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Prevalence of Iron Deficiency Anemia in Children with Severe Early Childhood Caries

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Dental caries is an international public health challenge, especially amongst young children. Early childhood caries (ECC) is a serious public health problem in both developing and industrialised countries. ECC can begin early in life, progresses rapidly in those who are at high risk, and often goes untreated. Its consequences can affect the immediate and long-term quality of life of the child's family and can have significant social and economic consequences beyond the immediate family as well. ECC can be a particularly virulent form of caries, beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly, and having a lasting detrimental impact on the dentition. Children experiencing caries as infants or toddlers have a much greater probability of subsequent caries in both the primary and permanent dentitions. Iron deficiency being the most common nutritional deficiency in childhood is often seen associated with severe caries destruction. Lack of iron is one of the most common dietary deficiency observed worldwide particularly in developing countries. In some instances this deficiency is alleviated by supplementary foods with added iron salts. In many countries where the iron deficiency is apparent, the prevalence of dental caries is high.

Keywords: Early childhood caries, Dietary factors, Developing country, Iron deficiency anemia, lack of iron, virulent form.

Early childhood is a very important stage in child's life. Normal growth and development at this stage is hindered by the common, however preventable, conditions of early childhood tooth decay (ECC).[1] ECC is acommunicable disease that may begin as presently as an infant's teeth erupt and has been outlined as " presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger". In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC), from ages 3 through 5, 1 or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of e"4 (age 3), e"5 (age 4), or e"6 (age 5) surfaces constitutes Severe early childhood caries (American Academy of medical specialty dentistry). [2]Early childhood caries has been thought of at epidemic proportions within the developing countries. several with severe infancy tooth decay are believed to be ill-fed, anemic, scrawny, and have altered physical growth patterns.

Thus, result in nutritional deficiency anemia significantly iron deficiency and poor oral health-related quality of life (OHRQOL).

Iron deficiency anemia (IDA) is caused by many factors, as well as dietary factors, genetic factors, inflammatory processes and environmental factors like low socioeconomic standing and cavity . This kind of anemia ends up in learning and memory inabilities, reduced ûne motor skills and exaggerated anxiety in childhood. [3] Approximately, the prevalence of Iron deficiency anemia in preschool children is 47.4% worldwide. Iron deficiency anemia is usually diagnosed by abnormally low haemoglobin (hgb value under 11 g/dL 5 years of age), hematocrit value(Hct <34% <5 years of age and Hct <35% >5 years of age), as well asMeancorpuscular cell volume value (MCV <73 û <5 years of age and MCV <75 û >5years of age) as biochemical indicators.[4]Similarly, severe early childhood dental caries could be a complex disease andalso various risk factors (biological, psychosocial and behavioral) will contribute to the current disease . SECC is wide-spread in developing countries as well as in low socioeconomic strata of industrialised countries. Significantly in developing countries, iron deficiency anemia and caries are the foremost common and widespread public health issues. Families with lower financial gain typically consume unhealthy, calorie dense, high sugar content, nutrient poor diets.[5]Additionally, excessive consumption of cow's milk or prolonged breastfeeding could contribute each to SECC and iron deficiency anemia (IDA) throughout infancy. Severe early childhood dental caries and IDA are conditions of childhood diseases that have an effect on several children worldwide. A higher understanding of those diseases can serve to boost our current preventive and health promotion interventions. Two recent reports on the iron status and severe dental caries offer proof that the link between the 2 is salient. Many plausible explanations are given on why the anemia and severe dental caries is associated. [6] One hypothesis says that low hemoglobin (Hb) levels in S-ECC children is also attributed to the body's inflammatory response to chronic pulpitis. The later triggers a series of events that ultimately ends up in production of cytokines that successively could inhibit biological process and therefore cut back the extent of hemoglobin in blood. Second, pain skilled by S-ECC children could cause altered feeding habits which will cause anemic conditions because of poor diet. Young children with intensive dental caries were found to be physically underdeveloped, particularly in height and weight, symptoms which will be caused by aversions to feeding owing to tooth pain or a high sucrose diet that may compromise the intake of different nutrients. The physicians and dental practitioner, treating young children, ought to take into account that cavity in young children could be a risk marker for undernutrition.[7]

