



STRATIFIED ASSESSMENT OF DENTAL CARIES RISK FACTORS IN CHILDREN WITH DIFFERENT GRADES OF HEARING IMPAIRMENT

Peter Bakardjiev

Department of Pediatric Dentistry, Faculty of Dental Medicine, Medical University - Sofia, Bulgaria.

ABSTRACT

Introduction: Hearing impairments are often associated with communication difficulties, which can hinder effective health education and the implementation of programs for proper oral hygiene and dental disease prevention.

Aim: To assess the impact of oral hygiene, dietary patterns, and socioeconomic factors on dental caries prevalence in children with varying grades of hearing impairment

Materials and methods: The objects of the study were 58 children (7 to 10 years) – 21 healthy children without hearing impairment, 19 with mild and moderate hearing loss (they can't hear sounds below 20- 65 dB), 18 with severe and profound hearing loss (65 + dB). A comprehensive dental examination and professional oral hygiene were carried out on each child, during which the social status and eating habits were assessed through responses to a structured questionnaire administered in simple language and suitable formats. Data were collected and analyzed to identify the main factors influencing the prevalence of oral diseases in this special care need group.

Results: In the control group, 52.4% had a high socioeconomic status. In the mild to moderate hearing loss group, 84% had a medium status, and in the severe hearing loss group, 44.4% had a low status. Children with hearing impairments, particularly those with severe hearing loss, exhibit significantly higher DMF scores, with the severe hearing loss group and poor oral hygiene having a DMF of 8.31 ± 2.93 , compared to 5.29 ± 0.49 in the control group with poor hygiene. Children with frequent carbohydrate intake, reported by 67.7% of children with severe hearing loss, exhibit the highest mean DMF score (8.1), while those with limited intake, mostly from the control group (52.4%), show the lowest DMF score (2.4).

Conclusion: The results of this study emphasize the heightened oral health risks in children with hearing impairments, particularly those with severe hearing loss. Addressing socioeconomic, hygiene, and dietary factors through targeted interventions is essential for improving oral health outcomes in this vulnerable group.

Keywords: Socioeconomic status, oral health, hearing impairment,

INTRODUCTION

Dental caries remains one of the most common and widespread chronic diseases in childhood worldwide, and it is a significant health issue. The carious process as a disease continues throughout life, even after carious lesions have been influenced by preventive and therapeutic procedures. The socioeconomic status of the family, oral hygiene, lifestyle, eating habits, and risk behaviors can have a significant impact on the resistance to caries or the development of the carious process in children with disabilities [1, 2].

Children with hearing impairments are at an increased risk of developing dental caries due to various factors related to the specifics of their disability and their unique needs. Hearing impairments are often associated with communication difficulties, which can hinder effective health education and the implementation of programs for proper oral hygiene and dental disease prevention. Additionally, the families of children with hearing impairments may be of lower socioeconomic status, which affects their access to regular dental care and health prevention programs [3, 4].

Diet and lifestyle also play an important role in the development of caries. Children with hearing impairments may have eating habits that involve increased consumption of sugary foods and drinks, which raises the risk of developing carious lesions. The lack of early recognition and treatment of oral problems, as well as a reduced ability to follow oral hygiene recommendations, may also contribute to a higher incidence of caries [5, 6].

Oral hygiene in children with hearing impairments can be further complicated by communication barriers and limitations in their daily assistance with hygiene procedures [7]. They may often struggle to understand or follow instructions related to tooth brushing, leading to inadequate oral care. It is also possible that parents or caregivers may not be fully informed about the necessary methods for tooth cleaning and maintaining oral hygiene [8].

The study of the prevalence of dental caries and the

factors affecting oral health among children with hearing impairments is essential for developing effective prevention programs and reducing the risk of oral diseases [9]. The main priority of dental interventions is to facilitate the strategies relating to these major risk factors for oral diseases.

AIM

To assess the impact of oral hygiene, dietary patterns, and socioeconomic factors on dental caries prevalence in children with varying grades of hearing impairment.

MATERIAL AND METHODS

The objects of the study were 58 school aged children (7 to 10 years) with with varying degrees of hearing impairment. They were divided into four groups as follows: control group - 21 children with normal hearing, test group 1 - 19 with mild to moderate hearing loss (unable to hear sounds below 20–65 dB), 18 with severe and profound hearing loss (+ 65 dB). A comprehensive dental examination and professional oral hygiene were carried out on each child, during which the assessment of the social status, oral hygiene and eating habits were carried out true responses to a structured questionnaire administered in simple language and suitable formats (e.g., pictures or icons for younger children, multiple-choice questions). Data were collected and analyzed to identify the main factors influencing the prevalence of oral diseases in this special care need group.

