Association of Dental Caries and Sugar Consumption in Children Aged 5-12 Visiting Hospital in District Peshawar

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Abstract

Background and Objectives: Dental caries, a prevalent chronic disease, significantly affects children worldwide, leading to discomfort and impacting their quality of life. This study attempts to look at the link children's dental cavities and sugar intake aged 5-12 years visiting a hospital in the Peshawar district, Pakistan.

Methodology: This observational cross-sectional study included 200 children from the dental outpatient department of a major hospital in Peshawar. Clinical examinations assessed dental caries using standardized WHO diagnostic criteria. Data on sugar consumption and other variables were collected through dietary surveys and structured questionnaires. Statistical analysis was performed to look at the association between sugar intake and dental caries, controlling for potential confounding factors.

Results: The study found a high prevalence of dental caries (68%) among the participants, with an average daily sugar intake of 50 grams, significantly higher than WHO recommendations. There was a notable positive association found between the severity of dental caries and sugar consumption ($p < 0.001$). An increased incidence of dental caries was shown to be independently correlated with higher sugar consumption (OR = 2.5, 95% CI: 1.8-3.4).

Conclusion: The findings highlight the critical role of dietary sugars in initiating dental caries among children in Peshawar. Public health interventions are urgently needed to reduce sugar intake, promote better oral hygiene practices, and improve access to preventive dental care services. These measures are essential for lowering the burden of dental caries and improving the overall well-being of children in the region.

Keywords: Dental caries, sugar consumption, oral health, public health intervention, dietary habits.

Introduction

Dental caries or tooth decay is one of the most prevalent chronic diseases affecting children across the globe. This condition, characterized by the progressive demineralization and destruction of the tooth's hard tissues, occurs due to the acidic byproducts produced by bacterial fermentation of dietary carbohydrates, particularly sugars. The process begins when oral bacteria, primarily Streptococcus mutans and Lactobacillus species, metabolize sugars from food and drink, producing acids as a metabolic byproduct. These acids dissolve the minerals in the tooth enamel and dentin, leading to demineralization and, eventually, the formation of cavities if the procedure is not halted or reversed by natural remineralization processes or dental interventions.[1]

The burden of dental caries is substantial, not only because of its high prevalence but also due to its significant influence on children's quality of life. Dental caries can cause pain, discomfort, and infection, which may lead to difficulties in eating, speaking, and concentrating in school, thereby affecting overall growth and development. In severe cases, untreated dental caries can lead to tooth loss and more severe infections that can spread to other parts of the body[2].

One of the critical risk factors for the initiation of dental caries is the intake of dietary sugars. Sugars are a major component of many foods and beverages consumed by children, and their intake has increased significantly over the past few decades. The World Health Organization (WHO) recommends consuming less than 10% of overall calories from free sugars, with a further decrease to less than 5% offering even more health advantages[3]. Despite these recommendations, many children consume far more than the advised amounts, primarily through sugary snacks, desserts, and sugar-sweetened beverages.

Several studies have stressed the strong connotation between sugar intake and the incidence of dental caries.

For instance, research has shown that children who frequently consume sugary snacks and drinks have a higher prevalence of dental caries compared to those with lower sugar intakes[4]. The type of sugar consumed, the frequency of intake, and the duration of sugar exposure are all crucial factors influencing the development of caries. Regular consumption of sugar leads to prolonged periods of low pH in the oral cavity, providing a conducive condition for cariogenic bacteria to thrive and produce acids that demineralize tooth enamel.

The high prevalence of dental caries among children, coupled with increasing sugar consumption, underscores the need for effective preventive strategies. Public health interventions focusing on reducing sugar intake, improving oral hygiene practices, and increasing access to fluoride treatments are essential components of comprehensive caries prevention programs[5].

The district of Peshawar, located in the Khyber Pakhtunkhwa province of Pakistan, faces substantial public health challenges, such as a high burden of dental diseases among children. Limited access to dental care services, low awareness about oral health, and dietary habits that include high sugar consumption contribute to the problem. Despite the known link between sugar intake and dental caries, there is lack of localized data that specifically examines this association in the context of Peshawar.

