

Comparative Evaluation Of Hemoglobin Level In Children With Severe - Early Childhood Caries Versus That In Caries Free Children- A Case-Control Study.

Vaishnavi Agarwal¹, Vasudha Sodani¹, Bhumi Sarvaiya¹, Sowjanya Rajesh¹,
Yash Agarwal²

¹(Department Of Pedodontics And Preventive Dentistry, Ahmedabad Dental College And Hospital, India)

²(Private Medical Practitioner, Gujarat, India)

Abstract:

Background: Severe dental caries is known to affect the health and well-being of young children. The implication of severe dental caries in children may have its effect on general health apart from affecting the orodental tissues. Many children reporting with severe dental caries are anemic.

Materials and Methods: 60 children free from any systemic disease in the age group of 3 to 6 years of age were selected. The children were divided in 2 groups according to deft score. Group A- 30 caries free children, Group B- 30 children with Severe - Early Childhood Caries (S-ECC). Hemoglobin level was evaluated at Pathology laboratory of the institute.

Results: Comparison of the Hb level between the two groups showed that it is lower in S-ECC group which is statistically significant (p -value=0.001). Moderate anemia is most prevalent in S-ECC group (p -value=0.003).

Conclusion: S-ECC is one of the risk markers for anemia. There is an oral-systemic relationship between anemia and S-ECC.

Key Word: S-ECC, Anemia, Hemoglobin level

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I. Introduction

Dental caries is the localized destruction of susceptible hard dental tissues by acidic by-products from bacterial fermentation of dietary carbohydrates.¹ Dental caries is caused due to transmissible bacteria of mutans streptococci strain. They are dental hard tissue adherent and produce acid by breakdown of sugars in the food resulting in demineralization of enamel and dentin over a period of time.²

Early childhood is an important stage in child's life. Normal growth and development at this stage can be hindered by the common, but preventable, conditions such as early childhood caries (ECC).³

ECC is defined as "the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth" in a child under the age of six. The definition of severe early childhood caries (S-ECC) is 1 any sign of smooth-surface caries in a child younger than three years of age, 2) from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or 3) a decayed, missing, or filled score of greater than or equal to four (age three), greater than or equal to five (age four), or greater than or equal to six (age five).⁴

The mouth acts as portal to the rest of the body has long justified the link between oral and systemic health. The connection between oral health and overall general health has received significant attention for the past 2 decades. Children with multiple carious teeth can have difficulty with learning, have their growth and development affected, and be affected by chronic pain and its consequences.⁵

Other nutrition-related complications have also been reported. Young children with extensive caries were found to be physically underdeveloped, especially in height and weight, symptoms that may be caused by aversions to eating because of tooth pain or a high sucrose diet that can compromise the intake of other nutrients.⁶

In addition, cytokines and other inflammatory factors that are released from damaged tissues during pulpitis and chronic dental abscess are known to suppress erythropoiesis and the synthesis of hemoglobin. Similar mediators of inflammation have also been shown to be prevalent in S-ECC.⁷ Pain experienced by S-ECC children may lead to altered eating habits that may lead to anemic conditions due to poor diet. Thus, making S-ECC a possible risk factor for anemia.⁸

Despite the epidemic nature of both dental caries and anemia worldwide, there has been little research as to whether an association exists between the two conditions.

This study was conducted with the aim of correlating blood hemoglobin levels and dental caries in children with S-ECC. The objectives were-

- To compare the hemoglobin levels of children suffering from S-ECC and caries free children.
- To substantiate the correlation between hemoglobin level and dental caries status.

II. Material And Methods

82 patients were screened at the Department of Pedodontics and Preventive Dentistry at Ahmedabad Dental College & Hospital from which 60 children i.e. 30 free from caries and 30 suffering from S-ECC were selected. Ethical clearance was obtained from the institutional ethical committee.

