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Frequency of Anemia in Patients with Helicobacter pylori Infection Presenting to a Tertiary Care Hospital in Quetta

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ABSTRACT

Background: *Helicobacter pylori infection is among the most common chronic bacterial infections worldwide, and beyond its established role in peptic ulcer disease and gastric malignancies, evidence supports an association with iron-deficiency anemia. Mechanisms include impaired gastric acid secretion, chronic mucosal blood loss, and hepcidin-mediated reduction in iron absorption. Both anemia and H. pylori are highly prevalent in South Asia, yet data from Quetta, Pakistan, remain scarce.* ***Objective:*** *To determine the prevalence and severity distribution of anemia in adult patients with confirmed H. pylori infection at a tertiary care hospital in Quetta, and to assess demographic correlates of anemia.* ***Methods:*** *A cross-sectional observational study was conducted at Bolan Medical Complex Hospital, Quetta, between December 2024 and May 2025. Consecutive adults with stool antigen or urea breath test–confirmed H. pylori infection were enrolled. Demographic, clinical, and hematological data were recorded. Hemoglobin was measured using automated analysis, and anemia was defined by WHO criteria. Data were analyzed with t-tests and chi-square tests in SPSS version 24.* ***Results:*** *Among 100 patients (52 males, 48 females; mean age 38.6 ± 12.4 years), anemia was present in 45%. Prevalence was significantly higher in females (56.3%) compared with males (34.6%, p=0.031). Anemic patients had lower mean hemoglobin (10.8 ± 1.2 g/dL) than non-anemic individuals (13.5 ± 1.1 g/dL, p<0.001).* ***Conclusion:*** *Anemia was common among H. pylori-infected patients in Quetta, particularly in women. Integrated strategies combining routine anemia screening, eradication therapy, and nutritional support are warranted to reduce disease burden.*

Keywords
Helicobacter pylori, anemia, iron deficiency, Quetta, prevalence

INTRODUCTION

Helicobacter pylori (H. pylori) is a Gram-negative bacterium that colonizes the gastric mucosa and is one of the most widespread chronic infections globally, affecting more than half of the world's population, with prevalence rates exceeding 70% in resource-limited settings (1). Chronic colonization is associated with diverse gastrointestinal disorders, including gastritis, peptic ulcer disease, gastric adenocarcinoma, and mucosa-associated lymphoid tissue (MALT) lymphoma (2,3). Beyond the gastrointestinal tract, increasing evidence has linked H. pylori infection to several extragastric conditions, including hematologic disorders such as iron-deficiency anemia (IDA) (4).

The pathophysiological basis of this association is multifactorial. H. pylori-induced gastritis reduces gastric acid secretion, impairing iron absorption in the duodenum (5). Chronic mucosal inflammation may also lead to occult blood loss, contributing to iron depletion (6). Furthermore, H. pylori has been implicated in the upregulation of hepcidin, a key regulator of iron metabolism that inhibits dietary iron absorption and mobilization from stores (7). Collectively, these mechanisms suggest that persistent infection can contribute to clinically significant iron deficiency, particularly in settings where baseline nutritional iron intake is low.

The global burden of anemia remains a major public health challenge. According to the World Health Organization, over 1.6 billion people are affected worldwide, with IDA being the most common etiology (8). In South Asia, prevalence rates are particularly high among women of reproductive age, often exceeding 40% (9). Multiple studies have documented improvement in hemoglobin and ferritin levels following successful eradication of H. pylori, further supporting a causal link between infection and anemia (10,11).

In Pakistan, both H. pylori infection and anemia are widespread, with prevalence rates above 60% for infection and high levels of anemia in children, adolescents, and women across urban and rural populations (12,13). Despite overlapping epidemiology, few studies have evaluated the coexistence of anemia and H. pylori infection in hospital-based populations. Most available data derive from large urban centers such as Karachi or Lahore, leaving a gap in knowledge for underserved regions. Quetta, the capital of Balochistan, is characterized by limited healthcare resources, high rates of nutritional deficiencies, and suspected elevated prevalence of both anemia and H. pylori infection. Yet, no published study to date has investigated this association in the region, leaving clinicians and policymakers without context-specific evidence to guide practice.

