Type of Study: *Original Research*

An Estimation of Haemoglobin Levels in Children with Early Childhood Caries- A Retrospective Study

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Abstract

Aim: This study aimed to evaluate Haemoglobin (Hb) levels in children with Early Childhood Caries (ECC) and to find out whether there is any variation from normal values in Hb level in children with early childhood caries.

Materials & Methods: In this retrospective study the Hb levels and dmft status of 281 children with ECC in the age group of 0 to 6 years were evaluated. The mean Hb values calculated were compared with the suggested normal levels by the World Health Organisation for the particular age group. Kruskal Wallis test and post hoc test comparisons were done to compare differences in Hb levels in 4 different groups based on dmft values in children with ECC.

Results: Overall mean value of Hb in children with ECC was 10.93 ± 1.73 g/dl and mean dmft was 7.19 ± 4.3. Group 1 with less than 5 dmft value showed significant difference in Hb values compared to children in groups with higher dmft values ($p \leq 0.05$).

Conclusions: Half of the study population had low haemoglobin levels i.e. below that of WHO criteria. Children with more than 5 dmft score had significantly lower Hb levels compared to children with less dmft values ($p \leq 0.05$). There was no significant difference noticed in the Hb levels in between boys and girls with ECC. This descriptive study results point that ECC can result in low Hb levels in children, however authors suggest that an analytical study with a control group should be done to test the hypothesis.

Key Words*: Anaemia, Children, Early Childhood Caries, Haemoglobin Levels, dmft.*

Introduction

Early childhood caries (ECC) is a major health problem affecting children all around the world. The impact of early childhood caries on childrens' health is enormous, affecting general development, nutritional intake, growth of the child etc. According to American Academy of Pediatric Dentistry "Caries is a biofilm (plaque)-induced acid demineralization of enamel or dentin, mediated by saliva. The disease of early childhood caries (ECC) is the presence of 1 or more decayed (non cavitated 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 ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC" [1] . Oral health should be of utmost importance in any age but it is very significant in early

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childhood. Since it is the phase during which most of the oral and overall development of the child takes place.[2] Dental caries is usually referred to as a multifactorial disease which affects the hard & soft tissues of a tooth. It is otherwise known as tooth decay.[3,4]

Early childhood caries, a serious dental health issue affecting infants and toddlers is prevalent all around the world[5] . Reported prevalence of ECC in various countries was, in USA it's 11% - 53.1%, England it's 6.8% - 12%, Asia (Far East) it's 36% - 85%, and in India it's 44%.[6–10] Early detriment of oral health due to early childhood caries may cause permanent damage to the underlying permanent dentition. Also when left untreated it could affect the nutritive intake of the child ultimately affecting the development of the child.[11] Nutritional impact in children with ECC can be a reason for low Hb levels in children.

Diet and nutrition being an important risk factor for ECC, iron deficiency i.e. lack of iron is one of the most frequently observed dietary deficiency all around the globe.[12,13] World Health Organisation -WHO states that anaemia in children less than 6 years of age as Haemoglobin (Hb) levels less than 11g/dl[14]. WHO also states that prevalence of anaemia is the greatest in preschool children which is 47.4%.[15]

Many studies show correlation between early childhood caries and nutritional status [16–18] India being a developing country is still coping with malnutrition, poverty, lower socio- economic status among the population which is undeniable.

ECC can influence the nutritional intake of children due to tooth pain and sensitivities. There are very limited studies conducted among the south Indian population evaluating Haemoglobin levels and its relation with early childhood caries.

Our department is passionate about child care, we have published numerous high quality articles in this domain over the past 3 years[19,11,20–32]. With this inspiration we planned to pursue research on Haemoglobin (Hb) levels in children and to find out whether there was any relation with early childhood caries.

Materials and Methods

Study Design & Study Setting

This retrospective descriptive cross sectional study evaluated the records of patients who visited the university dental hospital situated in Tamilnadu, India from June 2019 - March 2020. Study was carried out after obtaining approval from the institutional ethical review board, ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320 and informed consent from the parents. The study population included patients age ranging from 0 to 6 who visited the pediatric dentistry department and underwent blood tests for pre anaesthetic evaluation before treatment for ECC under general anaesthesia. Special children and children under any medication which can influence Hb levels such as iron supplements or with any systemic condition were excluded from the study.

