

Original Article

Comparative evaluation of serum iron level, serum ferritin level and salivary pH with Dental Caries in Children with Iron Deficiency Anaemia- An Observational Cross-Sectional Study

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ABSTRACT:

Background: Dental caries is one of the children's most common unmet health needs that can interfere with nutritional intake, including iron, which causes iron deficiency (ID) called as anaemia. Imbalances in the levels of free radicals, reactive oxygen species, and antioxidants in the saliva may play an important role in the development of dental caries. The level of serum ferritin indicates the iron level in the body and may be normal or high in infectious, inflammatory, or malignant diseases. Therefore, it is necessary to evaluate and compare the serum iron level, serum ferritin level, and salivary pH with dental caries in children and iron deficiency anaemia. **Methods:** A total number of 110 participants were considered for the study. Serum iron, serum ferritin, and pH levels were recorded. Thorough Intraoral Examination was carried out to evaluate DMFT/deft score to check presence of any decayed/missing/filled tooth. All the data was entered in a specially designed format by a principal investigator. **Results:** Mean Iron level was significantly higher ($p=0.011$) in participants with low DMFT (83.71 ± 35.47) compared to participants with high DMFT/deft (62.02 ± 40.21). Mean ferritin level was slightly higher in low DMFT (58.43 ± 30.35) compared to participants with high DMFT/deft (57.89 ± 28.05), the difference was found to be non-significant ($p=0.930$). In low DMFT/deft participants (6.51 ± 0.75), mean pH values with low DMFT/deft participants were highly significant ($p=0.001$) compared to high DMFT/deft participants (4.76 ± 0.52). **Conclusion:** There exists an inverse association between serum iron levels & dental caries; and no association between serum ferritin levels and dental caries.

Keywords: Dental caries, Iron deficiency anaemia, Serum iron, Serum ferritin, Salivary pH.

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INTRODUCTION

Dental caries is one of the children's most common unmet health needs that cause discomfort and pain. It can interfere with nutritional intake, including iron, which causes iron deficiency (ID) anaemia. Children with ID tend to fatigue easily and have a decreased appetite associated with irreversible cognitive and developmental delays.² ID is responsible for salivary function impairment, which in turn reduces salivary secretion, salivary flow-rate, and low buffering capacity. It has been argued that imbalances in the levels of free radicals, reactive oxygen species, and saliva antioxidants can play a significant role in the onset and development of dental caries. Serum ferritin level is an indicator of body iron stores and in infectious, inflammatory or malignant diseases, it can be normal or elevated. These conditions

could convert what would otherwise be a low ferritin level due to lack of iron into a normal range. Therefore, the low level of ferritin does not completely exclude iron deficiency. Additionally, iron ions precipitate as thin acid-resistant coatings on the enamel surface and adsorb the salivary calcium and phosphate ions to nucleate apatite formation, thereby replacing the minerals that are dissolved during the acid phases of apatite formation. The aim of the present study was to evaluate and compare the serum iron level, serum ferritin level, and salivary pH with dental caries in children with iron deficiency anemia.

METHODOLOGY

The present study was an observation based cross-sectional study. The present study was conducted at Department of Paedodontics and Preventive Dentistry, K.

M. Shah Dental College and Hospital, Piparia, Vadodara and Department of Pediatrics, Dhiraj General Hospital, Sumandeep Vidyapeeth, Piparia, Vadodara. The study protocol was approved by the ethical committee of the institution. Participants were informed about the study and prior written consent was taken. The final sample size for the present study was 110. Subject selection was made based on the inclusion and exclusion criteria. Children, both boys and girls, with iron deficiency anemia aged i.e., between 6 - 12 years and Hb level below 11.5 mg / dL as per World Health Organization 2011 were considered. However, children with iron deficiency & consuming any iron supplements, children with any congenital/ syndromic conditions, children who have suffered from any serious illness in the last 6 months, children from high fluoride belt, and children whose parents do not wish to give written consent were excluded from the study.

