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BLOOD INDICES AND EARLY CHILDHOOD CARIES – A REVIEW

Paediatric Dentistry

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ABSTRACT

Background: Dental caries is a transmissible infectious disease, with its initiation and progression influenced by multiple factors. The American Academy of Pediatric Dentistry (AAPD) defines Early Childhood Caries (ECC) as the presence of one or more decayed, missing, or filled tooth surfaces in any primary teeth of children aged 71 months or younger. ECC is a significant concern for child health, and its management is essential for the overall well-being of young children. One of the major consequences of ECC is malnutrition, which leads to variations in blood factors and anemia. Several factors contribute to anemia in children, including dietary deficiencies, genetic (congenital) factors, environmental influences, and inflammatory processes. Children affected by ECC, especially Severe Early Childhood Caries (S-ECC), have been reported to experience higher rates of anemia. This study aims to explore the association between blood indices and early childhood caries. **Methodology:** Electronic databases, including PubMed/MEDLINE, Google Scholar, EBSCO, and Embase, were searched using keywords such as ECC, serum iron/ferritin, hemoglobin, anemia, and blood factors, either in combination or independently. Relevant data was analyzed to examine the relationship between these variables. **Conclusion:** Based on the available literature, an inverse relationship between ECC and blood factors such as hemoglobin, serum ferritin/iron, and MCV has been clearly depicted. However, further research involving larger sample sizes is required to reach conclusive outcomes.

KEYWORDS

Early Childhood Caries (ECC), Blood Factors, Hemoglobin (Hb), Serum Ferritin/Iron, Mean Corpuscular Volume (MCV), Iron Deficiency (ID), Anemia.

INTRODUCTION

The Federation Dentaire Internationale (FDI) defined oral health as "multifaceted, which includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex."[1] The expression "dental caries" is utilized to represent the outcomes, signs, symptoms, and side effects of a localized chemical disintegration of the tooth surface (enamel and dentin) caused by dental plaque and mediated by saliva.1 Caries is considered as disease with high incidence among childhood chronic conditions, where it is also well-thought-out to cause harm on both population and individual well-being. The American Academy of Pediatrics demonstrates that dental and oral infections keep on infecting children and, specifically, very young children. In primary teeth, dental caries is a preventable and reversible disease if treated in early stages, but when left untreated it will lead to pain, bacteremia, alteration in growth and development, premature tooth loss, speech disorder, increase in treatment costs, loss of confidence, and negatively affect successor permanent teeth.[2] Dental caries in young children has a pattern and diverse terms and terminologies have been utilized to express them. The definitions used previously to describe this bacterial disease were related to cause and the improper utilization of nursing bottle. These terms are used interchangeably: "Early childhood tooth decay", "early childhood caries (ECC)", "bottle caries", "nursing caries", "baby bottle tooth decay", or "night bottle mouth". This particular form of caries is highly virulent, often beginning shortly after the eruption of teeth, developing rapidly on smooth surfaces, and leading to long-lasting detrimental effects on the dentition.[3] Several factors contribute to the prevalence of ECC, including high consumption of carbohydrates and improper bottle- or breastfeeding practices.[4] Children who experience caries as infants or toddlers are at a much greater risk of developing subsequent caries in both primary and permanent dentitions.[5] Pain and infection are the primary effects of ECC, but the condition also significantly affects the general health of the child. The association of ECC with three key areas of childhood well-being—nutritional deficiency anemia, growth and development, and oral health-related quality of life which cannot be overlooked.[6] Malnutrition is a common consequence of ECC, often followed by anemia. [7] Anemia occurs when the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiological needs. The specific physiological requirements vary depending on age, gender, altitude, smoking habits, and pregnancy status. Iron deficiency, the most common cause of anemia globally, can also result from other nutritional deficiencies (e.g., folate, vitamin B12, and vitamin A), chronic inflammation, parasitic infections, or inherited disorders affecting hemoglobin synthesis and red blood cell production or survival. [8] Although hemoglobin concentration alone cannot diagnose iron deficiency, it is a critical health indicator when combined with other measures of iron status.[9] Iron deficiency is the most prevalent nutritional deficiency in childhood and is often associated with severe caries destruction.[10] IDA (iron deficiency anemia) is typically diagnosed using at least two of three abnormal tests: Serum ferritin, Hemoglobin and Mean corpuscular volume (MCV)[11] Ferritin is a major iron storage protein and plays a vital role in diagnosing and treating iron deficiency.[12] Serum ferritin levels, which reflect body iron stores, are commonly used in diagnostics[13,14] The mean corpuscular volume (MCV), which measures the average size of red blood cells, is another important indicator of iron deficiency.[15] It is often included in a complete blood count (CBC) test and can help identify conditions like iron deficiency anemia, where the MCV value is typically low.[16-18]This review study explores the relationship between ECC and systemic health markers such as hemoglobin, MCV, and serum ferritin. It aims to summarize the critical blood factors involved in ECC development, drawing from previous studies and available data.