Data Collection

After analysis of 86000 records by two clinicians, 1519 patients' records of age ranging from 0-6 were obtained. Out of 1519 , 304 patients with early childhood caries who underwent haematological investigations for treatment of ECC under general anesthesia were shortlisted. Record of 304 children underwent blood tests were retrieved. After exclusion of 23 records which did not match the inclusion criteria a final sample of 281was obtained. Two clinicians collected and analysed the data after which it was cross verified and examined by another examiner to prevent any discrepancies. The required data such as age, gender, Hb levels, dmft status etc were collected.

Statistical Analysis

Data was obtained and filtered using (Microsoft Corporation. Microsoft Excel [Internet].2018.) and was then exported to (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) for further statistical analysis. After data collection descriptive statistics such as calculation of mean Hb levels, dmft values were performed. The mean values of Hb levels obtained were compared with the suggested normal levels by the World Health Organisation for the particular age group of the study. Point biserial correlation analysis was done to find out the relationship between Hb levels of children with ECC

and gender. Based on dmft values children with ECC were categorised into 4 groups to evaluate the severity of ECC in influencing the Hb values . The 281 participants were categorised into various groups based on dmft values for severity of ECC into, first group (n=124) had a dmft ≤5, the 2nd group (n=79) had dmft values between 6 to 10, the 3 rd group (n= 67) had dmft values between 11 to 15 and the 4th category (n=11) dmft ≥16. After homogeneity testing of the Hb values it was found that there were outliers in observations hence the Kruskal Wallis test and Post Hoc test were done to find out the differences in Hb levels between groups based on dmft values & severity of ECC. The confidence interval was set at 95 % at 0.05 level of significance.

Results

This retrospective study included 168 males (59.79%) & 113 (40.21%) females based on the inclusion and exclusion criteria , the study population had patients who had early childhood caries and were undergoing treatment of age ranging from 1-6. Frequency distribution of the age groups are as follows, age group 3 was the most frequently occurring age group in the given study population (42.35%) followed by, age group 4 patients (29.18%), age group 2 (15.66%), age group 5 (9.25%), age group 6 (2.55%) and age group 1 (0.71%).

Hb level ranges in males 5.1-15.4 g/dl,in females 5.6-14.1 g/dl. Overall range 5.1-15.4 g/dl. Mean value of Hb in Males 10.85 ±1.75 g/dl,in Females 10.87 ±1.65 g/dl. Overall mean value of Hb 10.93 ± 1.73 g/dl. WHO states Hb levels below 11g/dl are considered to be anaemic in children below 6 years of age [17]. 50 percentile of the participants had Hb levels below 11g/dl, 25 percentile had Hb values <10g/dl, 10 percentile had Hb levels below 8.5g/dl and 5 percentile had levels below 7.5 g/dl. It was found that almost half of the study population had Hb levels below that of WHO criteria. There was no correlation or difference in the Hb levels in boys and girls with ECC [Figure:2, 3].

The decayed, missing and filled tooth index (dmft) of all the study participants were assessed, mean value of the DMFT index was found to be 7.19 ± 4.33. Mean Hb levels of different groups based on severity of ECC was found to be, group 1 (dmft ≤5) was 11.92 ± 1.3 g/dl, group 2 (dmft values between 6 to 10) was 10.63 ± 1.53 g/dl, group 3 (dmft values between 11 to 15) was 9.64 ± 1.68 g/dl and of group 4 (dmft ≥16) was 9.74± 1.94 g/dl (table 1). Kruskal Wallis test showed a significant difference between the groups (p ≤0.05) and a post hoc test was done to find out which group differed significantly. It was found that group 1 differed significantly (p<0.05)compared to groups 2, 3 & 4 (table 2). This showed that children with higher dmft values had significantly lower Hb levels compared to children with dmft values ≤5 .

