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ORIGINAL ARTICLE

Frequency of iron deficiency anemia in children presenting with helicobacter pylori infection at a Tertiary Care Hospital, Karachi, Pakistan.

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ABSTRACT… Objective: To determine the frequency of iron deficiency anemia (IDA) in children presenting with Helicobacter pylori (H. pylori) infection at a Tertiary Care Hospital, Karachi, Pakistan. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatrics, Memon Medical Institute Hospital, Karachi, Pakistan. **Period:** April 2024 to September 2024. **Methods:** A total of 184 children of either gender, aged 2-14 years, and presenting with H. pylori were analyzed. Brief history including symptoms of the disease were taken along with demographic data which included parent's information (educational status and socioeconomic status). IDA was labeled as hemoglobin<11 g/dl, serum ferritin<10 ng/ml and transferrin saturation< 12%. Data were analyzed using IBM-SPSS version 26.0. **Results:** In this study of 184 children, 97 (52.7%) were male and 87 (47.3%) female. The mean age was 7.78±3.40 years. There were 65 (35.3%) children who had pallor, 50 (27.2%) fatigue, 37 (20.1%) difficulty concentrating at school, and 31 (16.8%) presented with headache. IDA was identified in 88 (47.8%) children. IDA was significantly associated with pallor (p<0.001), fatigue (p<0.001), headache (p<0.001), atrophic glossitis (p<0.001), dry hair (p=0.001), and koilonychia (p=0.029). Employed mothers were more likely to have children with IDA (28.4% vs. 6.3%, p<0.001), and children with mothers who were illiterate or had only primary education had higher IDA rates (p<0.001). Low family income was also significantly associated with IDA (79.5% vs. 35.0%, p<0.001). **Conclusion:** High prevalence of IDA was observed among children with H. pylori infection. Maternal employment, lower maternal education, and low family income were identified as key associated factors.

Key words: Education, Employment, Family Income, Helicobacter Pylori, Iron Deficiency.

INTRODUCTION

Helicobacter pylori (H. pylori) is a persistent bacterial infection that remains widespread globally, with an especially high prevalence in developing nations. Estimates suggest that approximately 50% of individuals in these regions harbor the infection.[1] Epidemiological records have revealed that around 80% of H. pylori infected patients remain asymptomatic, although, gastritis potentially leads to severe complications with notable morbidity and mortality.[2,3] The most common symptoms among H. pylori infected patients could be abdominal discomfort, nausea, vomiting, or dyspepsia, and usually exhibit in the form of gastritis or peptic ulcers.[2] Investigating underlying cause could yield useful diagnostic and treatment related effects among children with H. pylori infection.[2] Age, geographical affiliation, and socioeconomic factors are known to influence the prevalence of H. pylori, although, the burden of H. pylori remains significant among developing countries.[1] If not eradicated timely, the H. pylori infection may persist and cause significant morbidity and mortality.[4]

Iron deficiency is a major global health concern estimated to affect around 1.6 billion people, equivalent to nearly 25% of the global population.[5] Among children and adolescents, H. pylori-associated iron deficiency anemia (IDA) is suspected to be particularly prevalent. The development and severity of H. pylori-related IDA are believed to be influenced by multiple factors, including bacterial virulence, environmental conditions, and host-specific genetic and immunological responses.[6]

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Epidemiological data indicate that regions with a high prevalence of iron deficiency anemia often also have a substantial burden of H. pylori infection.[7] This bacterium can impair iron absorption and increase iron demands in affected individuals. Gastric hypoacidity resulting from pan gastritis and reduced ascorbic acid levels in the stomach of H. pylori infected individuals may hinder iron uptake in the duodenum. Elevated lactoferrin in gastric mucosa have been revealed in individuals infected with H. pylori, suggesting a potential link between increased lactoferrin sequestration and altered iron metabolism.[8]

Children are particularly susceptible to IDA due to their relatively higher needs for iron especially in the early years of life which is considered to be the rapid growth period. However, data on the prevalence of IDA in children with H. pylori infection remain limited. There is also scarcity of research on this association in the local Pakistani population. Findings from this study could help healthcare professionals identify children at higher risk of developing IDA as a consequence of H. pylori infection, ultimately guiding improved diagnostic and treatment strategies. This study was aimed to determine the frequency of IDA in children presenting with H pylori infection.

METHODS

This cross-sectional study was performed at the department of Pediatrics, Memon Medical Institute Hospital, Karachi, Pakistan during April 2024 to September 2024. Approval from Institutional Review Board (IRB/MMIH/2023/24, dated: 08-11-2023) was obtained. A sample size of 184 was calculated using the online OpenEpi sample size calculator considering the prevalence of IDA in H. pylori as 37.5%[9], with 7% margin of error, and 95% confidence level. Inclusion criteria were children aged 2-14 years, and presenting with H. pylori. Exclusion criteria were history of malnutrition, congenital anomalies, sickle cell anemia, thalassemia, hemophilia, leukemia or lymphoma. H. pylori infection was labeled on the basis of positive H. pylori stool antigen test. Non-probability consecutive sampling technique was applied.