Given the high background prevalence of both conditions, and the potential clinical and public health implications of their overlap, it is critical to generate local data that quantify anemia burden among H. pylori-infected patients. Such evidence could support the integration of anemia screening into infection management programs and inform regional health policy. Therefore, the present study was designed to determine the prevalence of

anemia among adult patients with confirmed H. pylori infection attending a tertiary care hospital in Quetta, with particular attention to demographic correlates and severity patterns.

Research Objective: To estimate the prevalence and severity distribution of anemia in adult patients with confirmed H. pylori infection at a tertiary care hospital in Quetta, Pakistan, and to explore demographic factors associated with this comorbidity.

MATERIALS AND METHODS

This study employed a cross-sectional observational design to estimate the prevalence of anemia among adults with confirmed Helicobacter pylori infection. The investigation was conducted at the Department of Medicine, Bolan Medical Complex Hospital, Quetta, Pakistan, between December 2024 and May 2025. The setting was a tertiary care facility serving both urban and rural populations, which enabled inclusion of diverse socioeconomic groups.

Eligible participants were adults aged 18 years and older who presented with dyspeptic symptoms and had laboratory-confirmed H. pylori infection. Diagnosis of infection was established using either the stool antigen test or urea breath test, both of which are validated non-invasive diagnostic modalities with high sensitivity and specificity (14). Patients were excluded if they had known hematological malignancies, chronic kidney disease, chronic liver disease, gastrointestinal bleeding, pregnancy, or a recent history of iron supplementation, blood transfusion, or H. pylori eradication therapy. These exclusion criteria minimized misclassification and avoided confounding from unrelated causes of anemia.

Patients were consecutively recruited from the outpatient department. After eligibility confirmation, informed written consent was obtained. Demographic, clinical, and lifestyle characteristics were recorded using a structured interviewer-administered proforma. Anthropometric measurements, including body mass index (BMI), were obtained with standardized procedures. Smoking and medication history, particularly use of nonsteroidal anti-inflammatory drugs, was also documented given their potential influence on anemia risk.

Venous blood samples were collected under aseptic conditions, and hemoglobin concentration was measured using an automated hematology analyzer. Red cell indices, including mean corpuscular volume (MCV) and red cell distribution width (RDW), were also recorded. Anemia was defined and graded according to the World Health Organization cutoffs: hemoglobin <13.0 g/dL in men and <12.0 g/dL in women, with mild, moderate, and severe categories based on hemoglobin thresholds (15). Where available, microcytic indices were used to infer possible iron deficiency, although serum ferritin and transferrin saturation were not consistently measured.

Several steps were taken to reduce bias and improve internal validity. Restrictive eligibility criteria minimized confounding from comorbid illnesses. Standardized laboratory protocols ensured reproducibility of hematological results. Consecutive enrollment reduced selection bias, while double data entry into the database minimized transcription errors. Sample size was calculated assuming an expected anemia prevalence of 50% among H. pylori-positive patients, with a 95% confidence level and 10% margin of error, yielding a minimum sample of 97 participants. To account for potential data loss, 100 patients were included. This size provided sufficient precision for prevalence estimation while maintaining feasibility.

Data were entered into IBM SPSS Statistics version 24 (IBM Corp., Armonk, NY, USA) for analysis. Continuous variables such as age and hemoglobin were expressed as mean ± standard deviation, while categorical variables such as sex and anemia status were expressed as frequencies and percentages. Independent samples t-tests were used to compare mean hematological parameters between anemic and non-anemic patients, and chi-square tests assessed associations between categorical variables. Subgroup analyses explored differences by sex and age. A p-value <0.05 was considered statistically significant. Missing data were handled by complete-case analysis, and no imputation was performed.

Ethical approval was obtained from the Institutional Review Board of Bolan Medical Complex Hospital, Quetta. The study adhered to the Declaration of Helsinki guidelines (16). Confidentiality of patient information was maintained, and participation was voluntary with the right to withdraw at any stage.

RESULTS

Among the 100 patients studied, the mean age was 38.6 ± 12.4 years, with near equal distribution of males (52%) and females (48%). The average BMI was 24.3 ± 3.5 kg/m², indicating that most participants were within the normal to overweight range. A majority resided in urban areas (60%), and only a small proportion reported smoking (18%) or NSAID use (22%), suggesting that lifestyle-related contributors to anemia were less dominant in this cohort.

