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Research Article

Estimation of ferritin levels in children with and without early childhood caries - A case–control study

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ABSTRACT

The iron supplements can reduce the bacterial colonization and biofilm formation; they can also reverse the carious process and reduce the incidence of caries in animals. Hence, this study was carried out to determine the association between the ferritin level and the severity of early childhood caries (ECC) in children of age <72 months. A total of 114 children aged <72 months of age were recruited for this study. Oral examination was done to assess the severity of ECC based on Wayne's classification. Following the parental consent, children underwent blood investigation for the estimation of ferritin level. Statistical analysis was done using SPSS 23 versus software. Unpaired sample *t*-test was performed to determine the significance in the ferritin levels between case and control groups, and one-way ANOVA test was performed for the multivariate analysis. In the study, the mean value of ferritin level in case group is 28.22 ± 20.65, and the control group is 37.40 ± 24.20. The ferritin levels are lower in children with ECC than the children without ECC. On comparing the ferritin levels among the severity of ECC groups, severe ECC group has lower ferritin levels. However, there is no statistical difference (*P*: 0.069) between the three groups. The physicians and dentists should be aware of this oral-systemic relationship and consider S-ECC as a risk marker of anemia. Further studies with larger samples should be carried out for confirming the findings.

Keywords: Early childhood caries, ferritin, iron deficiency

Introduction

Ferritin is a major iron storage protein. In case of iron deficiency, serum ferritin levels play a critical role in diagnosis and treatment.[1] Serum ferritin is an acute phase protein. Serum ferritin level is an indicator of body iron stores and may be normal or elevated in infective, inflammatory, or malignant disease.[2] Iron ions will be precipitated on the enamel surface as thin acid-resistant coatings containing gels and crystals of hydrous iron oxides. By absorbing salivary calcium and phosphate ions, the iron ions can nucleate the formation of apatites and the replacement of minerals takes place during the acid phases of carious process.[3]

The disease of early childhood caries (ECC) is "the presence of one 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 ECC (S-ECC). From age 3 through 5, one or more cavitated, missing (due to caries), or filled smooth surface 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] ECC and Severe-ECC (S-ECC) can be virulent form of caries, beginning soon after tooth eruption, developing on smooth surfaces, progressing rapidly, and having a detrimental impact on the dentition.[5] Children with S-ECC are believed to be malnourished, anemic, underweight, and have altered somatic growth pattern.[6] Tang *et al.*, 2013, investigated the relationship between the caries status of the children and anemia and also showed that S-ECC was strongly associated with anemia.[7] S-ECC is a risk marker for anemia due to iron deficiency.[8]

Micronutrient deficiency, inadequate intake of iron, has direct influence on the nutritional status of young children and is the most common cause of anemia. Anemia is a nutrition problem worldwide, and its prevalence is higher in developing countries than the developed countries.[9] In a study conducted in South Karnataka, among 300 preschool children, 62% of children showed clinical sign of anemia.[10]

In a study by Clarke *et al.*, 2007, S-ECC children reported with a high prevalence of anemia. Shaoul *et al.*, demonstrated the resolution of dental caries leads to a parallel resolution of iron deficiency anemia without iron treatment.

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The following statements provide evidence that the relationship between the iron status and severe caries is salient.[11,12]

- Low hemoglobin (Hb) levels in S-ECC children may be attributed to the body's inflammatory response to chronic pulpitis. This inflammation triggers a series of events that ultimately leads to the production of cytokines which in turn inhibits erythropoiesis and reduces Hb level.[12,13]
- Pain experienced by S-ECC children may lead to anemic conditions due to poor diet intake.[11]
- Chronic infections are also known to lower Hb levels, which may contribute to anemia.[14]

Hence, the aim and objective of this study are to estimate the ferritin levels in children with and without ECC and to compare it with the severity of ECC.

Materials and Methods

The ethical approval for the study was obtained from the institutional review board. A convenient sample of 114 children aged <72 months of age were recruited for the study. Among 114 children, 79 children were with ECC (case group), and 35 were without ECC (control group). Children with and without ECC, ASA 1 patient (healthy), and ASA 2 patient (mild systemic disease and no functional limitation) were included in this study. ASA 3 or greater children (complex metabolic or medical disorder) and children under vitamin supplementation were excluded from the study. Oral examination was done to record the severity of ECC based on Wayne's classification (Table 1).

After getting concern from the parents, 2 ml of blood samples were collected from the participants by venipuncture. Blood samples were collected either from antecubital fossa or metacarpal veins in children by the experienced nurses or laboratory technicians. The collected samples were kept in the test tubes and were transported to the diagnostic centers on the same day. In the diagnostic center, ferritin levels were estimated in the blood using electrochemiluminescence immunoassay method. Statistical data analysis was performed using SPSS 23 versus software. Unpaired *t*-test was performed to determine the significance in ferritin levels between case and control groups, and one-way ANOVA test was performed for multivariate analysis.

