But frequently, the timing and frequency of these visits are insufficient to stop the development of severe caries [30].

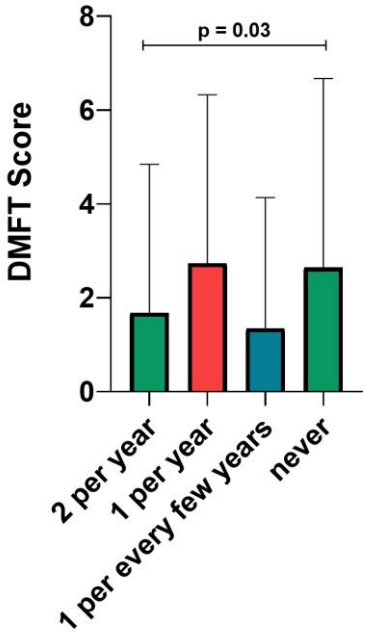

Figure 7. DMFT score associated with the frequency of dental check-ups

CONCLUSIONS

1. The prevalence of S-ECC in this group of preschool children from the Mureș County was 31.80%, which is relatively high compared to other studies from Romania.
2. S-ECC is closely linked to socio-behavioral factors such as irregular toothbrushing frequency, high sugar intake from frequent snacking between meals, infrequent dental visits, and bottle feeding practices.
3. S-ECC is a significant public health problem which requires comprehensive public health strategies, including early dental visits, parental education, and community-based preventive programs.

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