ORIGINAL ARTICLE
Journal of Science Technology Education Art and Medicine
DOI: 10.63137/jsteam.776215

Prevalence of Dental Caries and Its Association with Iron Supplements in School Children of Rawalpindi and Islamabad

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Received: 18 September 2025 / **Revised:** 05 November 2025 / **Accepted:** 22 November 2025 / **Available Online:** 15 December 2025

ABSTRACT

Objective: This study aimed to assess the prevalence of dental caries among school children aged 5 to 12 years using the decayed, missing, and filled teeth (dmft) index. It also aimed to investigate the relationship between dental caries and the use of iron supplements, as well as the impact of oral hygiene habits on caries prevention. Additionally, the study addresses the current knowledge gap regarding the potential link between iron supplementation and dental health, aiming to provide clarity for parents on the safe use of iron supplements in young children.
Methods: This cross-sectional study was conducted among 315 children aged 5-12 years in selected private and public schools in Rawalpindi and Islamabad. Data on iron supplement intake, oral hygiene practices, and dietary habits were collected using structured questionnaires administered to mothers/guardians, and clinical dental examinations were used to assess DMFT scores. Statistical analyses were performed using Jamovi software for bivariate and multivariate analyses to evaluate the predictive accuracy and determine the important variables.
Results: The sample size of this study was n = 315 children. Among the 315 children, 35.2% (n = 111) reported iron supplement intake, and 64.8% (n = 204) did not. There was no significant difference in the mean DMFT scores between the non-supplement and supplement groups, which were 2.170 ± 2.630 and 2.350 ± 2.650, respectively. Children aged 11–12 years had significantly lower DMFT scores than those aged 5–7 years ($\beta = -1.330$, $p = 0.003$), whereas the 8–10 year group did not differ significantly from the reference group ($p = 0.157$). Balanced, healthy, and protein diets were correlated with lower DMFT scores than processed/sugary diets. No significant interactions were observed between age and iron supplementation.
Conclusion: The findings showed that iron supplementation was not significantly associated with an increased risk of dental caries in children; however, the cross-sectional design and limited statistical power preclude causal conclusions. Age and dietary habits were more strongly linked to caries prevalence.
Keywords: Child; Dental caries; Dietary habits; Iron; Oral hygiene

Citation: Aamir A, Nisar A, Fatima T, Tahir M, Saeed M, Ashraf J. Prevalence of Dental Caries and Its Association with Iron Supplements in School Children of Rawalpindi and Islamabad. J Sci Technol Educ Art Med. 2025;2(2):41-50

Introduction

Dental caries is one of the most prevalent chronic conditions globally, affecting an estimated 60–90% of school-aged children, and remains a leading cause of pain, infection, and tooth loss in childhood. [1] It is not merely a dental issue but a significant public health burden with implications for general health, quality of life, and academic performance. The disease is multifactorial, linked to cariogenic diets, inadequate oral hygiene, microbial colonization, and socio-behavioral determinants, yet disproportionately affects children in low- and middle-income countries (LMICs), where preventive infrastructure is often underdeveloped and access to dental care is limited. [2] In Pakistan, the prevalence of dental caries among children remains alarmingly high, as recent systematic reviews estimate caries rates between 50–70%, with wide disparities based on geography, school type, and parental education. [3] These patterns signal a need to examine less-studied, systemic contributors that may be compounding this persistent burden.

One such systemic factor is iron supplementation, a common pediatric intervention endorsed by global and national health authorities for the prevention and treatment of iron-deficiency anemia (IDA). IDA affects approximately 42% of children under five worldwide, with even higher rates in South Asia, making iron supplements a cornerstone of pediatric health strategies in LMICs. [4] Iron is essential for neurodevelopment, immunity, and cellular function, and its supplementation has well-documented benefits on cognitive and physical growth. However, despite its biomedical value, concerns about iron's potential adverse effects on oral health, particularly the development or progression of dental caries, remain underexplored and poorly understood. [5]

Emerging hypotheses suggest that iron formulations, particularly in liquid or chewable forms, may contribute to changes in oral pH, promote tooth surface staining, and possibly facilitate plaque accumulation, especially in children with suboptimal oral hygiene. [6] Moreover, iron compounds may serve as a substrate for certain acidogenic bacteria, further exacerbating caries risk. Conversely, other studies suggest iron may have inhibitory effects on cariogenic microorganisms, thereby offering a protective effect. [7] These conflicting findings underscore a lack of scientific consensus. For instance, studies reported no significant impact of iron supplementation on caries in a small pediatric cohort, whereas in vitro studies have noted iron-induced enamel erosion under certain conditions. [5] The paucity of large-scale, community-based studies leaves clinicians and caregivers with insufficient guidance, especially when making therapeutic decisions in populations already burdened by dental disease.