Patients fulfilling the eligibility criteria were enrolled. Written as well as informed consents were obtained from parents/guardians. Brief history including symptoms of the disease were taken along with demographic data which included parent's information (educational status and socioeconomic status). Monthly family income was labeled as low, middle, and high as PKR < 30,000, between PKR 30,000 to 60,000, and > PKR 60,000, respectively. The blood sample was sent to the institutional laboratory for iron profile. IDA was defined as Hb under 11 g/dl, serum ferritin <10 ng/ml and transferrin saturation < 12%.[10] Common Signs and symptoms of IDA were documented on the basis of physical and clinical evaluation. All the information was recorded on a proforma especially designed for this study.

Data was analyzed using "IBM-SPSS Statistics, version 26.0". Qualitative data like gender, place of residence, maternal educational status, family's monthly income status, maternal occupational status, and IDA (yes/no) were represented as frequency and percentages. Mean and standard deviation (SD) were reported for continuous data. Effect modifiers like age, gender, place of residence, maternal educational status, family month income status, and maternal occupational status were controlled through stratification to see the effect of these on the outcome variable (frequency of IDA). Post-stratification, chi square test or Fischer's exact test were applied, taking $p<0.05$ as significant.

RESULTS

In this study of 184 children, 97 (52.7%) were male and 87 (47.3%) female. The mean age was 7.78±3.40 years. There were 117 (63.6%) children who belonged to urban areas. Maternal employment was noted in 31 (16.8%) cases. Regarding maternal education, 39 (21.2%) were illiterate. Monthly family income was low in 94 (51.1%) families (Table-I).

Overall, pallor, fatigue, difficulty in concentrating, and headache were the most common signs and symptoms reported in 65 (35.3%), 50 (27.2%), 37 (20.1%), and 31 (16.8%) children, respectively.

The mean Hb, serum ferritin, and transferrin saturation were 10.90±2.07 g/dl, 8.44±1.97 ng/dl, and 11.04±2.01 %, respectively. IDA was identified in 88 (47.8%) children. IDA was significantly associated with pallor (p<0.001), fatigue (p<0.001), headache (p<0.001), atrophic glossitis (p<0.001), dry hair (p=0.001), and koilonychia (p=0.029) (Table-II).

Characteristics		Frequency (%)
Gender	Male	97 (52.7%)
	Female	87 (47.3%)
Age (years)	2-5	52 (28.3%)
	6-9	74 (40.2%)
	10-14	58 (31.5%)
Residence	Urban	117 (63.6%)
	Rural	67 (36.4%)
Maternal occupation	Employed	31 (16.8%)
	Unemployed	153 (83.2%)
Maternal education	Illiterate	39 (21/2%)
	Primary	56 (30.4%)
	Secondary	54 (29.3%)
	Matriculation or above	35 (19.0%)
Monthly family income	Low	94 (51.1%)
	Middle	61 (33.2%)
	High	29 (15.8%)

Table-I. Characteristics of children (n=184)

Employed mothers were more likely to have children with IDA (28.4% vs. 6.3%, p<0.001), and children with mothers who were illiterate or had only primary education had higher IDA rates (p<0.001). Low family income was also significantly linked with IDA (79.5% vs. 35.0%, p<0.001). Other demographics did not show significant associations with IDA (Table-III).

DISCUSSION

It was found that 47.8% of the children with H. pylori infection had IDA. A study from Alaska, USA noted a 38% prevalence of IDA among school-aged children with high rates of H. pylori, with 91% of iron-deficient children testing positive for active H. pylori by urea breath test.[11] These findings support the role of H. pylori as a significant factor in IDA in pediatric populations. A study from Romania (n=542) analyzing children with confirmed H. pylori infection found that 14.5% had IDA along with microcytic hypochromic anemia, indicating a relationship between the infection and reduced iron stores.[12] In contrast, Haghi-Ashtiani et al, from Iran, evaluating children with H. pylori documented that only 19% presented with IDA (p>0.05).[13] This discrepancy could be attributed to regional differences in dietary practices, healthcare access, and the prevalence of other IDA risk factors, including socioeconomic factors. The Iranian study's findings suggest that, in some populations, H. pylori alone may not account for IDA without the compounding influence of other risk factors.[14] Our results are also consistent with findings from Ethiopia, where an association was identified between early childhood H. pylori infection and anemia with infected children showing significantly reduced hemoglobin and red cell indices.[15] This consistency across diverse settings indicates that the combined impact of H. pylori infection and socioeconomic challenges could create a high-risk scenario for IDA.