The study was conducted by recording hemoglobin %, serum iron and serum ferritin levels. After this, salivary pH of the participants was recorded. Participants were instructed to be in fasting state after breakfast for two hours and not to brush their teeth for 45 minutes before collecting the saliva sample.¹⁰ 1 ml of unstimulated saliva was collected in a small calibrated sterile container, by asking the participants to spit therein, to estimate the salivary pH level using a digital pH meter. The digital pH Meter was calibrated using 10 µl of 0.1 N hydrochloric acid, before being used on the salivary sample. In a further step, a thorough intraoral examination was conducted to evaluate the score of DMFT / deft to check the presence of any decayed/ missing / filled tooth using

mouth mirror, probe and tweezer in the presence of sufficient natural light. To achieve good visibility, excess saliva was removed from individual's mouth using cotton rolls. The data collected was assessed and entered in specially designed format by the principal investigator. Dental caries assessment was done by using DMFT/deft index.⁹

STATISTICAL ANALYSIS

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). The data was not found to be normal by Kolmogorov Smirnov test hence non parametric test was applied. For comparing mean values of iron level, ferritin level, haemoglobin and pH between low and high DMFT, Wilcoxon Ranksum test (intergroup comparison) was used for quantitative analysis. Level of significance was set at 0.05

RESULTS

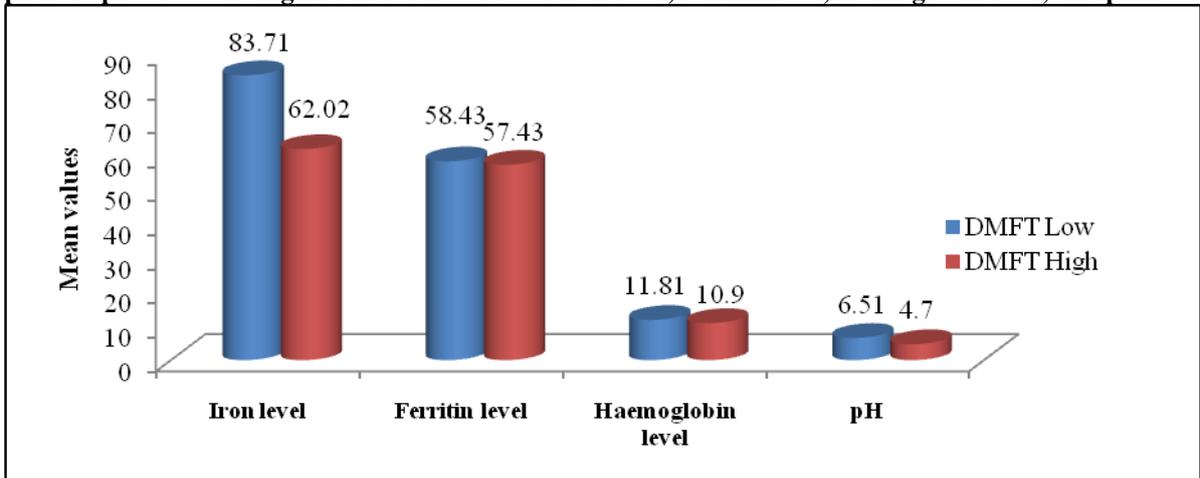
A total of 110 children aged between 6 - 12 years were examined, of which 65(59.1%) were males and 45(40.9%) were females sample size included 30 (27.3%) children in 6-8 years of age group, 45(40.90%) children belonged to 8-10 years age group, and 35(31.8%) children belonged to 10-12 years age group. The data was analysed by SPSS 20.0 software. The statistical significance was tested at p<0.05% level. The results obtained as per the objectives of the study, using various statistical tests, are illustrated in **Table 1** and **Graph 1**.

Table 1: Depicts a correlation between serum iron level, serum ferritin level, and salivary pH with dental caries (i.e., low and high DMFT/deft).