Risk factors

Three main risk factors for early childhood caries are,

Microbiological risk factors

Dietary risk factors

Environmental risk factors

Microbiological risk factors

Two vital microorganism strains in early childhood caries are streptococcus mutans and streptococcus sobrinus. [8,9]On the opposite hand, lactobacilli have key role within the decay progression. This infection will be transmitted by vertical and horizontal transmission. Vertical transmission is carried between mother or father and child.

Dietary risk factors

Diet with high-sugared drinks increase the danger of this illness additionally to infection. streptococci mutans and lactobacilli process the sugar to acid by metabolic process and fermentation. [10,11]This produced acid cause demineralization of tooth structure. Proof recommends that each cow's and human milk are thought of to be less cariogenic than sucrose, with cow's milk being the least cariogenic.[12]

Environmental risk factors

Several studies confirmed that once S streptococcus mutans bacteria have been acquired at an early age, it will principally cause early childhood caries , wherever other necessary factors, like economic and monetary situation, the utilisation of fluoride and alternative connected factors, will contribute to the event or prevention of early childhood caries. [13,14]Children with a background marked by caries, whose parents and siblings have serious decay, are viewed as being

at high risk of getting decay in their future. In addition, children involvement in monetary burden influences grownup dental well being.

Association between iron deficiency anemia and ecc in children with dental caries

There are several theories association between iron deficiency anemia and early childhood caries in children with dental caries,

1.Body's inflammatory response: Inflammation in early childhood caries will result in the assembly of cytokines, which may inhibit biological process and cause reduction of haemoglobin level within the blood and also in the level of iron.[15] One necessary potential mechanism of severe decay on children health is that pulpitis and chronic dental abscesses have an effect on growth by causing chronic inflammation that affects metabolic pathways wherever cytokines influence biological process. For instance, interleukin-1 (IL-1), that incorporates a big variety of actions in inflammation, will induce inhibition of biological process. This suppression of hemoglobin will result in anemia of chronic sickness, as a result of which there is depression in RBC production within the bone marrow.

2.Destruction of salivary gland functioning in children with iron deficiency and then, reduction of buffering capability and caries.

3.Malnutrition because of early childhood caries and issue in mastication and eating: This status result in iron deficiency and its related anemia. Nutritional and Health Survey reported that the prevalence rate of iron deficiency in children between four and six years of age was 0.2–6.2%. Different studies reported higher incidence of iron deficiency and its connected anemia in children with early childhood caries.

4.Pain or discomfort in children: Early childhood caries cause pain or discomfort in children. So, these children have drawback in mastication iron-rich foods. Such drawback could cause nutritional deficiencies, as well as low iron levels.

5. Food habits or dietary factors: The dietary factors like high consumption of carbohydrates, beverages, and low meat intake cut back iron levels and develop the caries. Tang *et al*., and Shaoul *et al*., showed that iron deficiency anemia had high prevalence in children with severe childhood decay as a result of wrong ingestion habits. [16,17]These teams claimed that modification of food habits are often attributed to the relief from pain and improved ingestion habits once treatment for caries and so, reduction of iron deficiency anemia.

6. Chronic infections: Chronic infections are better-known to decrease haemoglobin levels, which can contribute to anemia.

Early Childhood Caries And Feeding Practices

Inappropriate use of baby bottle features a central role in the etiology and severity of early childhood caries . [18]The principle is that the prolonged use of bottles with sweet content, particularly glucose and galactose. Most of the studies have shown important correlation between early childhood caries and bottle feeding and sleeping with a bottle.[19,20] Breastfeeding provides the proper nutrition for kid, and there are variety of health advantages to the breastfed kid, as well as a reduced risk of duct and metabolism infections. However, frequent and prolonged contact of enamel with human milk has been shown to end in acidiogenic conditions and softening of enamel. [21] Increasing the time per day that fermentable carbohydrates are available is the most important factor in shifting the re-mineralization equilibrium toward demineralization. There seems to be a clinical accord amongst dental practitioners that prolonged and nocturnal breastfeeding is related to an raised risk of early childhood caries , particularly after the age of twelve months. [22,23]These conditions explained by less saliva production at nighttime that end in higher levels of sugar content within the resting saliva and plaque for extended than would be expected throughout the day. Thereby, balance is shifted toward de-mineralization instead of remineralization throughout the night as a result of the deficient protection caused by reduced nocturnal flow of saliva.