Sign and Symptoms	Total (%)	Iron Deficiency Anemia		P-Value
		Yes (n=88)	No (n=96)	
Pallor	65 (35.3%)	57 (64.8%)	8 (8.3%)	<0.001
Fatigue	50 (27.2%)	41 (46 6%)	9 (9.3%)	<0.001
Difficulty concentrating	37 (20.1%)	23 (26.1%)	14 (14.6%)	0.050
Headache	31 (16.8%)	25 (28.4%)	6 (6.3%)	<0.001
Atrophic Glossitis	25 (13.6%)	21 (23.9%)	4 (4.2%)	<0.001
Dry hair	21 (11.4%)	17 (19.3%)	4 (4.2%)	0.001
Koilonychia	18 (9.8%)	13 (14.8%)	5 (5.2%)	0.029

Table-II. Comparison of the frequency of sign and symptoms with respect to iron deficiency anemia (N=184)

Characteristics		Iron Deficiency Anemia		P-Value
		Yes (n=88)	No (n=96)	
Gender	Male	50 (56.8%)	47 (49.0%)	0.286
	Female	38 (43.2%)	49 (51.0%)	
Age (years)	2-5	25 (28.4%)	27 (28.1%)	0.259
	6-9	40 (45.5%)	34 (35.4%)	
	10-14	23 (26.1%)	35 (36.5%)	
Residence	Urban	55 (62.5%)	62 (64.6%)	0.769
	Rural	33 (27.5%)	34 (35.4%)	
Maternal occupation	Employed	25 (28.4%)	6 (6.3%)	<0.001
	Unemployed	63 (71.6%)	90 (93.8%)	
Maternal education	Illiterate	30 (34.1%)	9 (9.4%)	<0.001
	Primary	30 (34.1%)	26 (27.1%)	
	Secondary	18 (20.5%)	36 (37.5%)	
	Matriculation or above	10 (11.4%)	25 (26.0%)	
Monthly family income	Low	70 (79.5%)	24 (35.0%)	<0.001
	Middle	15 (17.0%)	46 (47.9%)	
	High	3 (3.4%)	26 (27.1%)	

Table-III. Comparison of IDA with socio-demographic factors (N=184)

A multicenter study from Latin America and the United Kingdom showed that H. pylori infection was related with reduced serum ferritin and hemoglobin in children, especially in Latin America, where H. pylori infection rates were as high as 35%.[16] Their study also proposed that H. pylori related inflammation in the gastric and duodenal mucosa could impair iron absorption, contributing to IDA.[16]

Our findings on the relationship between maternal employment and increased IDA rates in children (28.4% vs. 6.3%, $p<0.001$) suggests that employed mothers may have less time for meal preparation, which can lead to dietary deficiencies in children. This factor, combined with lower maternal education, further emphasizes the importance of maternal knowledge and availability in promoting adequate nutrition. Children of illiterate or primary-educated mothers in our study had significantly higher rates of IDA, reinforcing evidence from previous research on the critical influence of maternal education on child health outcomes.[17] Low family income also emerged as a substantial determinant of IDA in our study ($p<0.001$). This finding resonates with studies showing that socioeconomic status plays a crucial role in anemia prevalence.[18,19] Limited financial resources may restrict access to iron-rich foods, which is a concern in resource-constrained settings.[20] The high prevalence of IDA in low-income families underscores the compounded vulnerability of children facing both H. pylori infection and economic hardship.

Our study underscores the need for healthcare providers to consider routine iron status screening in children diagnosed with H. pylori, especially those presenting with symptoms such as pallor, fatigue, and headache. The significant prevalence of IDA in this group highlights the importance of early intervention, which may include dietary counselling, iron supplementation, and targeted H. pylori eradication strategies to improve iron absorption. Given the association between maternal factors and IDA, public health initiatives should prioritize educational programs for mothers, focusing on nutrition and the impact of IDA.

Public health efforts should also address socioeconomic challenges by providing resources for low-income families, which could mitigate the burden of IDA in this population. Policies that

support work-life balance for employed mothers could help reduce the risk of nutritional deficits in their children. Given that H. pylori infection and IDA often co-occur, policies aimed at improving sanitation and access to healthcare could further alleviate the impact of H. pylori on pediatric health.

This study had several limitations. The cross-sectional design prevented establishment of causality between H. pylori infection and IDA. As the sample was drawn from a single setting, the findings may not be applicable to other populations. Dietary intake and other potential confounding factors were not assessed, which limits the analysis of factors that may contribute to IDA beyond H. pylori infection.

CONCLUSION

Our study reveals a high prevalence of IDA among children with H. pylori infection. Maternal employment, lower maternal education, and low family income were identified as key associated factors.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Kanchan Samtani:** Data collection, data analysis, drafting, proof reading, responsible for data's integrity, approved for publication.
2	**Arshad Mahmood:** Conception, design, proof reading, critical revisions, approved for publication.