This study aims to fill this gap by investigating the relationship between dental caries and sugar consumption in children aged 5-12 years visiting a hospital in the Peshawar district. Understanding this association is crucial for several reasons. Firstly, it will provide evidence-based data to support public health initiatives aimed at decreasing the incidence of dental caries through dietary modifications. Secondly, it will help in designing targeted interventions and educational programs to raise perception about the importance of oral health and the risks associated with excessive sugar consumption. Lastly, the findings of this study can inform policymakers and healthcare providers about the need for improved access to preventive dental care services in the region.

By addressing these issues, this research seeks to contribute to the broader efforts of improving oral health outcomes for children in Peshawar and similar settings. The ultimate goal is to reduce the burden of dental caries and promote healthier dietary and oral hygiene practices among children, thereby enhancing their overall well-being and quality of life.

Methodology

This observational, cross-sectional study was designed to investigate the correlation between sugar intake and dental caries in children aged 5-12 years visiting a hospital in the Peshawar district. A cross-sectional design was chosen to capture a snapshot of the relationship between dietary habits and dental health within the defined age group at certain point in time. This approach allows for the data collection from a diverse sample of children, providing insights into the prevalence of dental caries and patterns of sugar consumption within the study population.

The study population consisted of children aged 5-12 years who visited the dental outpatient department of a major hospital in the Peshawar district. The inclusion criteria for participants were:
Age between 5 and 12 years.
Consent from parents or guardians to take part in the study.
No history of chronic systemic diseases that could affect dental health or dietary habits.
A sample size of 200 children was determined to be adequate for the study, based on power calculations to detect significant associations between sugar consumption and dental caries. The sample was selected using a convenience sampling method, where children meeting the inclusion criteria and visiting the hospital during the study period were invited to participate. Data collection was conducted over a period of three months. Written informed consents were obtained from the parents or guardians of all participating children. The privacy and confidentiality of the participants was maintained throughout the study period, and all the data was anonymized before analysis. The following methods were used to gather data on dental caries and sugar consumption:
Trained dentists performed clinical examinations to assess the presence and severity of dental caries in the participating children. The examinations were conducted using standardized diagnostic criteria recommended by the World Health Organization (WHO) for oral health surveys. The criteria included:
"Decayed, Missing, and Filled Teeth" (DMFT) index for permanent teeth.
"Decayed, Missing, and Filled Surfaces" (DMFS) index for permanent teeth.
"Decayed, Missing, and Filled Teeth" (dmft) index for primary teeth.
"Decayed, Missing, and Filled Surfaces" (dmfs) index for primary teeth.
The severity of dental caries was categorized as:
Mild: Caries affecting enamel only.
Moderate: Caries extending into the dentin.
Severe: Caries involving the pulp or causing abscesses.
Information on sugar consumption was collected through a dietary survey completed by the parents or guardians of the participants. The survey was designed to capture detailed information about the children's dietary habits, including:
Frequency and quantity of sugary foods and beverages consumed (e.g., candies, chocolates, soft drinks, sweetened juices).
Types of meals and snacks typically consumed.
Average daily sugar intake was estimated in grams.
The dietary survey was adapted from validated food frequency questionnaires (FFQs) used in previous nutritional studies. Parents and guardians were provided with instructions and examples to ensure accurate reporting of their children's dietary intake.
A semi-structured questionnaire was administered to collect additional data on potential confounding factors, including:
Demographic information (age, gender, socioeconomic status).
Oral hygiene habits (frequency of tooth brushing, use of fluoride toothpaste, dental visits).
Parental education and awareness about dental health and nutrition.

The questionnaire was reviewed by experts in pediatric dentistry and nutrition to ensure its validity and reliability. The data was analyzed by using statistical software (e.g., SPSS, Stata). The following steps were taken to analyze the data:

The frequency of dental caries, patterns of sugar consumption, and the demographics of the study population were all summarized using descriptive statistics. For continuous variables, calculations were made using measures of central tendency (mean, median) and dispersion (standard deviation, range) while for categorical variables, frequencies and percentages were utilized.