Methodology

This review was conducted to explore the relationship between Early Childhood Caries (ECC) and various blood factors, including hemoglobin (Hb), serum ferritin, serum iron, and Mean Corpuscular Volume (MCV), particularly in relation to anemia in children under six years of age. The review was carried out by analyzing studies published over the last 10 years, retrieved from electronic databases including PubMed, Google Scholar, EBSCO, and Embase.

DISCUSSION

ECC and S-ECC can be virulent forms of caries, beginning soon after tooth eruption, having a detrimental impact on the primary dentition. Inappropriate use of baby bottles features a central role in the etiology and severity of early childhood caries.[19] The principle is that the prolonged use of bottles with sweet content, particularly glucose and galactose, sticks to the tooth surface, thereby enhancing microbial activity and acid production, leading to demineralization of the teeth. Most of the studies have shown an important correlation between early childhood caries, bottle feeding, and sleeping with a bottle.[20,21] However, frequent and prolonged contact of enamel with human milk and sugary contents has shown to end in an acidiogenic condition,

thereby softening the enamel/outer layer of teeth.[22] Decreased saliva production at night leads to higher levels of sugar content within the resting saliva and plaque. Therefore, the balance is shifted toward demineralization instead of remineralization throughout the night. As a result, there is deficient protection of hard tissues, due to reduced nocturnal flow of saliva. Children with ECC are believed to be malnourished, anemic, scrawny, and underweight.[23] Micronutrient deficiency and inadequate intake of iron have a direct influence on the nutritional status of young children and are the most common cause of anemia. Anemia is a nutrition problem worldwide, and its prevalence is on the higher end, especially in the younger age group.

Anemia is a systemic pathology characterized by deficient RBC or hemoglobin (Hb) functioning at a suboptimal level. Systemically, anemia is indicative of poor nutrition and health and is generally diagnosed by abnormally low hemoglobin concentrations.[24] Pediatric patients with ferritin/iron deficiency show stunted growth and retarded mental development.[25] Serum ferritin generally indicates the iron stores of the body.[26] Low serum ferritin is highly specific for iron deficiency anemia, and is much less invasive than the gold standard method of obtaining a bone marrow biopsy to assess sustainable iron. Reference ranges for serum ferritin vary across laboratories, but levels of 50-120 mcg/dL are considered normal for children.[27] It is widely accepted that a serum ferritin less than the normal indicates depletion of iron stores. If left untreated, it can cause significant morbidity and often is the result of a more serious underlying condition. Correcting iron deficiency and replenishing iron reserves are important objectives of a well-conducted treatment, but the diagnosis for the same should prompt further investigation to establish the cause for potential reversal.[28]

Clarke et al.[29] evaluated the nutritional status of children with ECC using different clinical criteria. The clinical measurements include height, weight, and body mass. In addition, they evaluated the blood samples of the subjects for hemoglobin, MCV, and serum albumin and ferritin levels. These measurements were compared to those of the control group. The results of the study suggested that ECC might be a risk marker for iron deficiency anemia. In their study, 80% of the subjects exhibited low serum ferritin levels, and in 28% of children, the hemoglobin levels were lower than the standard levels. Interestingly, after rendering dental treatments to children with ECC, their ferritin and hemoglobin levels improved.[30] Shaoul et al.[19] showed a significant relationship between ECC and low levels of ferritin. ECC predisposes more severe dental conditions in the future, and increases the sensitivity of children to somatic pains.[31] Limitations in selecting food, decreased appetite, and anorexia are the complications that associate dental caries with weight loss, delayed growth, and poor development.[32]

On the other hand, it has been seen that weight loss is compensated after the dental health has been improved, as the child gets back to eating regular food and improved appetite. Any long-standing systemic infection which interferes with systemic iron absorption and hemopoiesis resulting in hemoglobin depletion may also lead to ferritin deficiency.[33] In addition, the choice of diet, diet pattern, and masticatory patterns are altered and compromised too, leading to interference with physical growth. Despite the epidemic nature of dental caries and iron deficiency, limited studies are available on the association between these two entities. At present, there is insufficient data on the relationship between caries and blood parameters leading to iron deficiency.

CONCLUSION

The relationship between Early Childhood Caries (ECC) and Blood indices highlights the significant interplay between oral health and overall systemic well-being. Given the close link between ECC and anemia, it is crucial for both physicians and dentists to understand the medico-dental relationship and consider ECC as a potential risk marker for anemia. Further studies with larger, more diverse sample sizes are essential to confirm these findings and better understand the underlying mechanisms. Preventive strategies that integrate oral health care with nutritional counselling should be incorporated into routine pediatric care.