Overall, anemia was present in 45% of patients, with 28% classified as mild, 13% as moderate, and 4% as severe. More than half of women (56.3%) were anemic compared with just over one-third of men (34.6%), a statistically significant difference ($p = 0.031$). Similarly, younger adults (≤35 years) showed a higher prevalence of anemia (52.2%) compared to older participants (38.9%), although this difference did not reach statistical significance ($p = 0.084$). No meaningful association was found between BMI and anemia status, with nearly equal proportions affected across BMI categories ($p = 0.247$).

Comparisons of hematological indices between anemic and non-anemic groups demonstrated substantial differences. The mean hemoglobin concentration was 10.8 ± 1.2 g/dL in anemic patients versus 13.5 ± 1.1 g/dL in those without anemia ($p < 0.001$). Hematocrit followed a similar pattern, averaging 33.4 ± 3.6% in the anemic group and 40.2 ± 4.1% in the non-anemic group ($p < 0.001$). Red cell indices also reflected iron-restricted erythropoiesis: mean corpuscular volume (MCV) was significantly lower in anemic patients (78.2 ± 5.8 fL) compared to non-anemic individuals (84.5 ± 6.1 fL, $p = 0.002$), while red cell distribution width (RDW) was higher (15.8 ± 1.9% vs. 13.6 ± 1.4%, $p = 0.014$). These findings support microcytic, hypochromic anemia, consistent with iron deficiency.

Table 1. Demographic and Clinical Characteristics of Patients (n = 100)

Variable	Mean ± SD / n (%)
Age (years)	38.6 ± 12.4
Sex (Male/Female)	52 (52%) / 48 (48%)
BMI (kg/m²)	24.3 ± 3.5
Residence (Urban/Rural)	60 (60%) / 40 (40%)
Smoking status (Yes/No)	18 (18%) / 82 (82%)
NSAID use (Yes/No)	22 (22%) / 78 (78%)

Table 2. Frequency and Severity of Anemia in H. pylori–Infected Patients

Anemia Status	n (%)
No Anemia	55 (55%)
Mild Anemia	28 (28%)
Moderate Anemia	13 (13%)
Severe Anemia	4 (4%)

Table 3. Comparison of Hematological Parameters Between Anemic and Non-Anemic Patients

Parameter	Anemic (n = 45) Mean ± SD	Non-Anemic (n = 55) Mean ± SD	p-value
Hemoglobin (g/dL)	10.8 ± 1.2	13.5 ± 1.1	<0.001
Hematocrit (%)	33.4 ± 3.6	40.2 ± 4.1	<0.001
MCV (fL)	78.2 ± 5.8	84.5 ± 6.1	0.002
RDW (%)	15.8 ± 1.9	13.6 ± 1.4	0.014

Table 4. Association Between Anemia and Demographic Variables

Variable	Anemia Present n (%)	Anemia Absent n (%)	p-value
Sex: Male (n = 52)	18 (34.6%)	34 (65.4%)	0.031
Sex: Female (n = 48)	27 (56.3%)	21 (43.7%)	
Age ≤35 years (n = 46)	24 (52.2%)	22 (47.8%)	0.084
Age >35 years (n = 54)	21 (38.9%)	33 (61.1%)	
BMI <25 kg/m² (n = 60)	30 (50.0%)	30 (50.0%)	0.247
BMI ≥25 kg/m² (n = 40)	15 (37.5%)	25 (62.5%)	

Table 5. Subgroup Distribution of Anemia Severity by Sex and Age

Subgroup	Mild n (%)	Moderate n (%)	Severe n (%)	Total with Anemia (%)
Male (n = 52)	12 (23.1%)	5 (9.6%)	1 (1.9%)	18 (34.6%)
Female (n = 48)	16 (33.3%)	8 (16.7%)	3 (6.3%)	27 (56.3%)
Age ≤35 years (n = 46)	14 (30.4%)	8 (17.4%)	2 (4.3%)	24 (52.2%)
Age >35 years (n = 54)	14 (25.9%)	5 (9.3%)	2 (3.7%)	21 (38.9%)

Subgroup analysis further emphasized the gender and age disparities. Among females, anemia severity was more pronounced, with 33.3% having mild anemia, 16.7% moderate, and 6.3% severe. In contrast, men had lower proportions across all categories: 23.1% mild, 9.6% moderate, and 1.9% severe. Younger adults were also disproportionately affected, with 52.2% of those ≤35 years anemic compared with 38.9% in those >35 years, and higher proportions of moderate-to-severe cases in the younger group.