Table 1 : Categorisation of children with ECC into groups based on dmft values and mean Hb and dmft values of each group shown.

Groups	Mean dmft value of each group	Mean Hb level of each group (g/dl)
Group 1 (dmft ≤ 5) n=124	3.23 ± 1.35	11.92 ± 1.20
Group 2 (dmft 6 to 10) n=79	7.67 ± 1.25	10.63 ± 1.53
Group 3 (dmft 11 to 15) n=67	12.43 ± 1.34	9.64 ± 1.68
Group 4 (dmft ≥16) n=11	16.63 ± 1.03	9.74 ± 1.94
Total Sample : Children with ECC(n=281)	Overall mean dmft value 7.19±4.33	Overall mean Hb Value 10.93±1.73

Table 2: Post Hoc Test Comparison of Hb levels of children with ECC categorised into different groups depending on dmft values observed. Kruskal Wallis test showed a significant difference between the groups ($p < 0.05$). Results showed that Hb levels of group 1 i.e of children with dmft level ≤ 5 differed significantly in there Hb levels compared to other group children with higher dmft values.

Post Hoc Comparisons	Significance value ($p \leq 0.05$ considered significant)
Group 1 vs Group 2	0.000
Group 1 vs Group 3	0.000
Group 1 vs Group 4	0.000
Group 2 vs Group 3	0.006
Group 2 vs Group 4	.907
Group 3 vs Group 4	1.000

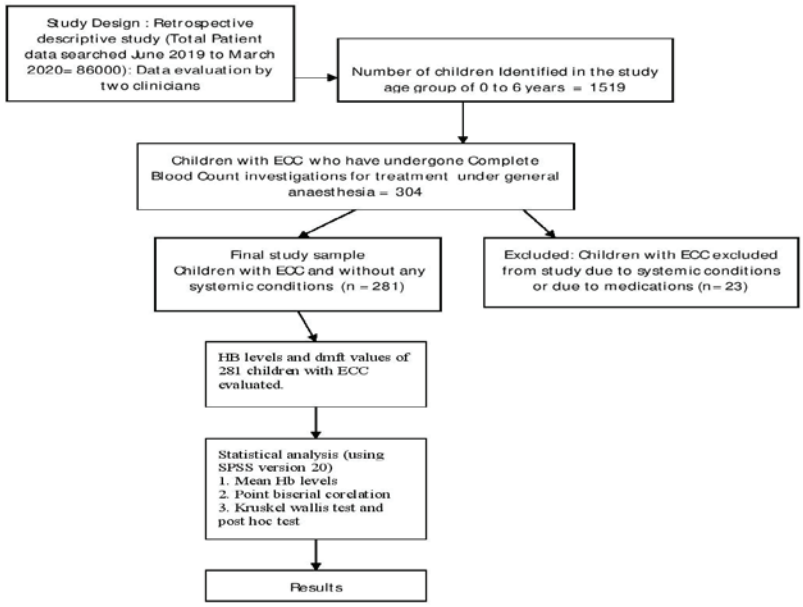

Figure 1 : Flowchart showing the study methods and design.