The knowledge gap is even more pronounced in the Pakistani context. Despite widespread use of iron supplementation in school-aged children, often initiated without dental consultation, minimal empirical data evaluate whether such supplementation interacts with caries risk. Furthermore, public health messaging seldom addresses oral hygiene measures specifically tailored to iron use, leaving parents unaware of any potential oral side effects. Given the high background prevalence of caries, frequent iron supplementation, and dietary patterns high in refined sugars, Pakistani children may be at unique risk if a synergistic effect exists between these factors. Therefore, an evidence-based understanding of this potential association is both timely and clinically meaningful.

In this context, the current study seeks to assess the prevalence of dental caries among children aged 5–12 years in Rawalpindi and Islamabad and to investigate its association with iron supplementation status using the decayed, missing, and filled teeth (DMFT) index.

Materials and Methods

Study Design and Settings

This was a cross-sectional epidemiological study conducted from July to September 2025 in selected public and private primary schools across Rawalpindi and Islamabad, Pakistan. The study was designed to assess both the prevalence of dental caries and its potential association with iron supplement use among school-aged children in a representative urban cohort. Schools were selected to ensure inclusion of children from a range of socioeconomic backgrounds, enhancing the external validity of findings.

Study Population

The target population included children aged 5 to 12 years enrolled in the selected schools. Inclusion criteria were children within the defined age range whose parents or guardians provided written informed consent. Children with diagnosed systemic diseases, congenital dental anomalies, or those undergoing orthodontic treatment were excluded to minimize confounding effects on oral health outcomes.

Sampling and Sample Size Calculation

A total of 315 children were enrolled using a convenience sampling approach from selected schools, which limits the generalizability of findings to the broader population. No priori sample size calculation was performed, which is acknowledged as a limitation. Post-hoc power analysis was conducted using G*Power version 3.1.9.7 for the primary comparison of DMFT scores between iron supplement users (n = 111) and non-users (n = 204). Given the observed effect size of d = 0.07 and $\alpha = 0.05$ (two-tailed), the achieved statistical power was 0.09. The minimum detectable effect size at 80% power for the current sample was d = 0.32. These values indicate that the study was insufficiently powered to detect small differences in DMFT scores between groups, and null findings should be interpreted with this constraint in mind. [8]

Data Collection Procedures

Data were obtained using a structured, interviewer-administered questionnaire completed by the child's mother or legal guardian. The questionnaire was developed in consultation with oral health experts and pre-tested in a pilot group of 15 participants to ensure clarity and face validity. It collected information on demographic characteristics, oral hygiene practices, dietary habits, and iron supplementation. Although the tool was not formally validated against an external criterion, its structure and content were aligned with existing surveys used in pediatric oral health research.

Iron supplementation data included frequency of intake (daily, weekly, monthly, or rarely), formulation type (liquid, chewable, or combination), and maternal reports of perceived side effects such as dental discoloration or complaints. Mothers were asked to recall iron supplement use within the preceding six months. Verification through prescriptions or packaging was not performed due to logistical constraints, and this is acknowledged as a study limitation.

Clinical Assessment

Clinical dental examinations were performed at the school premises under natural daylight by trained third-year dental students under the supervision of senior dentists. Oral health status was evaluated using the Decayed, Missing, and Filled Teeth (DMFT) index, in accordance with the World Health Organization's Oral Health Surveys: Basic Methods (5th edition). Due to limited field resources, sterilized disposable wooden spatulas were used for oral examination in lieu of standard dental mirrors and explorers. This approach, while enabling consistent examination conditions across all participants, reduces diagnostic sensitivity, particularly for detecting incipient or interproximal caries that are not visible under direct inspection. Consequently, the reported DMFT scores may represent an underestimate of true caries prevalence. Importantly, any resulting misclassification would be non-differential (i.e., equally affecting both supplement users and non-users), which would bias the primary association toward the null rather than creating a spurious association. This limitation should be considered when interpreting the absolute caries prevalence figures, though it is less likely to affect the comparative analyses.

