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RELATION BETWEEN SEVERE EARLY CHILDHOOD CARIES AND BODY MASS INDEX (BMI) AND HAEMOGLOBIN CONTENT IN CHILDREN AGES 4-5 YEARS

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ABSTRACT

Purpose: Early Childhood Caries (ECC) can lead to pain, discomfort and difficulty in maintaining proper nutrition. The implication of severe dental caries in children impact overall health in addition to effecting orodental tissue. A high percentage of children with severe dental caries are also anaemic. The study was undertaken to evaluate the relationship between severe childhood caries to Body mass index (BMI) and haemoglobin content in the blood in the absence of any underlying medical condition for school going (4-5 years old) children affected severe early childhood caries. **Methods:** A total of 100 urban school-going children in Ferozpur in the age group of 4-5 years were selected, out of which 50 children constituted control group (caries free children) and rest of 50 children were affected severe early childhood caries. Then body mass index score and haemoglobin content was assessed by taking random blood sample of each patient. **Results:** Significant difference was found in the Body mass index (BMI) and content in children age 4-5 years affected with severe early childhood caries and group. **Conclusion:** Children with severe early childhood caries in the present study had significant

less Body mass index (BMI) and haemoglobin content as compared to control group due to - a lack of proper intake of nutrients.

Keywords: ECC, BMI, Haemoglobin, Children

INTRODUCTION

Early childhood oral health plays an important role in the overall health and well-being of young children ¹. Healthy teeth allow for optimal function in eating and speaking and provide an acceptable appearance facilitating early socialization. Children with good oral health associated with proper growth and development [1].

Sever early childhood caries is a public health problem among school-going children. Malnutrition is a condition commonly prevalent in children with severe early childhood caries due to the lack of proper intake of nutrients as pain affects the quantity of food intake [2].

Caries of primary teeth “early childhood caries” (ECC) is one of the most prevalent health dilemmas in infants and toddlers [3]. While early childhood caries (ECC) is a very broad case definition that includes children with one or more primary teeth affected by decay, many children suffer from a more severe form of ECC, termed Severe Early Childhood Caries (S-ECC) [3].

Early childhood caries (ECC) is the 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 indicates 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 ≥ 4 (age 3), ≥ 5 (age 4), or ≥ 6 (age 5) surfaces constitutes S-ECC [4].

The relationship between dental caries and body mass index (BMI) in children was evaluated in different countries and the results were inconsistent. In some advanced countries, frequent eating of food and high consumption of carbohydrates were reported to be the reason of increasing obesity and dental caries [5].

Dental caries, while being the most frequent preventative disease, affects almost half of the world's population [6]. Aside from traditional risk factors for dental caries, recent research has indicated substantial relationship between severe early childhood caries and anaemia in children; however, anaemia still not acknowledged as a possible risk factor for dental caries [7].

Tang *et al.* (2013) described severe early child caries (S-ECC) in relation to nutritional factors among pre-schoolchildren in Taiwan in a clinical study. The researchers state that 46% and 9% of the

children with S-ECC were recognized as being iron deficient and anaemic, respectively [8]. Thus, children with S-ECC were at greater risk for anaemia and iron deficiency. Similarly, Sadeghi *et al.* (2012) examined 204 children aged 24e71 months and found that there was no significant difference between genders with respect to early childhood caries (ECC); however, there was a statistically significant inverse association between ECC and serum iron levels [9].

Chronic inflammation resulting from extensive early childhood caries (ECC) can disrupt normal metabolic functions, including erythropoiesis—the process by which red blood cells are produced. This disruption can lead to decreased hemoglobin levels and, consequently, iron deficiency anemia [10].

A key factor in this process is the increased production of pro-inflammatory cytokines, such as interleukin-1 (IL-1). IL-1 can suppress erythropoiesis by inhibiting erythropoietin (EPO) expression in the kidneys and directly affecting erythroid progenitor cells. Additionally, IL-1 promotes myelopoiesis over erythropoiesis by inducing the expression of PU.1, a transcription factor that antagonizes GATA-1, essential for erythroid lineage commitment. This cytokine-driven shift can result in anemia of chronic disease,

characterized by reduced red blood cell production in the bone marrow [10].

In children, dental pulpitis and chronic dental abscesses can serve as significant sources of such inflammation. These conditions lead to elevated levels of inflammatory cytokines in saliva, which may contribute to systemic inflammatory responses affecting overall health and growth. Therefore, addressing dental infections in children is crucial not only for oral health but also for preventing potential systemic complications like anemia [10].

MATERIAL AND METHOD

A total of 100 urban school-going children in the age group of 4-5 years were selected, out of which 50 children constituted control group (caries free children) and rest of 50 children were affected sever early childhood caries.

Inclusion criteria:

1. Children from 4-5 years of age.
2. Willing to participate in the study.
3. Complete primary dentition erupted in the oral cavity.

Exclusion criteria:

1. Children with any systemic disease.
2. Patient with any medication.
3. Permanent tooth erupted.
4. Children below 4 and above 5 years of age.

Procedure methodology

Weight (kg) and height (m) were measured using a standard balanced beam scale.