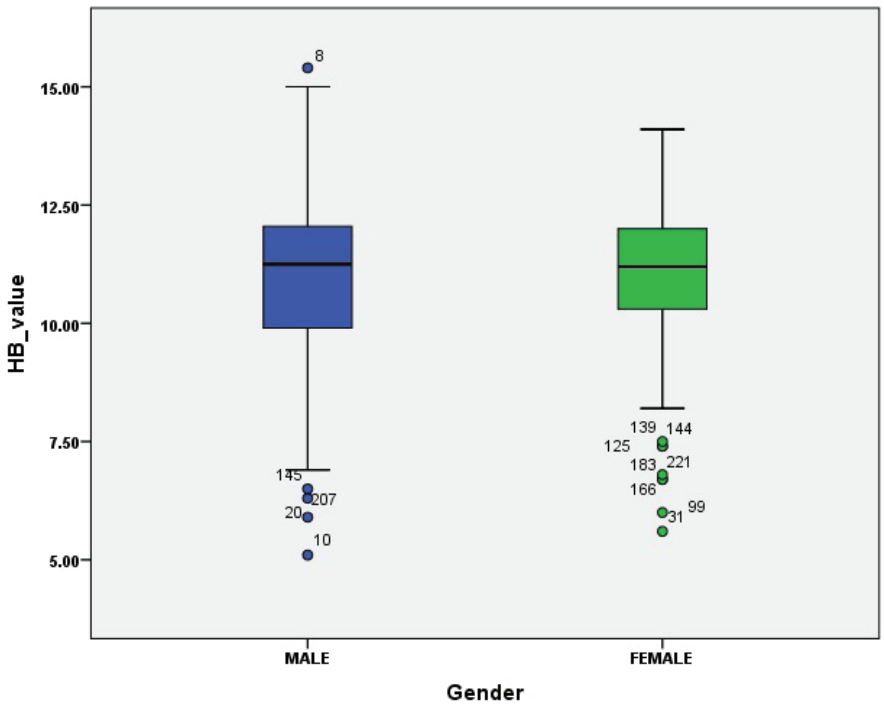

Figure 2: Box plot depicting correlation between Hb levels in boys and girls with ECC. X axis depicts the gender and the Y axis represents the Hb levels of the participants. Multiple outliers can be noticed as dots in the plot suggesting unusual low levels of Hb in some participants. Point biserial correlation coefficient was elicited and value was found to be .007 (close to zero) suggesting no significant differences between Hb levels of boys and girls with ECC.

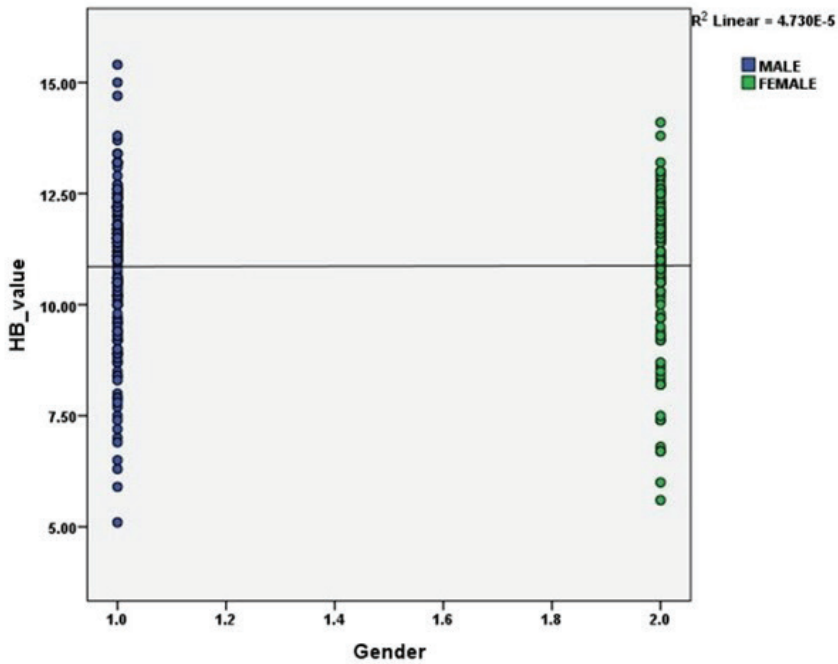

Figure 3: Scatter plot depicting the correlation between gender and Hb levels. X axis denotes gender and Y axis denotes the Haemoglobin level in g/dl.Blue represents male gender and green represents female gender. Point biserial correlation coefficient was elicited and value was found to be .007 (close to zero) suggesting no significant differences between Hb levels of boys and girls with ECC

Discussion

This study was based on the south indian population who visited a university dental hospital in Chennai, Tamil Nadu. To our knowledge this was the first study done in Chennai to evaluate Hb levels in children with early childhood caries.