Study Design: Case-Control study

Study Location: This was a teaching dental hospital-based study done in the Department of Pedodontics and Preventive Dentistry at Ahmedabad Dental College & Hospital.

Sample size: 60 patients

Sample size calculation: The sample size was fixed to 60 and calculated using the formulation:

$$n = (Z_{\alpha/2} + Z_{\beta})^2 \times 2 \times \sigma^2 / d^2$$

where $Z_{\alpha/2}$ is the analytic value of the normal spread at $\alpha/2$ (e.g., for a confidence level of 95%, α is 0.05 and the analytic value is 1.96), Z_{β} is the analytic value of the normal spread at β (e.g., for a power of 80%, β is 0.2 and the critical value is 0.84), σ^2 is the population variance, and d is the difference.

Subjects & selection method: The child was examined for carious teeth. The decayed, missing and filled (def) score was recorded and children were categorized into groups. The sample size consisted of 60 children according to inclusion and exclusion criteria. They were divided into 2 groups-

- Group A- 30 caries-free children
- Group B- 30 children with S-ECC

Inclusion criteria:

1. Children from 3 to 6 years of age.
2. Willing to participate in the study.
3. Complete primary dentition erupted in the oral cavity.

Exclusion criteria:

- Children below 3 and above 6 years of age.
- Children with any systemic disease.
- Patient on any medication.
- Permanent tooth erupted.

Procedure methodology

Parental consent was obtained for hemoglobin level investigation. The collection of blood by venipuncture was done at the institute's hematology laboratory. The classification of Hb level for anemia was done according to WHO recommendations for anemia (Table 1).⁹

Table 1- WHO classification of anemia according to age and severity(g/dl-grams/deciliter)

Age	Non-Anemia (g/dl)	Mild Anemia (g/dl)	Moderate Anemia (g/dl)	Severe Anemia (g/dl)
6-59 months	≥ 11	10- 10.9	7- 7.9	<7
5-11 years	≥ 11.5	11- 11.4	8- 10.9	<8
12-14 years	≥12	11- 11.9	8- 10.9	<8

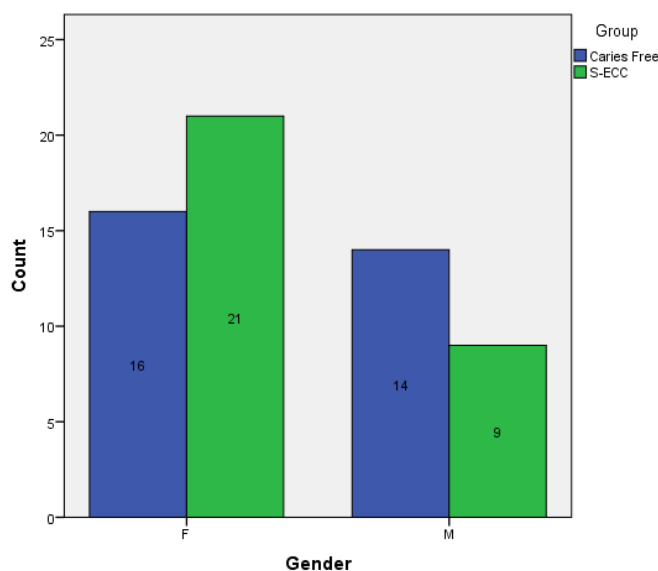
Statistical analysis

All the recorded data was tabulated and subjected to statistical evaluation and SPSS 20.0, IBM, Chicago software was used for analyzing the data. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Result

A total of 60 children from the age group of 3 to 6 years from both genders were included in the study.

Children from both groups were compared for gender distribution by Chi-square test. Gender distribution across the two groups showed that within the Caries free group, 53.3% were females and 46.7% were males. In the S-ECC group, 70.0% were females and 30.0% were males (Graph 1). However, the difference in gender distribution between the two groups was not statistically significant ($p > 0.05$).