Height was measured to the nearest 0.1cm, and weight was measured in kilograms to the nearest 100 grams. The BMI (kg/m²) was calculated according to the Centres of Disease Control and Prevention (CDC) (USA)¹² formula: weight in kilograms (kg) divided by height in metres squared (m²) [11].

$$\text{BMI} = \frac{\text{weight in kilograms (kg)}}{\text{Height meter (m)}^2}$$

All the children were categorized as 1) underweight (85th to 95th percentile) 2) normal weight (fifth to 84th percentile, 3) at the risk for overweight (>85th to 95th percentile) and 4) overweight (>95th

percentile) utilizing age with CDC BMI percentiles. The data thus obtained was analysed using SPSS Software (Statistical Package for Social Science) version 11.5 for Windows and an independent t-test was used to evaluate whether the weight, height and BMI of S-ECC children is significantly different from caries-free children [12].

Parents' consent was obtained for haemoglobin level investigation. Collection of the blood by venipuncture was done at the haematology laboratory. The classification of Hb level for anemia was done according to WHO recommendations for anemia (Table 1) [13].

Table 1: WHO Classification of anemia according to age and severity (g/dl-grams/decilitre)

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

RESULTS

A total of 100 children from the age group of 4-5 years were selected, out of which 50 children constituted caries-free children and the rest of 50 children were affected severe early childhood caries in this study.

Table 2 shows that mean Hb differs significantly between carious and non-carious groups ($p < 0.001$) however, there was no significant difference in BMI

between carious and non-carious groups ($p = 0.656$).

Table 3 shows that the correlation between BMI and Hb was positive and significant in the non-carious group ($r = 0.483$, $p < 0.001$), however no significant correlation between BMI and

Hb was found in the carious group ($r = 0.202$; $p = 0.160$).

Table 2

Variable	Carious Group (n=50)	Non-Carious Group (n=50)	Mean Difference	't' value	p value
BMI	17.079 ± 1.709	17.246 ± 2.019	0.167	0.447	0.656 ^{NS}
Haemoglobin	11.780 ± 1.117	9.494 ± 0.728	2.286	12.126	<0.001**
Correlation b/w BMI and Hb (r value)	0.483	0.202			
p value	<0.001**	0.160 ^{NS}			

NS: $p > 0.05$; Not significant; ** $p < 0.001$; Highly significant

Table 3

Group			BMI	Haemoglobin
Non-Carious	BMI	Pearson Correlation	1	.483**
		Sig. (2-tailed)		.000
		N	50	50
	Haemoglobin	Pearson Correlation	.483**	1
		Sig. (2-tailed)	.000	
		N	50	50
Caries	BMI	Pearson Correlation	1	.202
		Sig. (2-tailed)		.160
		N	50	50
	Haemoglobin	Pearson Correlation	.202	1
		Sig. (2-tailed)	.160	
		N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Early childhood caries (ECC) affects teeth of children aged under six years. According to the Global Burden of Disease Study in 2017, more than 530 million children globally have dental caries of the primary teeth. However, as primary teeth are exfoliated due to growth of the child, ECC has previously not been considered important [14].

ECC has a significant influence on individuals, families and societies. The disease affects primary teeth and permanent teeth and influences general health and quality of life across the entire life course. ECC links with other frequent diseases of childhood, primarily due to risk factors shared with other non-communicable diseases (NCDs) such as high sugar intake, and the disease relates to other health conditions such as obesity. Dental caries can lead to abscesses and cause toothache, which may compromise ability to eat and sleep and restrict life activity of children.

Severe dental caries is associated with poor growth. Moreover, ECC is an economic to the family and society; treatment of ECC under general anaesthesia for extensive dental repair is especially costly [14].

A total of 100 children from the age group of 4-5 years were selected, out of which 50 children constituted caries-free children and the rest of 50 children were affected severe early childhood caries in this study.

Results shows that mean Hb differs significantly between carious and non-carious groups ($p < 0.001$) however, there was no significant difference in BMI between carious and non-carious

groups ($p = 0.656$) which is in accordance to the studies conducted by Hossam Mohamed *et al*, which statistically significant Hb level mean difference between the high and low caries index groups, also results in accordance with study conducted by Ru-Shing Tang *et al* [8], SECC is strongly associated with anemia. For BMI difference, in the present study no significant difference

in BMI between carious and non-carious groups which was in contrast to the study conducted by Shakya A *et al.* have also reported that the children with less BMI score tend to have more caries affected teeth than children with normal BMI [11]. Similar results were found by Mohammadi TM *et al.*; Clarke M *et al.* [15, 16].

A similar study was done by Deshpande AN *et al* 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 [17].

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.* [17].

In the study, correlation between BMI and Hb was positive and significant in the non-carious group however no significant correlation between BMI and Hb was found in the carious group which was in contrast to study conducted by Hossam Mohamed *et al*,

[15] a significant negative correlation between caries index score and Hb level ($r = -0.475$, $p = 0.0019$).

There was a statistically significant Hb level mean difference between the high and low caries index groups. There was also a significant moderate negative correlation between caries index score and age, and height.

Limitation

The study's findings are limited by geographical school children, as they focus on a specific area in India, which may not be applicable to other regions with different dietary habits, healthcare systems, and cultural practices.

CONCLUSION

The study revealed that there was a significant between children without dental caries had haemoglobin levels than those with caries. Although BMI was similar in both groups, a positive link between BMI and haemoglobin was seen only in children without caries. This suggests that good oral health may be related to better overall nutrition and health. So, Early childhood oral health plays an important role in the overall health and well-being of young children.

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