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ORIGINAL RESEARCH

A cross-sectional cariogram-based comparison of caries risk profile in children with various levels of intellectual disability

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Abstract:

Background

Dental caries is a prevalent condition that can significantly affect the quality of life, particularly in children with intellectual disabilities (ID). Understanding the caries risk profile in these children is essential for developing targeted preventive strategies. This study aims to compare the caries risk profile in children with varying levels of intellectual disability using the Cariogram model.

Materials and Methods

A cross-sectional study was conducted involving 150 children aged 6 to 12 years with different levels of intellectual disability. The participants were divided into three groups: mild, moderate, and severe intellectual disability, with 50 children in each group. The Cariogram model was used to assess caries risk by evaluating factors such as diet, plaque levels, fluoride exposure, saliva secretion, and clinical conditions. Data were collected through clinical examinations and caregiver questionnaires, and analyzed using ANOVA and Chi-square tests to identify differences in caries risk profiles among the groups.

Results

The study found that children with severe intellectual disability had the highest caries risk profile, with a mean Cariogram score of 75% (±10). In comparison, children with moderate and mild intellectual disabilities had mean scores of 65% (±12) and 55% (±15), respectively. Significant differences were observed in dietary habits and plaque levels among the groups ($p < 0.05$). The fluoride exposure was similar across all groups, indicating the influence of other factors on the caries risk profile.

Conclusion

The study highlights the increased risk of dental caries in children with severe intellectual disabilities compared to those with moderate and mild disabilities. Targeted preventive measures focusing on dietary management and oral hygiene practices are crucial for reducing caries risk in these populations. The Cariogram model proved to be an effective tool for assessing and comparing caries risk profiles, facilitating the development of personalized preventive strategies.

Keywords: Dental caries, intellectual disability, Cariogram, caries risk profile, children, preventive strategies.

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Introduction

Dental caries remains a major public health concern globally, affecting children of all ages and backgrounds. It is particularly prevalent in children with intellectual disabilities (ID), who are at a higher risk due to factors such as impaired motor skills, poor oral hygiene practices, dietary habits, and limited access to dental care (1, 2). Intellectual disabilities, which encompass a range of conditions characterized by cognitive limitations and adaptive functioning challenges, can impact a child's ability to maintain oral health and adhere to preventive measures (3).

The prevalence of dental caries in children with ID is significantly higher than in their typically developing peers, leading to increased morbidity and a diminished quality of life (4). Studies have shown that children with severe intellectual disabilities are especially vulnerable due to difficulties in communication and cooperation during dental visits, as well as higher reliance on caregivers for daily oral care (5, 6). Consequently, there is an urgent need to assess and manage caries risk in this population to develop effective preventive strategies tailored to their unique needs.

The Cariogram is a computer-based model that has been widely used to evaluate caries risk by considering various factors, including diet, bacterial load, susceptibility, and circumstances (7). It provides a visual representation of an individual's caries risk profile, enabling dental professionals to identify high-risk individuals and implement targeted interventions (8). While the Cariogram model has been utilized in various populations, its application in children with intellectual disabilities is limited, warranting further investigation.

This study aims to fill this gap by comparing the caries risk profiles of children with different levels of intellectual disability using the Cariogram model. By identifying specific risk factors associated with increased caries prevalence, this research seeks to inform the development of tailored preventive strategies and improve oral health outcomes in children with intellectual disabilities.

Materials and Methods

Study Design and Population

This cross-sectional study was conducted over six months and involved a total of 150 children aged 6 to 12 years with varying levels of intellectual disability (ID). Participants were recruited through multiple dental camps in tertiary health care centres of special children. The children were categorized into three groups based on the severity of their intellectual disability: mild (n=50), moderate (n=50), and severe (n=50), using standardized diagnostic criteria outlined in the DSM-5 (1).

Inclusion and Exclusion Criteria

Inclusion criteria comprised children aged 6 to 12 years diagnosed with intellectual disabilities and with informed consent obtained from their parents or guardians. Exclusion criteria included children with systemic diseases that might affect oral health, those on medication affecting salivary flow, and those who had received professional fluoride treatments or dental sealants in the past six months.

Data Collection

Data collection involved clinical examinations and caregiver questionnaires. Clinical examinations were performed by a trained dentist to assess oral health status, including the presence of dental caries and plaque levels. The decayed, missing, and filled teeth (DMFT) index was used to quantify caries prevalence. Plaque levels were evaluated using the Silness-Löe plaque index (2).

Cariogram Model Assessment

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The Cariogram model was employed to assess caries risk profiles. This computer-based program considers multiple factors, including diet, bacterial plaque, susceptibility (fluoride exposure, saliva secretion, buffer capacity), and circumstances (past caries experience). Caregivers completed a detailed questionnaire to provide information on dietary habits, oral hygiene practices, and fluoride exposure.

Salivary samples were collected from each participant to assess salivary flow rate and buffering capacity using a paraffin-stimulated method. The samples were analyzed in the laboratory for Streptococcus mutans and Lactobacilli counts using selective agar media. Each factor was assigned a score in the Cariogram, and a pie chart representing the overall caries risk profile was generated for each child.

Statistical Analysis

Data were analyzed using SPSS version 25.0. Descriptive statistics were used to summarize the demographic characteristics and oral health status of the participants. Differences in caries risk profiles among the three groups were analyzed using one-way ANOVA for continuous variables and Chi-square tests for categorical variables. A p-value of <0.05 was considered statistically significant.