Bivariate analysis was performed to examine the association between sugar consumption and the prevalence of dental caries. Chi-square tests were used for categorical variables, while t-tests and ANOVA were used for continuous variables to compare groups with different levels of sugar intake.

Multivariate logistic regression analysis was conducted to control for potential confounding factors and to determine the independent effect of sugar consumption on the risk of dental caries. The dependent variable was the presence of dental caries (yes/no), and the independent variables included:

Daily sugar intake (grams).
Frequency of sugary food and beverage consumption.
Demographic factors (age, gender, socioeconomic status).
Oral hygiene practices.

Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to quantify the strength of the association between sugar consumption and dental caries.

Sensitivity analyses were conducted to evaluate the robustness of the findings. This included repeating the analysis with diverse categorizations of sugar intake and dental caries severity and excluding participants with incomplete data. The

Results

The study comprised of 200 children aged 5-12 years, with an equal distribution of boys (50%) and girls (50%). The mean age of the participants was 8.5 years (SD = 2.1). Most children (65%) were from middle-income families, while the remaining 35% were from low-income families. Parental education levels varied, with 40% of parents having completed primary education, 35% having completed secondary education, and 25% having higher education degrees.

Prevalence of Dental Caries
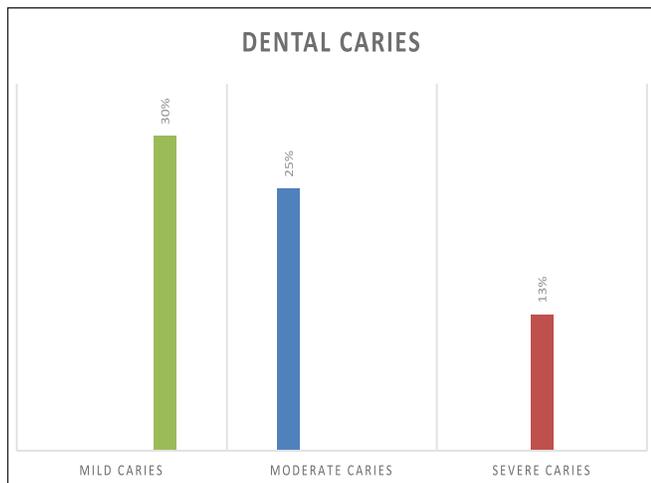
inclusive prevalence of dental caries among the participants was 68%. The mean DMFT (Decayed, Missing, and Filled Teeth) score for permanent teeth was 2.3 (SD = 1.5), and the mean dmft (decayed, missing, and filled teeth) score for primary teeth was 3.1 (SD = 1.8).

Sugar Consumption Patterns

Data from the dietary surveys revealed that 80% of the children consumed sugary foods and beverages daily. The most common sources of sugar included:

Candies and chocolates (45%).
Soft drinks (30%).
Sweetened juices (15%).
Pastries and cakes (10%).
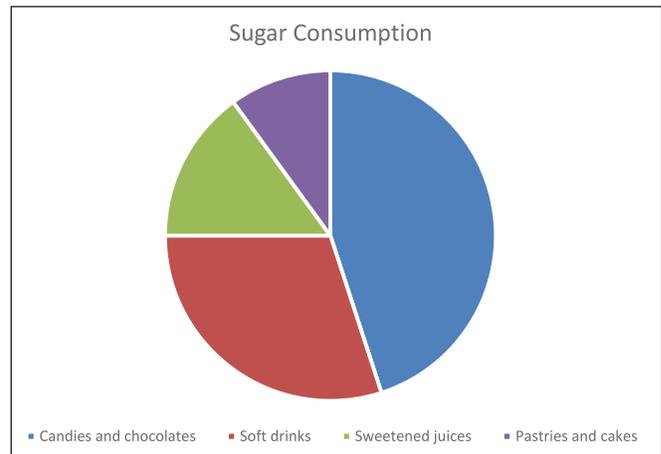
The average daily sugar intake was 50 grams (SD = 20 grams), significantly higher than the recommended levels. The frequency of sugar consumption was highest among children aged 8-10 years.