Variable Definitions

Dental caries was quantified using cumulative DMFT scores and individual components (decayed, missing, and filled teeth). For children with mixed dentition (ages 5–10), both primary and permanent teeth were assessed. The dmft index (lowercase, for deciduous teeth) and DMFT index (uppercase, for permanent teeth) were recorded separately and summed to produce a combined caries experience score (dmft + DMFT), hereafter referred to as the total DMFT score for simplicity. The combined dmft + DMFT score was used as a proxy for total caries experience; however, this approach may overestimate comparability across dentition stages. Oral hygiene behavior was categorized based on reported brushing frequency (none, once, twice, or thrice daily), flossing habits (none, once, or twice daily), and frequency of dental visits (regular, occasional, or rare). Dietary habits were grouped as balanced/varied, fruits and vegetables, processed/sugary, or other. Iron supplement intake was defined based on both self-reported frequency and formulation, as described above.

Training and Calibration

Five junior dental examiners were trained and calibrated under the guidance of a senior investigator to ensure consistency in caries detection. A calibration exercise was conducted on 30 children who were independently examined by all five examiners and the senior investigator. Inter-examiner reliability was assessed using Cohen's kappa (κ), yielding a value of 0.82 (95% CI: 0.76 – 0.88). Reliability of the questionnaire components showed acceptable internal consistency, with a Cronbach's alpha value of 0.70.

Statistical Analysis

Data entry and cleaning were performed using Microsoft Excel 2019, and statistical analyses were conducted using Jamovi version 2.4. Descriptive statistics summarized participant demographics and oral health characteristics. Bivariate associations between iron supplement intake and dental caries were examined using Chi-square tests for categorical variables, and Mann–Whitney U tests for non-normally distributed continuous variables. Multivariable linear regression was used to identify independent predictors of DMFT scores, adjusting for key covariates including age, sex, dietary patterns, and oral hygiene behaviors. Normality of continuous variables (DMFT scores) was assessed using the Shapiro-Wilk test, supplemented by visual inspection of Q-Q plots and histograms. DMFT scores were significantly non-normally distributed (Shapiro-Wilk $W = 0.84$, $p < 0.001$), as expected for count data with a floor effect at zero. Statistical significance was established at a p-value less than 0.05. Categorical predictors were entered into the regression model using dummy coding. Reference categories were selected based on clinical relevance: iron supplement intake = No; age = 5–7 years (youngest group); frequency of intake = Rarely; dietary habits = Mostly processed/sugary (highest-risk category). This coding scheme allows interpretation of regression coefficients as the difference in mean DMFT scores relative to the reference group. All reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to enhance transparency and reproducibility.

Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of the Islamic International Dental Hospital, Riphah International University (Ref. No: IIDC/IRC/2025/007/007). Written informed consent was obtained from all participating children's parents or legal guardians. Data confidentiality was strictly maintained, and participation was entirely voluntary.

Results

Descriptive Statistics

The demographics of the study population based on iron supplement intake are shown in Table 1. A total of 315 children were assessed. Iron supplement intake was significantly associated with age group ($p = 0.004$), school class ($p < 0.001$), and gender ($p < 0.001$), but not with maternal education level ($p = 0.068$) (Table 1).

Bivariate

The confounder and predictor variables related to iron supplement intake are presented in Table 2. Iron supplement intake was strongly associated with its form and frequency, whereas no significant association was observed with tooth brushing frequency and dietary habits.

Primary Analysis

The distribution of DMFT scores according to iron supplement intake is shown in Figure 1. There was no significant difference in the mean DMFT scores between the non-supplement and supplement groups, which were 2.17 ± 2.63 and 2.35 ± 2.65, respectively. The DMFT scores assessed through their median and interquartile ranges were almost similar (statistically non-significant) between those taking iron supplements and those not taking iron supplements.