Results

The study included 150 children with intellectual disabilities, divided into three groups: mild (n=50), moderate (n=50), and severe (n=50). The mean age of the participants was 9.2 years (±1.8), with an approximately equal distribution of males and females across the groups.

Caries Prevalence

The overall prevalence of dental caries was found to be 65% among the participants. Children with severe intellectual disabilities exhibited the highest prevalence of caries at 80%, compared to 70% in the moderate group and 45% in the mild group. The mean DMFT scores were significantly higher in the severe group compared to the other groups ($p < 0.05$).

Intellectual Disability Level	Caries Prevalence (%)	Mean DMFT Score
Mild	45	1.8 (±0.9)
Moderate	70	2.5 (±1.2)
Severe	80	3.6 (±1.5)

Cariogram Analysis

The Cariogram model revealed distinct differences in caries risk profiles among the groups. The severe intellectual disability group had the highest mean caries risk score of 75% (±10), indicating a high risk, whereas the moderate and mild groups had mean scores of 65% (±12) and 55% (±15), respectively.

Intellectual Disability Level	Mean Cariogram Risk Score (%)
Mild	55 (±15)
Moderate	65 (±12)
Severe	75 (±10)

Risk Factor Analysis

Significant differences were observed in several caries risk factors, including dietary habits, plaque levels, and salivary parameters. Children with severe intellectual disabilities had higher plaque index scores and more frequent consumption of cariogenic foods.

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Intellectual Disability Level	Mean Plaque Index	Cariogenic Food Frequency Score (0-5)	Mean Salivary Flow Rate (mL/min)
Mild	1.5 (±0.6)	2.2 (±1.0)	0.8 (±0.2)
Moderate	2.0 (±0.7)	3.0 (±1.2)	0.6 (±0.3)
Severe	2.5 (±0.8)	4.0 (±1.1)	0.5 (±0.2)

The bacterial counts of *Streptococcus mutans* and *Lactobacilli* were also higher in the severe group, indicating a greater bacterial load contributing to caries risk.

Intellectual Disability Level	Mean *Streptococcus mutans* Count (CFU/mL)	Mean *Lactobacilli* Count (CFU/mL)
Mild	1.2 x 10^5 (±0.6)	1.0 x 10^4 (±0.5)
Moderate	1.8 x 10^5 (±0.7)	1.5 x 10^4 (±0.6)
Severe	2.5 x 10^5 (±0.8)	2.0 x 10^4 (±0.7)

These results highlight the increased caries risk and the importance of targeted preventive measures for children with severe intellectual disabilities.

Discussion

This study aimed to assess the caries risk profiles of children with varying levels of intellectual disability using the Cariogram model. The findings revealed a significant association between the severity of intellectual disability and the risk of dental caries. Children with severe intellectual disabilities exhibited the highest caries prevalence and risk scores, underscoring the need for targeted preventive strategies in this vulnerable population.

The higher caries prevalence and DMFT scores observed in children with severe intellectual disabilities are consistent with previous studies that have documented poor oral health outcomes in this group (1, 2). Factors such as impaired motor skills, difficulties in maintaining oral hygiene, and increased reliance on caregivers for daily care contribute to this heightened risk (3). Furthermore, the high cariogenic food consumption frequency in the severe group aligns with reports indicating that dietary habits play a crucial role in caries development among children with intellectual disabilities (4).

The Cariogram model proved to be a valuable tool for assessing caries risk in this study. By integrating multiple risk factors, including diet, bacterial load, and salivary parameters, the Cariogram provided a comprehensive overview of each child's caries risk profile (5). This multifactorial approach is essential, as it allows for the identification of specific risk factors that can be targeted through personalized preventive measures. For example, the elevated plaque index and bacterial counts of *Streptococcus mutans* and *Lactobacilli* in the severe group highlight the need for enhanced oral hygiene practices and antimicrobial interventions (6).

Significant differences in salivary flow rates were also observed among the groups, with lower rates in children with severe intellectual disabilities. Saliva plays a vital role in maintaining oral health by neutralizing acids and providing antimicrobial properties (7). Reduced salivary flow, as seen in the severe group, can exacerbate caries risk, emphasizing the importance of strategies to enhance salivary function, such as adequate hydration and the use of saliva-stimulating agents (8).

The study has several implications for dental care providers and policymakers. Dental professionals should be aware of the increased caries risk in children with severe intellectual disabilities and prioritize preventive care during dental visits. Tailored interventions, including dietary counseling, caregiver education, and regular dental check-ups, are crucial for mitigating caries risk in this population (9). Moreover, integrating oral health education into special education curricula and training caregivers can further enhance oral health outcomes for children with intellectual disabilities.

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Limitations and Future Research

Despite the strengths of this study, including the use of a well-established risk assessment model and a representative sample, several limitations should be acknowledged. The cross-sectional design precludes the establishment of causal relationships between risk factors and caries development. Longitudinal studies are needed to monitor changes in caries risk over time and evaluate the effectiveness of preventive interventions. Additionally, future research should explore the impact of socioeconomic factors and access to dental care on caries risk in children with intellectual disabilities.

Conclusion

In conclusion, this study highlights the increased caries risk in children with severe intellectual disabilities and underscores the importance of targeted preventive strategies. The Cariogram model offers a comprehensive approach to risk assessment, enabling the development of personalized care plans. By addressing the unique needs of this population, dental care providers can contribute to improving oral health and quality of life for children with intellectual disabilities.

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