Association Analysis

Bivariate analysis showed a significant positive correlation between sugar consumption and the prevalence of dental caries ($p < 0.001$). Children with higher sugar intake had a higher incidence of dental caries:

Mild caries was most common among children consuming 40-60 grams of sugar daily.
Moderate caries was prevalent in children with daily sugar intake of 60-80 grams.
Severe caries was observed primarily in children consuming more than 80 grams of sugar daily.

Multivariate logistic regression analysis confirmed that higher sugar consumption was independently associated with an increased risk of dental caries. After adjusting for age, gender, socioeconomic status, and oral hygiene practices, the odds ratio (OR) for developing dental caries was 2.5 (95% CI: 1.8-3.4) for children consuming more than 50 grams of sugar daily compared to those consuming less than 30 grams.

Sensitivity analyses, including different categorizations of sugar intake and caries severity, consistently supported the main findings, indicating robust results.

Discussion

The study findings confirm a strong association between sugar consumption and dental caries in children aged 5-12 years in the Peshawar district. The high prevalence of dental caries (68%) observed in this study aligns with global trends and highlights the significant burden of this preventable condition among children. A systematic review and meta-analysis revealed the global prevalence of early childhood caries (ECC), with sugar consumption being a major factor. The study reported the highest ECC prevalence in the Philippines (98%) and lower rates in countries like Japan and Greece (around 20%). This study emphasizes the global burden of dental caries and the need for preventive measures.[16]

The average daily sugar intake of 50 grams, significantly above the WHO recommended levels, underscores the critical role of dietary sugars in the etiology of dental caries. The data indicate that as sugar intake increases, the severity of dental caries also escalates, with severe caries most prevalent among children consuming more than 80 grams of sugar daily. Research shows a direct link between free sugar intake and an increased risk of dental caries in children. The association is consistent across various regions and age groups, highlighting the importance of reducing sugar consumption and promoting oral hygiene.[17]

The findings of this study have several important public health implications. Firstly, there is a clear need for targeted interventions to reduce sugar consumption among children in the Peshawar district. Public health campaigns should focus on educating parents and children about the risks associated with high sugar intake and promoting healthier dietary choices. These findings align with the global trends observed in your study and underscore the importance of addressing dietary habits to prevent dental caries in children.[18]

Secondly, the study underscores the importance of implementing school-based oral health education programs. Schools can play a vital role in promoting good oral hygiene practices and reducing the availability of sugary snacks and beverages. Incorporating oral health education into the school curriculum can help instill healthy habits from a young age.

Thirdly, the high prevalence of dental caries highlights the need for improved access to preventive dental care services. Regular dental check-ups, fluoride treatments, and dental sealants can significantly reduce the incidence of dental caries.

Policymakers and healthcare providers should work towards ensuring that these services are accessible and affordable for all children.

Limitations of the Study

While this study provides valuable insights, there are several limitations to consider. It is more difficult to prove a link between sugar intake and dental caries when a cross-sectional design is used. In order to verify the causal association and investigate the long-term impacts of dietary sugars on oral health, longitudinal research are required.

The reliance on self-reported dietary data may introduce recall bias, as parents and guardians might not accurately recall or report their children's sugar intake. Future studies could benefit from using more objective measures of dietary intake, such as food diaries or direct observation.

Additionally, the study was conducted in a single hospital in the Peshawar district, which may limit the generalizability of the findings to other regions. Further research involving multiple sites and diverse populations is necessary to validate the results.