Oral health and hygiene is often neglected among children in the south indian population.[27] Half of our study population with early childhood caries had Hb levels below that of 11g/dl which is the suggested normal level for the age group of study by WHO. This could be due to various factors such as improper diet and nutrition which plays a major role in Hb level deficiency. Diet & nutrition plays a major role in relation to early childhood caries.[33] India being a developing country, factors such as the socioeconomic status might affect the diet, nutrition and food habits leading to iron deficiency anemia in children aged 5 and below.[34]

Mean value of Hb in Males 10.85 ± 1.75 g/dl, in Females 10.87 ±1.65 g/dl .Overall mean value of Hb 10.93 ± 1.73 g/dl. It was noticed that half of our study population had Hb levels lower than what is suggested for the age group by WHO. There was no relation found between the gender of children with ECC and Hb levels. However male population had a higher frequency of 59.79% and this is similar to another study done in Puducherry which assessed age, gender, weight and height association with early childhood caries.[35]

Age group 3 was the most frequently occurring age group in the given study population 119 patients (42.35%) followed by age group 4, 89 patients (29.18%) and as such. Age group 1 had the least mean Hb value of 10.15 g/dl, however this value was not statistically significant to show that this age group was more prone to have low Hb levels, thus depicting age is not directly associated with Early childhood caries & Hb Levels and is supported by few similar studies.[35,36]

A study done in Canada by Clarke et al reported that almost 28% of their study population with early childhood caries had low Hb concentration levels.[37] Another study done by Bansal K et al depicted strong association of anaemia due to iron deficiency[38]. A study done by Koppal P et al. showed that there is no direct relation of Early childhood caries with Hb levels but are interrelated. These above study results are in accordance with our study.[39]

Another study done by Schroth et al depicted that children with ECC have lower haemoglobin levels and are most likely to have Iron deficiency anaemia. He found that 75% of the children with Early childhood caries had low Hb levels, which is also confirmed by another study by Janaki Ram et al [40,41] . In another study done by Hashemi et al it was found that early childhood caries could be a risk factor for low Hb levels.[42]

From the above discussion it is very evident that early childhood caries & low Hb levels are interrelated but it is still inconclusive whether early childhood caries is the reason for low Hb levels. The evaluation of dmft score and categorisation of children into 4 groups based on dmft score in this study showed that children with higher dmft values had significantly lower haemoglobin levels compared to children with dmft values less than 5. This clearly indicated that early childhood caries is influencing the Hb levels in children. However our study is a descriptive study without a control group due to ethical reasons. Hence an analytical case control study will be more beneficial in establishing a clear consensus.

It was noticed that half the children with ECC had Hb levels below the WHO criteria for the age group. Since both Hb levels & early childhood caries play a major role and might affect development of a child, it is essential to conduct further case control or longitudinal studies in future to understand the association between Hb levels and ECC.

Anaemia in children with Early childhood caries will not only affect the primary dentition but as well as can affect the overall systemic health. Proper awareness and knowledge regarding the relationship between oral health and systemic health is important. Low levels of Hb in children with ECC can affect the systemic health which in turn can affect the quality of life. This study throws light to the fact that oral health in children cannot be neglected, if neglected can have systemic health implications. Hence adequate preventive and therapeutic measures against ECC should be taken by health providers for overall well being of children.

Our study had few limitations such as unequal male/female ratio,unequal age ratio, control group of normal

children were not available due to ethical reasons, and also the reference value for comparison is based on generalised criteria by WHO which is not derived from the same south indian population.

Conclusion

Despite the limitations of the study it can be concluded that half of the study population had low haemoglobin levels i.e. below that of WHO criteria. Children with more than 5 dmft score had significantly lower Hb levels compared to children with less dmft values ($p \leq 0.05$). There was no significant difference noticed in the Hb levels in between boys and girls with ECC. This descriptive study results point that ECC can result in low Hb levels in children, however authors suggest that an analytical study with a control group should be done to test the hypothesis.

Conflict of Interest: None declared.

Source of Funding : Self

Ethical Approval: Study was carried out after obtaining approval from the institutional ethical review board, ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320 and informed consent from the parents

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