The prevalence of dental caries was registered with the index DMF (T+t) of Klein, Palmer & Knutson (1938), considering the total number of the teeth that are carious (D), missing (M) due to caries or fillings (F) with an initial diagnostic threshold according to ICDAS II code 01, accountable the very early reversible carious lesions in

enamel. The assessment of caries lesions is made by all the rules of modern examination of caries of the teeth. The assessment of socioeconomic status included responses to a questionnaire regarding the education, employment, and profession of the parents, housing conditions, and the number of family members. Oral hygiene was assessed using Green Vermillion's simplified oral hygiene index. Values up to 0.66 were considered good, values between 0.67-1.66 were considered satisfactory, and above 1.67 were considered poor oral hygiene. The assessment of the children's dietary habits and socioeconomic status was conducted using a questionnaire-based method. Data were collected and analyzed based on responses to structured surveys completed by the participants and/or their guardians.

Statistical analysis - All statistical analyses have been carried out using SPSSr v.30.0 statistical software (IBM, Armonk, NY) - Frequency distribution for categorical responses, Chi-Square Test or Fisher's exact test to examine the association between socioeconomic status and prevalence of dental caries and carbohydrate intake and prevalence of dental caries. Differences have been considered statistically significant at the $p < 0.05$ level.

RESULTS

Oral health is determined by a range of social determinants mediated through individuals' interactions with their sociocultural environment. Socioeconomic status, in particular, has been consistently identified as a key risk factor for the development of dental caries. In the present study, data analysis was stratified according to the degree of hearing loss, enabling a comprehensive assessment of how social factors may differentially influence oral health outcomes across distinct levels of hearing impairment.

Fig. 1. Socioeconomic status and dental caries in children with varying degrees of hearing impairment

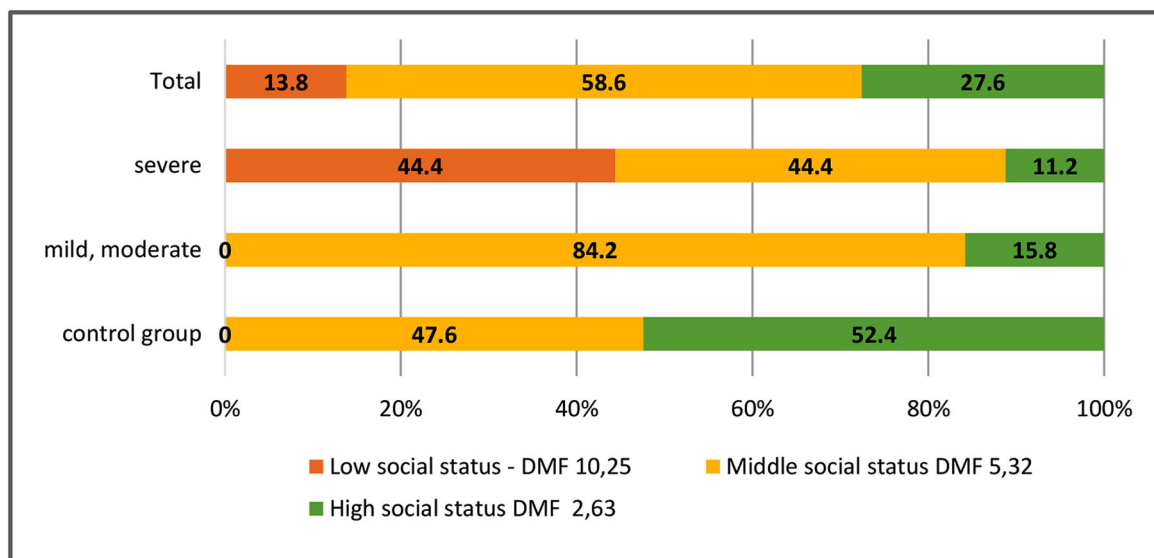


Figure presents the distribution of socio-economic status (SES) and dental caries in children with varying degrees of hearing loss. The control group, consisting of healthy children, is split between 47.6% from middle SES and 52.4% from high SES. Among children with mild to moderate hearing loss, 84,2% are from middle SES and 15,8% from high SES. In the severe hearing loss group, 44.4% are from low SES, 44.4% from middle SES, and 11.2% from high SES. The index values DMF shows a clear SES-related pattern in caries prevalence. Children from low SES exhibit the highest DMF index (10.25), followed by those from middle SES (5.32) and high SES (2.63), indicating a higher incidence of dental caries in lower socio-economic groups ($\chi^2 = 89,34$ $p < 0.01$).