Recommendations

Based on the study findings, several recommendations can be made:
1. **Public Health Education:** Implement comprehensive public health campaigns to educate parents and children about the risks of high sugar consumption and the importance of good oral hygiene practices.
2. **School-Based Programs**: Introduce oral health education programs in schools and limit the availability of sugary snacks and beverages within school premises.
3. **Access to Preventive Care:** Improve access to preventive dental care services, including regular check-ups, fluoride treatments, and dental sealants, particularly for low-income families.
4. **Policy Interventions:** Advocate for policies that reduce sugar content in commercially available foods and beverages and promote healthier alternatives.
5. **Further Research**: Conduct longitudinal studies to establish causality and explore the long-term effects of sugar consumption on dental health. Expand research to include diverse populations and settings to enhance the generalizability of findings.

References

1. Fejerskov O. Changing paradigms in concepts on dental caries: consequences for oral health care. Caries Res. 2004;38(3):182-91.

2. Moynihan PJ, Kelly SAM. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. J Dent Res. 2014;93(1):8-18.

3. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. Bull World Health Organ. 2005;83(9):661-9.

4. Sheiham A, James WPT. A new understanding of the relationship between sugars, dental caries and fluoride use: implications for limits on sugars consumption. Public Health Nutr. 2015;17(10):2176-84.

5. World Health Organization. Guideline: sugars intake for adults and children. Geneva: World Health Organization; 2015.

6. Alm A, Wendt LK, Koch G, Birkhed D. Oral hygiene and parent-related factors during early childhood in relation to approximal caries at 15 years of age. Caries Res. 2008;42(1):28-36.

7. Burt BA, Pai S. Sugar consumption and caries risk: a systematic review. J Dent Educ. 2001;65(10):1017-23.

8. Ismail AI, Tanzer JM. Current trends of sugar consumption in developing societies. Community Dent Oral Epidemiol. 2009;27(4):301-7.

9. Rugg-Gunn AJ. Dental caries: Strategies to control this preventable disease. Acta Med Acad. 2013;42(2):117-30.

10. Van Loveren C. Sugar restriction for caries prevention: amount and frequency. Which is more important? Caries Res. 2013;47(1 Suppl 1):69-77.

11. Lim S, Sohn W, Burt BA, Sandretto AM. Cariogenicity of soft drinks, milk and fruit juice in low-income African-American children: a longitudinal study. J Am Dent Assoc. 2008;139(7):959-67.

12. Sheiham A. Dietary effects on dental diseases. Public Health Nutr. 2001;4(2b):569-91.

13. Nakayama Y, Mori M, Noda T, Shibuya T. Association between dietary habits and dental caries in preschool children: a longitudinal study. Community Dent Health. 2010;27(4):211-5.

14. Marshall TA, Eichenberger Gilmore JM, Broffitt B, Stumbo PJ, Levy SM. Diet quality in young children is influenced by beverage consumption. J Am Coll Nutr. 2005;24(1):65-75.

15. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr. 2004;7(1A):201-26.

16. Boustedt K, Roswall J, Twetman S. Free sugars and early childhood caries development: a prospective cohort study. European Archives of Paediatric Dentistry. 2022 Oct;23(5):829-33.

17. Chi DL, Hopkins S, O'Brien D, Mancl L, Orr E, Lenaker D. Association between added sugar intake and dental caries in Yup'ik children using a novel hair biomarker. BMC oral health. 2015 Dec;15:1-8.

18. Rodrigues CS, Watt RG, Sheiham A. Effects of dietary guidelines on sugar intake and dental caries in 3-year-olds attending nurseries in Brazil. Health Promotion International. 1999 Dec 1;14(4):329-35.

How to cite this article?

How to cite this article: Shaukat HS, Zarafshan, Syed S, Association of Dental Caries and Sugar Consumption in Children Aged 5-12 Visiting Hospital in District Peshawar. J Rehman Coll Dent 2024; 5(1): 26-30

Author Contributions

1. Hafiza Summyya Shaukat – Conceptualization, data collection and data interpretation
2. Zarafshan - Methodology of study and Manuscript writing
3. Saira Syed - Literature review, Manuscript review and Data Analysis