Multivariate Analysis

Iron supplement intake was not significantly associated with the DMFT score. Among the age groups, the 11–12 years category had significantly lower DMFT scores than the 5–7 years reference group. Dietary habits demonstrated strong associations, with all categories except spicy food showing significantly lower DMFT scores than the mostly processed/sugary diet reference group (Table 3)

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Table 1: Demographic characteristics of study population by iron supplement intake status (n=315)

Variable	Category	No (n, %)	Yes (n, %)	Total (n)	p-value
Age Category	5–7 Years	95 (57.9%)	69 (42.1%)	164	0.004
	8–10 Years	71 (67%)	35 (33%)	106	
	11–12 Years	38 (84.4%)	7 (15.6%)	45	
Class	Prep	58 (48.7%)	61 (51.3%)	119	<0.001
	One	17 (60.7%)	11 (39.3%)	28	
	Two	46 (80.7%)	11 (19.3%)	57	
	Three	31 (79.5%)	8 (20.5%)	39	
	Five	6 (40%)	9 (60%)	15	
	Seven	9 (69.2%)	4 (30.8%)	13	
	Six	35 (89.7%)	4 (10.3%)	39	
	Four	2 (100%)	0 (0%)	2	
	Eight	2 (66.7%)	1 (33.3%)	3	
Gender	Female	155 (72.8%)	58 (27.2%)	213	<0.001
	Male	49 (48%)	53 (52%)	102	
Mother's Education	Matric	64 (75.3%)	21 (24.7%)	85	0.068
	Undergraduate	71 (60.7%)	46 (39.3%)	117	
	Postgraduate	69 (61.1%)	44 (38.9%)	113	

† Values are presented as numbers and percentages.

Table 2: Bivariate analysis of confounders and predictors by iron supplement intake status (n=315)

Variable	Categories	Iron supplements intake (yes) (n, %)	Iron supplements intake (no) (n, %)	p-value
Iron supplement frequency	Yes	111 (35.2%)	204 (64.8%)	< 0.001
	No	0 (0%)	204 (64.8%)	
Form of Supplement	Liquid	91 (82%)	0 (0%)	< 0.001
	Chewable	15 (13.5%)	0 (0%)	
	Liquid + Chewable	4 (3.6%)	1 (0.5%)	
	Not Applicable	1 (0.9%)	203 (99.5%)	
Dietary Habits	Balanced and varied	51 (45.9%)	98 (48%)	0.180
	Fruits/Vegetables	12 (10.8%)	11 (5.4%)	
	Mostly Processed/Sugary	13 (11.7%)	40 (19.6%)	
	Healthy	18 (16.2%)	38 (18.6%)	
	Other	17 (15.3%)	17 (8.4%)	
Tooth Brushing Frequency	Nil	2 (1.8%)	4 (2%)	0.868
	Once Daily	61 (55%)	102 (50%)	
	Twice Daily	41 (36.9%)	83 (40.7%)	
	Thrice Daily	7 (6.3%)	15 (7.4%)	
Flossing Frequency	Does not Floss	94 (84.7%)	191 (93.6%)	0.035
	Once Daily	12 (10.8%)	9 (4.4%)	
	Twice Daily	5 (4.5%)	4 (2%)	

† Values are presented as numbers and percentages.

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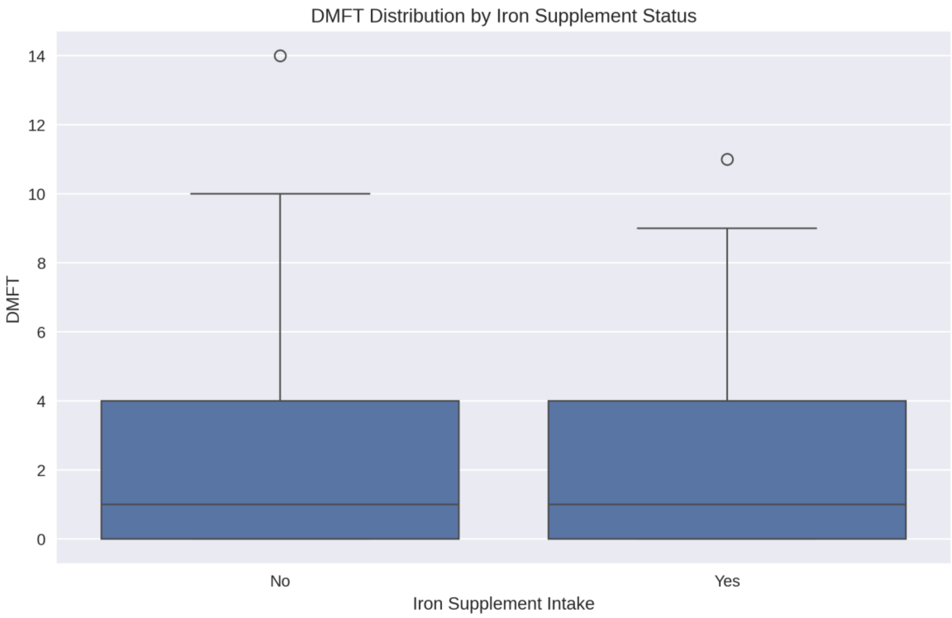