Results

In the study, the mean value of ferritin level in case group is 28.22 ± 20.65, and the control group is 37.40 ± 24.20. The children with ECC have lower Ferritin levels than the children without ECC (Graph 1).

Among the study population, 36% of children were in mild ECC group; 49% children were in moderate ECC group; and 15% of children were in S-ECC group (Graph 2).

The mean value of mild ECC group is 33.03 ± 22.14; moderate ECC group is 28.33 ± 21.46; and S-ECC group is 16.63 ± 4.76 (Table 2). On comparing the ferritin levels among the severity of ECC groups, S-ECC group has lower ferritin levels. However, there is no statistical difference (*P*: 0.069) in the ferritin levels between the three groups (mild, moderate, and severe) (Graph 3).

Discussion

In the present study, 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 ECC (i.e., S-ECC) shows lower level of ferritin than the other two types. The results of the present study are similar to the studies by Shaoul *et al.*, 2011 and Schroth *et al.*, 2013. Sadeghi *et al.*, 2012, in the cross-sectional study stated that there exists an inverse, statisticaldifference between

Table 1: Wayne's classification

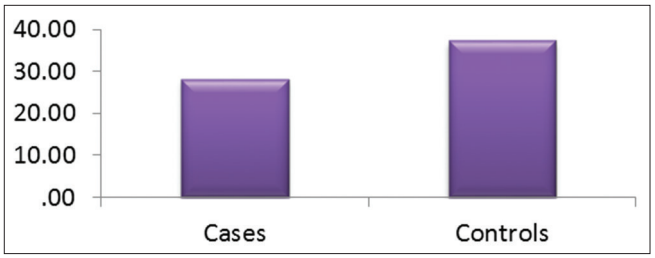
Type I	Mild to moderate ECC (isolated carious lesion(s) involving molars and/or incisors)
Type II	Moderate to severe ECC (Labiolingual carious lesions affecting maxillary incisors with or without molar caries and unaffected mandibular incisors)
Type III	Severe ECC (carious lesions affecting all teeth including lower incisors)

ECC: Early childhood caries

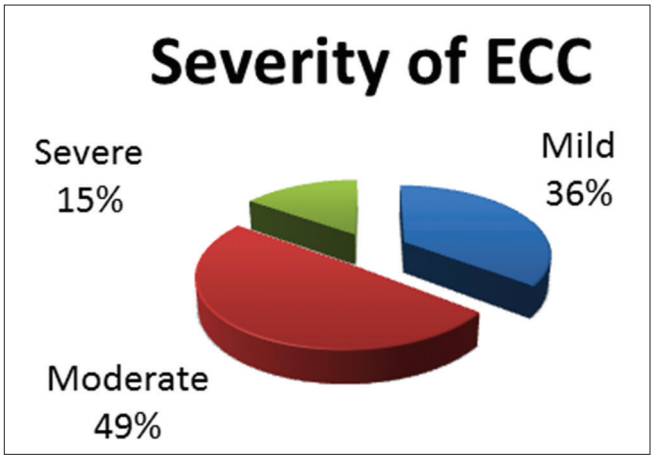
Table 2: Mean value of different ECC types

ECC type	*N*	Mean±SD
Mild	28	33.03±22.1473
Moderate	39	28.33±21.4670
Severe	12	16.63±4.7694
Total	79	28.222±20.6515

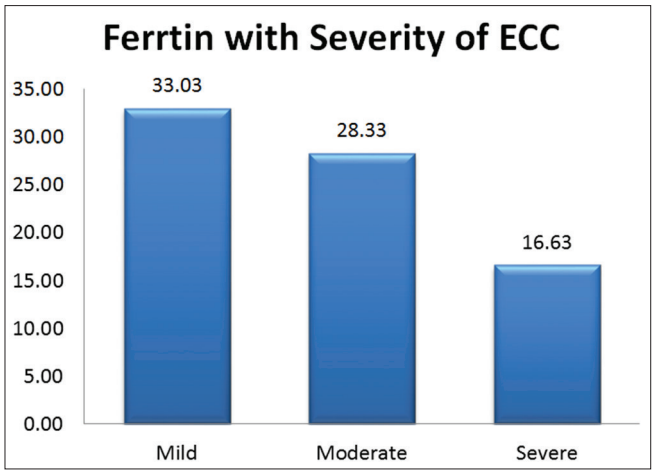
SD: Standard deviation, ECC: Early childhood caries



Graph 1: Mean ferritin values among case and control group



Graph 2: Distribution of early childhood caries among the study population



Graph 3: Mean ferritin values among the three types of early childhood caries based on Wayne's classification

serum iron levels and caries experience in young children aged 24-71 months.[15,16]

Conclusion

- The physicians and dentists should be aware of this oral-systemic relationship and consider S-ECC as a risk marker of anemia.
- Further studies with larger samples should be carried out for confirming the findings.

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