Variable	DMFT/deft	N	Mean	Std. deviation	Std. Error Mean	p-value
Iron level	Low	30	83.71	35.47	6.47	0.011*
	High	80	62.02	40.21	4.49	
Ferritin level	Low	30	58.43	30.35	5.54	0.930
	High	80	57.89	28.05	3.13	
pH	Low	30	6.51	0.75	0.13	0.001**
	High	80	4.76	0.52	0.05	

(Participants with a value of DMFT/deft ranging between 0-2 was considered "Low", Participants with a value of DMFT/deft >2 was considered "High")

Graph 1: Depicts low and high DMFT/deft values of iron level, ferritin level, haemoglobin level, and pH level.



(Applied test: Wilcoxon rank test; ** p value - 0.001 (highly significant), * p value - 0.05 (significant), and p value >0.05 (non - significant))

The mean level of iron in participants with low DMFT / deft (83.71 ± 35.47) values was found to be significantly higher ($p=0.011$) as compared to participants with high DMFT / deft (62.02 ± 40.21) values. The mean level of ferritin in low DMFT / deft was found to be slightly higher (58.43 ± 30.35) values as compared to participants with high DMFT / deft (57.89 ± 28.05) values, the difference was not significant (i.e., $p=0.930$). Similarly, the mean level of haemoglobin in participants with low DMFT / deft (11.81 ± 2.83) values was found to be higher as compared to participants with high DMFT / deft (10.90 ± 2.96) values; however, the results were found to be insignificant (i.e., $p=0.149$). The mean level of pH in participants with low DMFT/deft (6.51 ± 0.75) values was found to be highly significant (i.e., $p=0.001$) as compared to participants with high DMFT/deft (4.76 ± 0.52).

DISCUSSION

One of humanity's most common chronic disease is dental caries, which is a multifactorial and transmissible bacterial infection. Diet plays a critical role in this infection's development and clinical characteristics. In some developing countries, the prevalence of nutritional anaemia and dental caries is still high. Also, the prevalence of anaemia in young children in most parts of India and Asia continues to exceed 70 percent.¹ Still, as per the published literature available, not much research has been done in the field of nutritional iron status and its relationship with caries in children, particularly in India. The present study was therefore conducted to ascertain the relationship between serum iron and ferritin levels in children with dental caries.

It is well known fact that the relationship between haemoglobin level factor (Hb) and caries prevalence has already been investigated; however, there is an evidence that the relationship between the deft index and Hb levels is minimal. The assessment and investigation of haemoglobin levels in relation to the prevalence of dental caries was therefore thought to be an interesting phenomenon that needs to be studied if it existed. It has also been shown that dental caries can be regarded as an indirect factor for low haemoglobin levels.⁴ Studies have recently investigated the association of serum iron levels with early child caries (ECC) in children and have used various epidemiological methods to measure the prevalence of dental caries.

In the present study, it was observed that a patient with a higher serum iron level indicated a lower DMFT / deft score, which in turn indicated a lower incidence of dental caries; whereas, a patient with a lower serum iron level indicated a high DMFT / deft score, thereby indicating higher dental caries incidences. From this study, it can therefore be concluded that there exists an inverse relationship between the level of serum iron and dental caries. Similar results were obtained and reported in a 2012 study conducted by Sadeghi et al.⁸

It was further observed that no significant association exists between serum ferritin level and DMFT / deft scores. It can therefore be inferred that the level of serum ferritin cannot be used to predict dental caries. Similar results were obtained and reported in a study by Babu NSV et al study.¹

It was also observed that salivary pH was found to be highly significant ($p=0.001$) in the participants with high DMFT/deft scores that indicated highly acidic pH values (4.76 ± 0.52) as compared to the pH values (6.51 ± 0.75) found in the participants with low DMFT/deft scores. Similar results were obtained and reported in a study conducted by Mahantesha et al 2014.²

CONCLUSION

It was found that the salivary pH in the anaemic children is acidic due to which they are at a high risk of developing dental caries as well as deterioration of oral health; and there exists an inverse relationship between serum iron levels and dental caries and no relationship between serum ferritin levels and dental caries. It can be concluded that dentists and paediatricians need to be aware of the relationship between the dental caries and iron deficiency anaemia for treating their patients, accordingly. As this study was done on small sample size further studies on large sample population may give us more definitive results.

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