Figure 1: Box plots comparing total caries experience scores (dmft + DMFT) between iron supplement users (n = 111) and non-users (n = 204). Boxes represent the interquartile range (IQR), horizontal lines indicate the median, whiskers extend to 1.5 × IQR, and hollow circles denote outliers. No statistically significant difference was observed between groups (adjusted p = 0.381; Table 3)

Table 3: **Multivariate linear regression analysis predicting DMFT scores by iron supplement intake, age, frequency of iron supplement intake, and dietary habits**

Predictor	Estimate	SE	t	p-value
Intercept[a]	8.594	2.689	3.196	0.002
Iron Supplement Intake				
Yes – No	-2.244	2.559	-0.877	0.381
Age categories				
8-10 Years – 5-7 Years	-0.470	0.331	-1.420	0.157
11-12 Years – 5-7 Years	-1.330	0.449	-2.960	0.003
Frequency of iron supplement intake				
Daily – Rarely	-0.382	0.585	-0.654	0.514
Weekly – Rarely	-0.853	1.511	-0.564	0.573
Monthly – Rarely	-0.080	0.682	-0.117	0.907
Not applicable – Rarely	-2.416	2.585	-0.934	0.351
Dietary habits				
Balanced and varied – Processed	-3.470	0.832	-4.169	<.001
Fruits/vegetables – Processed	-4.415	0.962	-4.588	<.001
Healthy – Processed	-3.760	0.876	-4.290	<.001
Meat – Processed	-3.829	1.391	-2.753	0.006
Mostly processed or sugary – Processed	-3.465	0.888	-3.902	<.001
Protein sources/meat – Processed	-4.828	1.074	-4.497	<.001
Protein sources/meat and fruits/vegetables – Processed	-5.257	1.403	-3.747	<.001
Spicy food – Processed	-4.880	2.674	-1.825	0.069

[a]Represents reference level (The relatively high intercept reflects the predicted DMFT score for the highest-

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risk reference category)
† Abbreviations: SE, standard error; DMFT, decayed, missing, and filled teeth. Reference categories: iron supplement intake = No; age = 5–7 years; frequency of iron supplement intake = Rarely; dietary habits = Mostly processed/sugary. The intercept represents the predicted DMFT score for the reference profile (i.e., a child aged 5–7 years, not taking iron supplements, with rare supplement frequency, consuming a mostly processed/sugary diet).

Age-stratified Analysis

Figure 2 shows the DMFT scores stratified by age group and iron supplement intake. No significant interactions were observed between age and iron supplementation. The DMFT scores, assessed through their medians and interquartile ranges, were similar between participants taking iron supplements and those not taking them, showing no statistically significant difference. Hollow circles represent outliers of the DMFT scores within the sample.