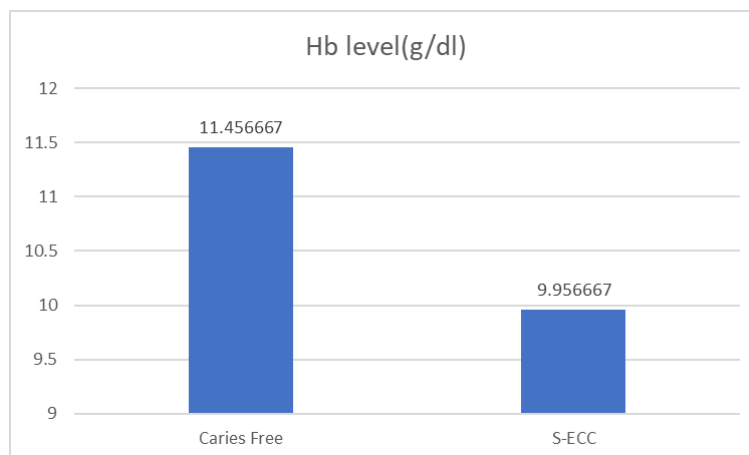


Graph 1- Gender distribution in both the groups

The analysis of hemoglobin (Hb) levels revealed a notable contrast between the Caries free and S-ECC groups (Graph 2). In the Caries free group, the mean Hb level was measured at 11.46 grams per deciliter (g/dl), with a standard deviation of ± 1.52 g/dl. Conversely, in the S-ECC group, the mean Hb level was notably lower at 9.96 g/dl, with a slightly higher standard deviation of ± 1.83 g/dl. The calculated independent t-test yielded a significant result ($t = 3.444$, $p = 0.001$), indicating a substantial difference in Hb levels between the two groups. This outcome suggests that individuals in the Caries-free group tend to have higher Hb levels compared to those in the S-ECC group.

The distribution of anemia types differed markedly between the Caries free and S-ECC groups (Table 2), indicating a potential link between anemia severity and dental caries status.

In the caries free group, the majority of individuals (66.7%) were categorized as not suffering from anemia. This was followed by a smaller proportion categorized as having mild anemia (20%), and even fewer categorized as having moderate (10%) or severe (3.3%) anemia. Conversely, in the S-ECC group, a notable shift in the distribution of anemia types was observed. The prevalence of moderate anemia was substantially higher, accounting for 50% of individuals in this group. Additionally, 10.0% of individuals in the S-ECC group were classified as having severe anemia. The proportions of individuals with mild (10%) and absent (30%) anemia were comparatively lower in the S-ECC group. A statistically significant difference was observed ($p = 0.003$) regarding the association between Anemia type and group.



Graph 2- Comparison of the Hb level(g/dl) between the two groups

		Group		Total	
		Caries free	S-ECC		
Anaemia type	Absent	Count	20	9	29
		% within Group	66.7%	30.0%	48.3%
	Mild	Count	6	3	9
		% within Group	20.0%	10.0%	15.0%
	Moderate	Count	3	15	18
		% within Group	10.0%	50.0%	30.0%
	Severe	Count	1	3	4
		% within Group	3.3%	10.0%	6.7%
Total		Count	30	30	60
		% within Group	100.0%	100.0%	100.0%

Table 2- Crosstabulation of anemia type and groups

IV. Discussion

Early childhood caries (ECC) is still one of the most prevalent diseases in children worldwide. Not only oral pain, orthodontic problems and enamel defects, but also problems with eating and speaking can occur as well as an increased risk for caries development in the permanent dentition. ECC does not only affect children's oral health but also the general health of children.¹⁰

Despite the epidemic nature of both dental caries and anemia worldwide, there has been little research as to whether an association exists between the two conditions. Though often used synonymously, there are distinctions between being iron deficient, anemia and having iron deficiency anemia. Anemia is a condition in which affected individuals have too few red blood cells or hemoglobin functioning at a suboptimal level. Anemia is indicative of poor nutrition and health and is generally diagnosed by abnormally low hemoglobin concentrations. However, hemoglobin is also sometimes used as a proxy measure for iron deficiency.¹¹

This study provided an opportunity to explore this relationship by comparing hemoglobin levels between children having S-ECC and caries-free children. This cross-sectional association study was conducted on a total of 60 children aged 3-6 years. The definition of S-ECC describes the status of caries present in children younger than 6 years.² Hence, this age group was selected for the study. Any child who had a systemic illness, that would affect normal growth, was excluded from the study.