These findings suggest that socio-economic status significantly influences dental health outcomes, with children from lower SES being more susceptible to dental caries. Additionally, a higher proportion of children with severe hearing loss come from lower SES, indicating potential disparities in access to healthcare. Targeted interventions focusing on children with severe hearing loss and those from lower socio-economic backgrounds may help reduce the incidence of dental caries and improve overall oral health outcomes.

Oral hygiene of studied children was assessed using the simplified oral hygiene index by Green Vermillion. The results are present on the following table.

Table 1. Oral hygiene and dental caries in children with varying degrees of hearing impairment

Hearing loss		Control group	Mild, Moderate	Severe	Total
OHI Green Vermillion	N	DMF Mean \pm SD	DMF Mean \pm SD	DMF Mean \pm SD	DMF Mean \pm SD
Good < 0.66	9	1,86 \pm 0,38	1,50 \pm 0,71	0	1,78 \pm 0,44
Unsatisfactory $\geq 0.67, < 1.67$	14	3,28 \pm 0,48	3,99 \pm 0,38	3,80 \pm 0,44	3,57 \pm 0,51
Poor ≥ 1.67	35	5,29 \pm 0,49	6,27 \pm 1,03	8,31 \pm 2,93	6,83 \pm 2,23
Ind T-test		$\chi^2_{1,2} = -6,12$ $p < 0.01$	$\chi^2_{1,2} = -5,10$ $p < 0.04$	no analyze	$\chi^2_{1,2} = -8,62$ $p < 0.01$
		$\chi^2_{1,3} = -14,69$ $p < 0.01$	$\chi^2_{1,3} = -6,24$ $p < 0.01$	no analyze	$\chi^2_{1,3} = -6,71$ $p < 0.01$
		$\chi^2_{2,3} = -7,67$ $p < 0.01$	$\chi^2_{2,3} = -3,18$ $p < 0.01$	$\chi^2_{2,3} = -3,37$ $p < 0.01$	$\chi^2_{2,3} = -5,38$ $p < 0.01$

Table 1 presents data on oral hygiene and dental caries in children with varying degrees of hearing impairment. In the control group, children with good oral hygiene (OHI < 0.66) show a mean DMF of 1.86 ± 0.38 , while those with unsatisfactory (OHI ≥ 0.67 and < 1.67) and poor oral hygiene (OHI ≥ 1.67) have significantly higher DMF scores, at 3.28 ± 0.48 and 5.29 ± 0.49 , respectively. Children with mild to moderate hearing loss show similar trends, with the highest DMF found in those with poor oral hygiene (6.27 ± 1.03). Those with good oral hygiene have a lower DMF of 1.50 ± 0.71 , indicating a better oral health status than the control group in this category. For children with severe hearing loss, the poor oral hygiene group has the highest DMF (8.31 ± 2.93), followed by those with unsatisfactory oral hygiene (3.80 ± 0.44). No cases of good oral hygiene are found in this group. These results indicate notably compromised oral health among children with severe hearing loss, particularly in those with poor oral hygiene. Statistical analysis reveals significant differences in DMF scores between groups, indicating that children with hearing impairment have poorer oral health than healthy peers. Children with hearing impair-

ments, particularly those with severe hearing loss, demonstrate worse oral hygiene and higher caries rates compared to healthy children. These findings emphasize the need for targeted dental interventions for children with hearing impairments to improve oral health outcomes.

The main factors that influence children regarding their oral health and behavior are the attitudes of parents towards oral health, their knowledge, and their health status. Since the family environment promotes healthy choice as a way of life, dental professionals must inform the parents about the impact of their behavior and attitudes on the oral health of their children. This information should include the benefits of oral health education programs and related oral health issues. The convictions and attitudes of parents are crucial in studies aimed at promoting oral health.

The assessment of the eating habits was carried out through responses to a structured questionnaire. Data were collected and analyzed to identify the main factors influencing the prevalence of oral diseases in this special care need group.