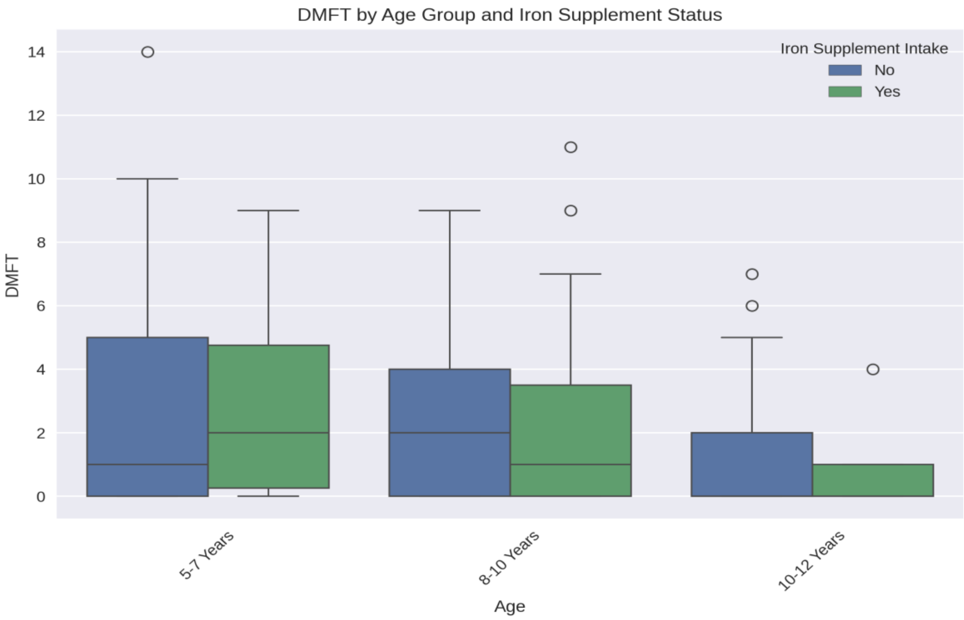

Figure 2: **Box plots of total caries experience scores (dmft + DMFT) stratified by age group and iron supplement intake status. Subgroup sample sizes: 5–7 years (No: n = 95, Yes: n = 69); 8–10 years (No: n = 71, Yes: n = 35); 11–12 years (No: n = 38, Yes: n = 7). Box plot elements as defined in Figure 1. No significant age × supplementation interaction was observed**

Component Analysis of DMFT (D, M, F)

To further elucidate the relationship between iron supplement intake and dental health, the individual components of the DMFT index, decayed (D), missing (M), and filled (F) teeth, were analyzed separately (Table 4). The results showed minimal differences in the mean values of each component between iron supplement users and non-users, indicating that iron supplementation does not significantly impact any specific aspect of dental health, as measured by the DMFT index.

Table 4: Component-wise analysis of DMFT (D, M, F) by iron supplement intake status

Iron Supplement	D Mean ± SD	M Mean ± SD	F Mean ± SD
No	2.09 ± 2.54	0.12 ± 0.49	0.01 ± 0.1
Yes	2.28 ± 2.56	0.06 ± 0.27	0.03 ± 0.17

† Values are presented as mean ± standard deviation (SD).

Discussion

The present study explored the relationship between iron supplementation and dental caries in school-aged children from urban Pakistan and found no statistically significant association between iron intake and DMFT scores. These findings hold considerable importance in pediatric dentistry and public health nutrition, particularly in low- and middle-income countries (LMICs) where both iron deficiency anemia and dental caries represent critical yet intersecting child health challenges. The absence of a statistically significant association between iron supplement use and DMFT scores in this sample is consistent with prior research and provides preliminary evidence that iron supplementation may not adversely affect dental health in school-aged children, though this interpretation must be tempered by the study's limited statistical power.

The results align with prior research, which similarly reported no harmful impact of iron-containing supplements on primary dentition in a smaller pediatric cohort. [9] This finding is further supported by Velliyagounder et al., who concluded that although iron deficiency anemia has known associations with oral health complications, therapeutic iron supplementation does not independently contribute to caries development in pediatric populations. [5] In a separate clinical study by Atri et al., involving Indian children aged 4–10 years, no significant increase in caries prevalence was observed among those receiving ferrous sulfate compared to non-users, even when controlling for brushing frequency and sugar intake. [10] Moreover, a cross-sectional investigation conducted in Brazil also found no correlation between systemic iron supplementation and increased DMFT scores among preschool children, emphasizing that socioeconomic and dietary variables were more predictive of oral health outcomes. [11] While in vitro studies have raised concerns regarding enamel erosion or discoloration associated with certain iron formulations, the in vivo relevance of such effects remains questionable in real-world settings where multiple biological and behavioral moderators are at play. For instance, the buffering capacity of saliva, the timing of oral hygiene practices, and concurrent food intake can mitigate potential erosive impacts of supplements. Therefore, the cumulative clinical evidence suggests that the hypothesized cariogenic or erosive potential of iron is likely overstated in laboratory contexts and not substantiated by epidemiological findings in diverse pediatric populations.