The pediatric dentist who selected and designated the children in the groups (S-ECC and caries-free) was trained for the clinical examination of the caries status hence the possibility of bias in the selection of sample is eliminated. The blood sample was collected in the laboratory setting of the hospital by a trained laboratory technician.

A similar study was done by Deshpande AN *et al*¹² in 2022. They compared various anthropometric measurements along with hemoglobin levels between S-ECC and caries-free children. The mean value of hemoglobin level for the S-ECC and caries free group was 9.496 ± 1.432 g/dl and 10.362 ± 1.689 g/dl, respectively. A statistically significant difference ($p = 0.003$) was observed between both the groups.

Whereas, it was 11.46 ± 1.52 g/dl in the caries-free group and 9.96 ± 1.83 g/dl in the S-ECC group. The t-value is 3.444 with a corresponding p value of 0.001. This indicates a statistically significant difference in hemoglobin levels between the two groups ($p = 0.003$). Thus, this result is in accordance with results by Deshpande AN *et al.*¹²

A systematic review by Easwaran HN *et al.*¹³ in 2022 demonstrated an association between ECC and increased odds of Iron Deficiency Anemia (IDA) rather than it being the cause of IDA.

Bansal K *et al.*¹⁴ in 2016 compared percentage of children with IDA in S-ECC and control group, it was found that children with S-ECC were more likely to have IDA. S-ECC children were significantly more likely to have low Hb. ($p = 0.002$)

Clarke *et al.*¹⁵ in their study on S-ECC children reported a significant proportion of children with an unacceptably low level of Hb and high prevalence of anemia. They suggested that severe ECC may be a risk marker for iron deficiency anemia.

Deane S *et al.*¹⁶ found that children with S-ECC were more likely to have inadequate vitamin D levels, elevated Parathyroid hormone, low hemoglobin, low ferritin or iron deficiency anemia compared to caries free group. 64 out of 140 S-ECC children (45.7%) had low Hb which was statistically significant. They provided no data regarding the severity of anemia.

Among the 60 participants in the current study, the majority in the "caries free" group did not have anemia (66.7%), while in the "S-ECC" group, moderate anemia⁹ was prevalent (50%). These findings were statistically significant ($p = 0.003$) and underscore the potential relationship between anemia severity and the occurrence of severe early childhood caries.

Children with S-ECC showed mild to moderate anemia, which demonstrates a substantial influence on health within the limitations of the study. The potential to detect early indicators of low iron levels in young children with widespread caries may help patients obtain the required treatments even before the long-term consequences of iron deficiency manifest.

This study was cross-sectional in design and had a limited sample size which are the limitations. Further long-term studies with a larger sample size and multiple parameters of anemia like CBC (complete blood count), serum ferritin, Vitamin B12 level, etc are advised.

V. Conclusion

This study highlights the clinical importance of recognizing severe early childhood caries (S-ECC) as an indicator of potential low hemoglobin levels. Oral-systemic relationship between anemia and S-ECC is reinforced by this study within its limits. Pediatricians and pediatric dentists should view S-ECC as a crucial sign of inadequate nutrition, which may progress to anemia in children. Healthcare providers must prioritize the prevention and treatment of S-ECC to promote the overall health and well-being of the child. Early intervention for both the conditions with the joint efforts of pedodontist, pediatrician and parents are advised.

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