

The Relevance of the Microbiological Substrate and the Determination of Salivary Biomarkers of Oxidative Stress on Early Severe Childhood Caries (S-ECC)

According to the IAPD statement from Bangkok, Early Severe Childhood Caries (S-ECC) is defined as the presence of one or more carious surfaces, with non-cavitated, cavitated, or restored lesions on any primary tooth in children under 6 years of age.

Primary teeth maintain the space for permanent teeth and are essential for the child's well-being, as caries in primary teeth can lead to chronic pain, infections, and other general health issues.

S-ECC is preventable, but it currently affects more than 600 million children globally and largely remains untreated. This condition significantly impacts the child's quality of life, as well as that of the entire family, and is considered a relevant societal issue. Like other forms of caries, it is regarded as a biofilm-mediated, carbohydrate-driven, multifactorial, and dynamic condition, resulting in an imbalance between the demineralization and remineralization of hard dental tissues.

Study 1: Assessment of the Prevalence and Severity of S-ECC in a Group of Children from Mureș County.

This study focused on evaluating the prevalence and severity of Early Severe Childhood Caries (S-ECC) in a cohort of children aged 3 to 5 years from Mureș County, Romania. The objectives of this study include assessing the prevalence of S-ECC, correlations with dmft, identifying risk factors, and monitoring oral health during childhood.

Methodology: The first clinical study lasted 6 months, including 197 children aged 3 to 5 years, selected following dental examinations in various locations. Parental consent was obtained, and clinical examinations were performed by specialized dentists, using inclusion and exclusion criteria. The dmft index was calculated by assessing the dental condition of the children, and statistical analysis was conducted using Jamovi software, establishing statistical significance at $p \leq 0.05$.

Results: The results indicated a notably high prevalence of S-ECC, with 40% of the examined children showing signs of this dental condition. The study identified a strong correlation between low socio-economic status and increased rates of S-ECC. Children from families with limited access to dental care and poor dietary habits were particularly vulnerable.

Discussions: This study emphasizes the need for targeted public health interventions aimed at improving oral health awareness among parents and caregivers, especially in disadvantaged communities. Educational programs focusing on dietary guidelines and the importance of regular dental check-ups are crucial for mitigating the risks associated with S-ECC.

Study 2: Dynamics and Prevalence of Streptococcus mutans and Lactobacilli in the Context of Salivary Buffering Capacity in Children with S-ECC.

This study investigated the dynamics and prevalence of Streptococcus mutans and Lactobacilli concerning salivary buffering capacity in children diagnosed with S-ECC.

Methodology: In this study, salivary pH and buffering capacity were measured using standard biochemical tests. Additionally, bacterial cultures were performed to quantify levels of Streptococcus mutans and Lactobacilli. A total of 58 children with S-ECC were compared with a control group of 30 healthy children.

Results: The results showed that children with S-ECC had significantly lower salivary buffering capacity compared to the control group. Moreover, there was a significant increase in the prevalence of Streptococcus mutans in the saliva of affected children, often exceeding 30% of the total oral flora. This finding suggests that a compromised salivary environment facilitates the growth of cariogenic bacteria, thereby exacerbating the severity of S-ECC.

Discussions: This study highlights the essential role of salivary function in maintaining oral health. Strategies to enhance salivary buffering capacity, such as encouraging hydration and the use of sugar-free chewing gum, may be beneficial in the prevention and management of S-ECC.

Study 3: Comparative Study of Salivary Malondialdehyde Levels Determined by HPLC Technique in Children Diagnosed with S-ECC.

The third study aimed to measure the levels of malondialdehyde (MDA) in saliva as a biomarker of oxidative stress in children diagnosed with S-ECC.

Methodology: This study included 115 children in the study group and 43 in the control group, aged 3 to 5 years. The HPLC technique was used to determine the presence of malondialdehyde (MDA) in the saliva of children through a detailed process of sample collection and analysis. Saliva was collected passively and processed according to strict procedures to avoid contamination, and data analysis was performed using IBM SPSS Statistics software.

Results: The study found significantly higher levels of MDA in the saliva of children with S-ECC, indicating increased oxidative stress compared to healthy controls. The data suggest a direct correlation between elevated MDA levels and the severity of S-ECC, underscoring the potential role of oxidative stress in the pathogenesis of S-ECC.

Discussions: This study emphasizes that monitoring oxidative stress biomarkers such as MDA could be valuable in assessing the risk of carious processes in young children. Furthermore, antioxidant strategies may be explored as adjunctive treatments in managing S-ECC.

Study 4: Analysis of Catalase, Superoxide Dismutase, and Glutathione Peroxidase Levels in the Saliva of Children with S-ECC: Correlations and Clinical Implications.

The final study focused on the analysis of antioxidant enzyme levels—catalase, superoxide dismutase (SOD), and glutathione peroxidase—in the saliva of children diagnosed with S-ECC.

Methodology: The study began after forming the target group of 115 children (64 girls and 51 boys) and the control group of 43 children (24 girls and 19 boys). Passive saliva was collected using Salimetrics containers, which were stored at -80°C until testing. The determination of oxidative stress biomarkers (catalase, superoxide dismutase, and glutathione peroxidase) was performed using ELISA techniques, including sandwich ELISA and competitive ELISA, which provide high sensitivity and specificity for measuring enzyme concentrations.

Results: The results showed reduced activity of antioxidant enzymes in children with S-ECC compared to the control group. Specifically, lower levels of catalase and SOD were observed in the saliva of children affected by S-ECC, suggesting impaired antioxidant defense mechanisms. The study indicated that children with S-ECC have diminished antioxidant capacity, which could exacerbate oxidative stress.

Discussions: These findings underscore the importance of antioxidant status in the oral health of children. Strategies to enhance antioxidant defenses, such as dietary interventions rich in vitamins C and E, may offer protective benefits against the development of caries.

Conclusions: The collective findings from these four studies provide a comprehensive view of the factors contributing to Early Severe Childhood Caries (S-ECC). They emphasize the importance of a multifaceted approach that includes microbiological, biochemical, dietary, and socio-economic considerations in understanding and addressing this significant public health issue.

Future research should focus on longitudinal studies to monitor the impact of preventive measures and to develop tailored interventions aimed at reducing the prevalence of S-ECC in vulnerable populations. Integrating these insights into public health policies and dental care practices will be crucial for improving oral health outcomes for children at risk of S-ECC.

By emphasizing the interplay between oxidative stress, microbiological factors, and socio-economic influences, this doctoral thesis contributes valuable knowledge to the field of pediatric dentistry and underscores the need for a collaborative approach in tackling childhood dental caries.