Notably, in our study, the strongest predictors of caries experience were age and dietary habits, factors that are biologically more plausible drivers of oral health outcomes than iron alone. For instance, younger children showed significantly higher caries prevalence, which is consistent with existing literature suggesting immature enamel, poor manual dexterity, and limited dental care access may compound early-life vulnerability to dental disease. These findings are further supported by other studies, which also demonstrated higher DMFT scores in younger age groups, reinforcing the critical need for preventive measures targeted at early childhood. [12] This may be due to immature enamel, suboptimal oral hygiene practices, and greater exposure to cariogenic feeding behaviors during early childhood. Diet emerged as a particularly potent variable in our model, with processed and sugary food consumption strongly linked to higher DMFT scores. These findings are in concordance with recent large-scale studies, such as Cheever et al., which highlighted a robust correlation between free sugar intake and caries among U.S. children. [13] This association likely reflects both the frequency and form of sugar exposure, as sticky and retentive snacks prolong acid attacks on tooth surfaces. Such results emphasize that dietary composition remains a principal modifiable risk factor, overshadowing the effect of micronutrient supplementation on oral outcomes. In addition, the role of maternal education and socioeconomic status as background modifiers of children's oral hygiene behaviors, as shown in this study and others such as Zhang et al. and Chang et al., further supports the integration of parent-focused educational interventions within broader oral health strategies. [14, 15]

From a clinical and policy perspective, these results provide reassurance to pediatricians, dentists, and public health professionals that iron supplementation, when medically indicated, can be prescribed without heightened concern for caries development. This is especially relevant in LMICs like Pakistan, where iron deficiency remains widespread and access to dental services is limited. Our findings are consistent with a growing body of evidence suggesting that clinical and public health efforts may be more productively directed toward oral hygiene education, school-based fluoride programs, and dietary interventions, rather than restricting iron supplementation on the basis of unsubstantiated oral health concerns. For caregivers and school health personnel, the message is clear: dental caries prevention should prioritize oral hygiene routines and healthy eating, not avoiding essential micronutrients.

Nonetheless, the study's limitations warrant careful consideration. First, as a cross-sectional analysis, causal inferences cannot be made. The reliance on self-reported data, particularly regarding iron supplementation and oral hygiene practices, introduces potential recall and social desirability biases. The use of non-standard diagnostic tools, such as sterilized wooden spatulas in lieu of dental explorers or mirrors, may have limited diagnostic sensitivity, possibly underestimating true caries prevalence. Additionally, the geographic confinement to Rawalpindi and Islamabad may limit generalizability to rural or underserved populations with distinct dietary habits and healthcare access. While the sample size was relatively robust, future studies should include statistical power calculations to optimize effect detection, particularly for subtle associations. Furthermore, the study did not distinguish between primary (dmft) and permanent (DMFT) dentition in the mixed-dentition age group, which may have affected caries prevalence estimates in younger children. The absence of an a priori power calculation limits our ability to rule out a small but clinically meaningful association between iron supplementation and dental caries; the observed null finding may reflect insufficient statistical power rather than a true absence of effect.

To build on these findings, longitudinal studies with validated diagnostic instruments and objective supplement verification are essential. Future research should explore younger and more diverse populations, including malnourished or rural children, where both dietary and environmental influences may differ markedly. Mechanistic investigations into the interaction between iron formulations and oral microbiota, salivary pH, and enamel demineralization could further clarify the biological neutrality or potential protective effects of iron in the oral environment.

Conclusion

In conclusion, this cross-sectional study found no statistically significant association between iron supplementation and dental caries among school-aged children in Rawalpindi and Islamabad. Age and dietary habits, rather than iron supplement use, were the strongest predictors of DMFT scores. While these findings provide preliminary reassurance regarding the oral health safety of iron supplementation in pediatric populations, the cross-sectional design, convenience sampling, and limited statistical power preclude definitive causal conclusions. Longitudinal studies with adequate sample sizes, validated diagnostic instruments, and objective verification of supplement intake are needed to confirm these findings. In the interim, clinical and public health efforts should continue to prioritize oral hygiene education and dietary interventions as the primary modifiable determinants of childhood dental caries.

Acknowledgments

None.

Author Contribution

AA conceived the research idea and drafted the introduction and references. AA played a role in developing the questionnaire and participated in data collection. AN participated in data collection, data entry, drafting the discussion and questionnaire, gathering references for the discussion and conclusion sections, formatting the manuscript according to journal guidelines, and obtaining ethical approval for the research. TF performed data analyses, drafted the results under the guidance of JA, and participated in data collection. MS participated in data collection, data entry, minor analysis, and drafting of the abstract. MT participated in data collection and drafted the methodology, discussion, and ethical approval of the research. JA supervised, reviewed, and finalized the manuscript.

Funding

No external funding was received for this study.

Conflict of Interest

The authors declare no conflicts of interest.

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