Role of serum ferritin

Serum ferritin is an acute-phase protein. Its level is an indicator of body-iron stores and may be normal or elevated in infective, inflammatory, or malignant disease .Ferritin is a major iron storage protein. In case of iron deficiency, serum ferritin levels play a critical role in diagnosis and treatment. [24]Iron ions will be precipitated on the enamel surface as Slim acid-resistant coatings containing gels and crystals of hydrated iron oxides. By

absorbing salivary calcium and phosphate ions, the iron ions can nucleate the formation of appetites and the replacement of minerals takes place during the acid phases of carious process. [25,26]Study done by Shaoul *et al*., 2011,Sadeghi *et al*., 2012, reported that children with ECC showed lower ferritin levels and there is a statistical difference in ferritin levels (P: 0.040) when children with ECC and children without ECC are compared. Among different types of ECC, type III early childhood caries which is the S-ECC shows lower levels of ferritin.

Low ferritin is proof that the body has depleted storage of iron in an attempt to keep up hemoglobin at an applicable level to maintain good health . Schroth *et al*., investigated the relationship between S-ECC and nutritional iron status. This group compared the ferritin and hemoglobin levels between children with S-ECC and cavity-free children recruited from the community. The results of this group showed that there is significant difference in the number of children exhibiting low ferritin levels.[27] This study showed that children with S-ECC had lower ferritin level than cavity-free children. Schroth *et al*., also indicated that children with S-ECC had significantly lower hemoglobin levels than the caries free controls. According to these studies, Children with S-ECC had low ferritin status and low hemoglobin levels compared with caries-free children. Iron deficiency anemia had more frequency in children with S-ECC in comparison with cavity-free children.

Early childhood caries (ECC) is a particular type of severe dental caries that affects infants and young children. These children have weight loss, growth retardation and iron deficiency due to pain, reduced ability to chew, and malnutrition.Impairment in sleep quality leads to insufficient growth by reducing the production of glucosteroids in these children . [28] On the other hand, anemia can be occurred due to several factors such as: nutritional factors, genetic factors (congenital), inflammatory processes and environmental factors such as low socioeconomic status and dental caries .[29]Nutrition-induced anemia is the most common form of malnutrition and includes nutritional deficiencies such as iron, folic acid, copper, and vitamins A, B, C, and E . Iron deficiency anemia is generally recognised by biochemical indices: hemoglobin, hematocrit, as well as MCV, and ferritin . According to WHO, if at least 2 parameters of 3 parameters (Hb, MCV, and serum ferritin) are lower than normal, iron deficiency anemia is confirmed. an acute phase protein and its level is an indicator of body iron storage. However, ferritin may increase as an inflammatory phase protein during inflammatory, infectious and malignant infections, but this is not interpreted as a very high level of iron in the body . The iron status has a significant impact on the health of the child.[30] For example, a child who suffers from iron deficiency may not only show nerve symptoms such as reduced learning and memory deficits, reduced motor skills and increased anxiety, but also weakness, poor physical growth, and weakened immune systems that lead to injury.

Schroth's *et al*., and Koppal *et al*., studies, children with SECC had significantly lower serum ferritin levels than non-caries control group, suggesting that ferritin is an acute phase protein and its level is an indicator of body iron storage. [31]However, in inflammatory diseases, the infection increases the amount of ferritin as an acute inflammatory phase protein and is not interpreted as a high level of iron in the body. Moreover, the cause of the difference can be due to a different methodology of studies ,Tang found in his study that children suffering from severe ECC form had 46% iron deficiency . In Shaoul's study , children with IDA and SECC, treatment of dental caries improved self-paced IDA in most cases without the use of iron supplements, which is similar to Nagarajan's study indicating a direct correlation between SECC and lack of weight and IDA in these children.