Fig. 2. Carbohydrate intake and in children with varying degrees of hearing impairment

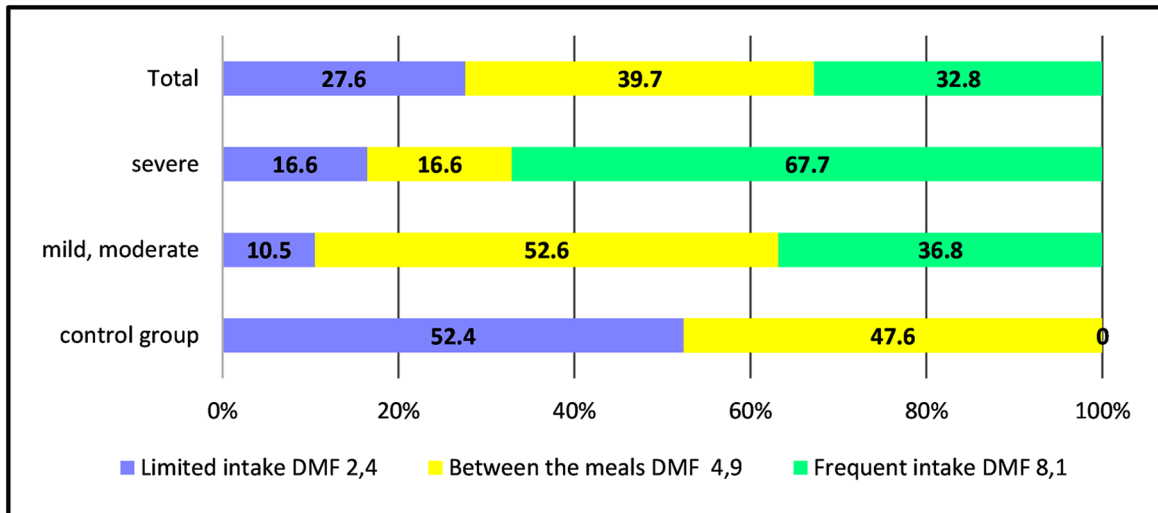


Figure 2 presents the relationship between the frequency of carbohydrate intake and the prevalence of dental caries in children with varying degrees of hearing impairment. The data reveal a clear association between higher intake frequency and increased caries experience, particularly among children with more severe hearing loss. Children with limited carbohydrate intake exhibit the lowest mean DMF score (2.4), with the majority belonging to the control group (52.4%), and significantly fewer from the mild to moderate (10.5%) or severe (16.6%) hearing loss groups. In contrast, intake between meals is most prevalent among children with mild to moderate hearing loss (52.6%) and is associated with a higher mean DMF of 4.9 ($\chi^2 = 86.24$, $p < 0.01$). The highest caries prevalence was observed in children with frequent carbohydrate intake—a pattern not present in the control group, but reported by 36.8% of children with mild to moderate and 67.7% with severe hearing loss intake ($\chi^2 = 27.6$, $p < 0.01$). This group shows the highest mean DMF score (8.1). Overall, the data suggest a strong positive correlation between carbohydrate intake frequency and dental caries, particularly in children with hearing impairments. The findings highlight the importance of targeted nutritional counseling and caries prevention strategies in this vulnerable population.

DISCUSSION

This study highlights several contributing factors to the poorer oral health observed in children with hearing impairments. Children with severe hearing loss were more frequently associated with lower socioeconomic status and showed significantly higher DMFT scores compared to their peers without hearing loss. Poor oral hygiene was also more common in these groups and closely linked to increased caries prevalence. Furthermore, frequent carbohydrate intake—completely absent in the control group—was particularly common among children

with hearing loss, especially those with severe impairment, and was associated with the highest levels of dental caries

The contemporary knowledge on the nature of dental caries as a multifactorial disease, which is not controlled and managed can arise and be developed at any age, individual, group or society requires the permanent to be applied prevention programs [10]. The age between 7 and 10 is one of the most important periods for the oral health of a child. This is the time during which the children learn the essential facts and rules for maintaining oral health. During this process, they need the help of their parents, teachers, and dentists to learn, reinforce, and apply their knowledge of dental caries prevention. To control it, a complex approach is required, including an evaluation of the risk of developing dental caries, dietary guidelines for so-called “Sugar-free” products, and professional clinical care by dentists [11, 12].

Although parents play the most important role in their children’s oral health, teachers must also be trained in this area [13]. The children spend a considerable time at schools and kindergartens where they can be trained in good healthy habits. The teachers could emphasize and reinforce the knowledge of the importance of the consumption of sweet food and drinks, the benefits of a healthy diet, good oral hygiene habits and visits to the dentist. Early oral health education and preventive measures will help reduce the need for treatment of oral diseases [14, 15].

The prevention and treatment of dental caries in children with hearing impairments require a multidisciplinary approach, which includes dental care, oral hygiene education, and family support [16]. Training and educating parents, as well as using adapted methods for tooth cleaning, can help improve oral hygiene in these children. Increased attention to these children and the creation of specialized prevention programs can reduce the risk of caries and improve their oral health [17].