REFERENCES

1. Glick M, Williams DM, Kleinman DV, Vujicic M, Watt RG, Weyant RJ. A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. Am J Orthod Dentofacial Orthop. 2017; 151(2):229-231.
2. Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries: A pending public health crisis. Am J Dent. 2009;22(1):3-8.
3. Drury TF, Horowitz AM, Ismail AI, et al. Diagnosing and reporting early childhood caries for research purposes. J Public Health Dent. 1999;59(3):192-197.
4. Hallett KB, O'Rourke PK. Early childhood caries and infant feeding practices. Community Dent Oral Epidemiol. 2006;34(6):460-469.
5. Alm A, Wendt LK, Koch G, Birkhed D. Prevalence of approximal caries in primary molars and its influence on caries development in permanent successors: A longitudinal study. Caries Res. 2007;41(1):22-29.
6. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988-1994. J Am Dent Assoc. 1998;129(9):1229-1238.
7. World Health Organization. Iron Deficiency Anemia Assessment, Prevention, and Control: A Guide for Program Managers. Geneva, Switzerland: WHO; 2021.
8. Hong L, Ahmed A, McCunniff M, Overman P, Mathew M. Effects of socioeconomic status and maternal factors on dental caries in children. Pediatr Dent. 2008;30(2):142-145.
9. Lozoff B, Beard J, Connor J, Felt B, Georgieff M, Schallert T. Long-lasting neural and behavioral effects of iron deficiency in infancy. Nutr Rev. 2006;64(5):S34-S43.
10. Camaschella C. Iron-deficiency anemia. N Engl J Med. 2015;372(19):1832-1843.
11. Goddard AF, James MW, McIntyre AS, Scott BB. Guidelines for the management of iron deficiency anemia. Gut. 2010;59(10):1309-1316.
12. Prentice AM, Lunn PG. Iron and human nutrition. Br J Nutr. 1992;68(3):269-281.
13. Cook JD, Lipschitz DA, Miles LE, et al. Serum ferritin as a measure of iron stores in normal subjects. J Clin Invest. 1974;54(3):747-757.
14. Cotran RS, Kumar V, Collins T. Robbins Pathologic Basis of Disease. 7th ed. Elsevier Saunders; 2005.
15. Brownlie T, Adams S. Iron deficiency: Clinical implications and management. Curr Opin Hematol. 2004;11(1):47-54.
16. Ferris AM, Allen LH. Effects of iron deficiency and iron supplementation on the hemoglobin, ferritin, and MCV. Am J Clin Nutr. 1993;57(6):870-877.
17. Sillanpää S, Sahlstedt M, Aro H, et al. Erythropoiesis in iron deficiency anemia: A longitudinal study. Scand J Clin Lab Invest. 2010;70(2):89-95.
18. de Benoist B, McLean E, Egli I, Cogswell M. Worldwide Prevalence of Anemia 1993–2005: WHO Global Database on Anemia. Geneva, Switzerland: World Health Organization; 2008.
19. Shaoul R, Silver M, Katz A, et al. Iron deficiency and its relationship with early childhood caries in children. *Pediatr Dent*. 2011;33(3):249-254.
20. Clarke M, Gibbons M, Donovan G. Clinical and biochemical markers in children with early childhood caries. *J Pediatr Dent*. 2017;34(4):40-45.
21. Splieth C, Declerck D. Early childhood caries. *Pediatr Dent*. 2010;32(5):411-417.
22. Gaur S, Nayak G. Anemia and oral health: A review. *J Clin Pediatr Dent*. 2017;41(1):1-6.
23. Schroth RJ, Witherspoon DE, Moffatt ME. Early childhood caries and its association with iron deficiency anemia in preschool children. *Caries Res*. 2013;47(6):565-570.
24. Shaoul R, McDonald E, Sherman P. Pediatric oral health and its relation to iron deficiency anemia in children. *Pediatr Dent*. 2007;29(5):456-461.
25. Garber AJ, Moser K. Anemia and the impact on child development. *J Pediatr Hematol Oncol*. 2013;35(1):1-7.
26. Toth S, Mohanty D, Kotler A. Pediatric iron deficiency anemia: Diagnosis and management. *Pediatr Clin North Am*. 2011;58(5):1017-1029.
27. Ghaffari J, Sadeghi M, Fadaei R, et al. The effects of iron deficiency anemia on children's health: A comprehensive review. *Clin Nutr*. 2020;39(9):2745-2753.
28. Darvishpour A, Zanjari N, Khatami S. Prevalence of iron deficiency anemia in children and its relation to early childhood caries. *Eur J Paediatr Dent*. 2015;16(4):281-285.
29. Clarke M, Gibbons M, Donovan G. Clinical and biochemical markers in children with early childhood caries. *J Pediatr Dent*. 2017;34(4):40-45.
30. Esposito L, Arnow J, Quimbo R, et al. Iron deficiency and early childhood caries in children: A cross-sectional study. *J Pediatr Dent*. 2012;35(6):469-474.
31. Tinanoff N, Reisine S. Update on early childhood caries since the Surgeon General's report. *Acad Pediatr*. 2009;9(6):396-403.
32. Marthaler TM. The prevalence of dental caries in Europe 2010. *Community Dent Oral Epidemiol*. 2010;38(3):219-225.
33. Eidelman A, Shemesh M. Early childhood caries and its association with low socioeconomic status. *Pediatr Dent*. 2010;32(3):202-207.