On the one hand, the long-term use of more than 2 years of milk and milk bottles for nutrition, in addition to exposing the child to early childhood caries, can be exposed baby to malnutrition by not consuming enough food containing iron and other nutrients. As a result, the likelihood of early childhood caries and iron deficiency and other nutritional problems are higher in this group of children. [31]Evidence showed that children who eat less meat and poultry and drink plenty of juice and milk, snacks, or candy are at high risk for iron deficiency because of high calories of these sources, the eating of other foods and preventing nutritional needs. Therefore, children with ECC should be evaluated for nutritional habits and iron levels.

Reduction in the haemoglobin levels may be a common incidence in several chronic diseases and, if severe enough, may lead to "anaemia of chronic disease". S-ECC may be one such chronic disease. It is also recognised that the pain experienced by children with severe early childhood caries may lead to altered eating habits. [32]These feeding habits might result in biological process deficiencies like low iron levels. Additionally, differences in nutritional status between caries-free children and those with S-ECC may also be shaped by household economics. Limited funds might limit a family's ability to get nourishing foods. Low socioeconomic status is thought to be related to hyperbolic risk for anaemia.

Acs *et al* reported a relationship between ECC and failure to thrive – a condition of poor growth in young children during a cohort of low financial gain children. [33]This study suggests that the manifestations of nursing dental caries might transcend pain and infection. Although, pain and infection conjointly will be the first impacts of nursing dental caries the condition also might effect general health. They ended that children with nursing dental caries weighed considerably less than control children.

Graham *et al* gave the conclusions and implications that the cultural influences that prolong bottle feeding past two years of age are related to iron deficiency in Southeast Asian toddlers.[34-35]Weaning with a cup, with enhanced solid food intake ought to be advised by eighteen months of age. When this is often not accomplished, toddlers should be monitored for development of iron deficiency and oral iron supplements should be provided.

Clarke *et al* reported that severe ECC is also a risk marker for iron deficiency anemia.[36] Since, iron deficiency has permanent effects on growth and development, paediatric dentists ought to suggest assessment of iron levels in severe ECC patients despite their anthropometrical look.

Szeto *et al* researched sociodemographic data, information related to feeding behaviors and diet risk factors for caries in 96 children (18-72 months of age). They determined that those risk indicators were related to iron deficiency and found that 64.6% of patients had caries and 25.0%had iron deficiency. As a result of this study, no risk indicators common to both disorders were identiûed and caries was significantly more prevalent in older children but iron deficiency was found primarily in the younger children. This result is also connected with excessive milk consumption which could be a risk issue for iron deficiency.

CONCLUSION

Severe early childhood caries is a virulent form of dental caries that can destroy the primary dentition of preschool children. This review identifies that early childhood caries as a risk marker for anemia due to iron deficiency, as well as the poor nutritional status as determined by low weight in children. It also suggests that children with S-ECC appear to be at significantly greater odds of having low ferritin status and lower haemoglobin levels when compared with caries-free controls and appear to be at significantly greater odds for iron deficiency anaemia than cavity-free children.Primary care providers and dentists should be aware of this oral-systemic relationship. Dietary diversity includes promoting a diet with a range of foods that naturally contain iron, in particular, red meat, chicken, and fish.Iron in meat is found better than non-alcoholic iron found in dairy products, fruits, and vegetables, and it is absorbed into the body. Evidence showed that children who eat less meat and poultry and drink plenty of juice and milk, snacks, or candy are at high risk for iron deficiency because of high calories of these sources. More studies are needed to examine lifestyle and socioeconomic risk factors that may be associated with the malnourished status of these children. Preventive strategies of ECC should be developed to reduce the risk of iron deficiency and its related anemia.

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