The combined influence of social disadvantage, inadequate oral hygiene, and unhealthy dietary patterns places these children at increased risk for oral disease. These findings underscore the need for comprehensive, tailored preventive programs that integrate dental care, dietary counseling, and social support, with special attention to children with severe hearing impairment.

CONCLUSION

The results of this study emphasize the heightened oral health risks in children with hearing impairments, particularly those with severe hearing loss. Addressing socioeconomic, hygiene, and dietary factors through targeted interventions is essential for improving oral health outcomes in this vulnerable group.

REFERENCES:

1. Shetty V, Kumar J, Hegde A. Breaking the sound barrier: oral health education for children with hearing impairment. *Spec Care Dentist*. 2014 May-Jun;34(3):131-7. [PubMed]
2. Almajed OS, Aljouie AA, Alharbi MS, Alsulaimi LM. The Impact of Socioeconomic Factors on Pediatric Oral Health: A Review. *Cureus*. 2024 Feb 4;16(2):e53567. [PubMed]
3. Rajab LD, Da'as NM. Oral health status, behavior, and practices among hearing impaired children attending a specialized school in Jordan. *Spec Care Dentist*. 2024 Nov-Dec;44(6):1651-1660. [PubMed]
4. Manohar PS, Subramaniam P. Oral Health-related Quality of Life and Oral Hygiene of Children and Adolescents with Hearing Impairment. *Int J Clin Pediatr Dent*. 2022 May-Jun;15(3):311-315. [PubMed]
5. Alamri H. Oral Care for Children with Special Healthcare Needs in Dentistry: A Literature Review. *J Clin Med*. 2022 Sep 22;11(19):5557. [PubMed]
6. Mahboobi Z, Pakdaman A, Yazdani R, Azadbakht L, Montazeri A. Dietary free sugar and dental caries in children: A systematic review on longitudinal studies. *Health Promot Perspect*. 2021 Aug 18;11(3):271-280. [PubMed]
7. Moin M, Haider MM, Rizvi KF, Imtiaz R, Maqsood A, Altamash S et al. Enhancing Oral Hygiene in Children With Hearing Impairment: The Impact of Skit Video Interventions - A Randomized Controlled Trial. *Glob Pediatr Health*. 2024 Mar 24;11:2333794X241240302. [PubMed]
8. American Academy of Pediatric Dentistry. Management of dental patients with special health care needs. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2024:343-50.
9. Pareek S, Nagaraj A, Yousuf A, Ganta S, Atri M, Singh K. Effectiveness of supervised oral health maintenance in hearing impaired and mute children- A parallel randomized controlled trial. *J Int Soc Prev Community Dent*. 2015 May-Jun;5(3):176-82. [PubMed]
10. Ruff RR, Niederman R. School-Based Caries Prevention, Tooth Decay, and the Community Environment. *JDR Clin Trans Res*. 2018 Apr;3(2):180-187. [PubMed]
11. Ruff RR, Niederman R. Comparative effectiveness of school-based caries prevention: a prospective cohort study. *BMC Oral Health*. 2018 Mar 27;18(1):53. [PubMed]
12. Lee Y. Diagnosis and Prevention Strategies for Dental Caries. *J Lifestyle Med*. 2013 Sep;3(2):107-9. [PubMed]
13. de Castilho AR, Mialhe FL, Barbosa Tde S, Puppim-Rontani RM. Influence of family environment on children's oral health: a systematic review. *J Pediatr (Rio J)*. 2013 Mar-Apr;89(2):116-23. [PubMed]
14. Nakre PD, Harikiran AG. Effectiveness of oral health education programs: A systematic review. *J Int Soc Prev Community Dent*. 2013 Jul;3(2):103-15. [PubMed]
15. Bourgeois DM, Phantumvanit P, Llodra JC, Horn V, Carlile M, Eiselé JL. Rationale for the prevention of oral diseases in primary health care: an international collaborative study in oral health education. *Int Dent J*. 2014 Oct;64 Suppl 2(Suppl 2):1-11. [PubMed]
16. Champion J, Holt R. Dental care for children and young people who have a hearing impairment. *Br Dent J*. 2000 Aug 12;189(3):155-9. [PubMed]
17. Doichinova L, Peneva M. Motivational Training Programme for Oral Hygiene of Deaf Children. *Int J Sci Research (IJSR)*. 2015 Feb;4(2):1124-1126. [Internet]

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Address for correspondence:

Peter Bakardjiev,
Department of Pediatric Dentistry, Faculty of dental medicine, Medical University - Sofia;
1, Georgi Sofiisky Str., Sofia, Bulgaria.
E-mail: bucki_tuz@yahoo.com,