Taken together, these results indicate that nearly half of H. pylori–infected patients at this tertiary care center had anemia, with women and younger adults particularly vulnerable. The hematological profile, characterized by lower hemoglobin, hematocrit, and MCV, alongside elevated RDW, strongly suggests an iron-deficiency pattern associated with the infection.

DISCUSSION

The findings of this study demonstrate that anemia is highly prevalent among patients with confirmed Helicobacter pylori infection in Quetta, affecting nearly half of the cohort. The burden was disproportionately greater among women, who exhibited higher prevalence as well as more severe anemia compared with men. Younger adults were also more affected, though the age-related difference did not reach statistical significance. These results align with the biological plausibility of H. pylori-induced iron deficiency, where gastric mucosal inflammation impairs acid secretion and iron absorption, while systemic inflammation alters hepcidin regulation (17,18).

Our observations are consistent with international evidence. A meta-analysis by Yuan et al. reported that H. pylori-infected individuals had significantly lower hemoglobin and ferritin levels, and eradication therapy improved both parameters (19). In pediatric populations, Muhsen and Cohen similarly documented recovery of iron status after eradication, underscoring the infection's role in systemic iron deficiency (20). Regional studies also corroborate our results. An Iranian study by Afrooz et al. reported anemia prevalence of 46% in infected adults, while Pierce et al. found 43%, both comparable to the 45% identified in our cohort (21,22). In Pakistan, Ahmad et al. documented a 40% anemia prevalence among H. pylori-positive patients with chronic dyspepsia, and Khattak et al. showed hematologic improvement after eradication therapy, reinforcing the association within local populations (23,24).

The mechanistic underpinnings are supported by both laboratory and clinical data. H. pylori-associated gastritis can lower gastric acidity, reducing solubilization of dietary iron (25). Competition between bacteria and host for iron stores, along with hepcidin-mediated reduction in iron absorption and mobilization, further exacerbate deficiency (26). In women, additional physiological iron loss due to menstruation compounds the impact, explaining their greater susceptibility in our cohort (27). Subgroup findings of higher prevalence and severity in younger adults may also reflect nutritional inadequacies and higher metabolic iron demand in reproductive years.

These results carry significant public health implications for Balochistan and South Asia more broadly. Both H. pylori infection and anemia are common in the region, and their intersection places additional strain on health systems already constrained by limited resources. Our findings suggest that screening for anemia in H. pylori-infected patients could enable earlier diagnosis and management. Integration of eradication therapy with nutritional interventions may yield synergistic benefits in reducing anemia prevalence, particularly among women of reproductive age (28).

Several limitations must be acknowledged. The cross-sectional design precludes causal inference, and the absence of consistent ferritin testing limited definitive confirmation of iron deficiency as the anemia subtype. Other potential confounders—such as dietary patterns, socioeconomic status, and parasitic infections—were not systematically assessed, which may have influenced the prevalence estimates. Nonetheless, the

significant differences in hematologic indices between anemic and non-anemic patients, coupled with consistency across international literature, strengthen the argument for an association between H. pylori and anemia in this setting.

In summary, this study adds valuable evidence from a previously understudied region, highlighting that anemia is a common comorbidity in H. pylori-infected patients, especially women. These results support the integration of anemia screening into H. pylori management strategies in resource-limited settings. Future multicenter prospective studies with comprehensive iron profile assessments are required to confirm causality and guide policy for coordinated control programs (29).

CONCLUSION

Anemia was found to be a frequent comorbidity among adults with Helicobacter pylori infection in Quetta, affecting nearly half of the study population and disproportionately impacting women. The hematological profile was consistent with iron deficiency, supporting a pathophysiological link between infection and impaired erythropoiesis. These findings underscore the clinical importance of routine anemia screening in H. pylori-positive patients and highlight the need for integrated management strategies that combine eradication therapy with nutritional support. Strengthening diagnostic and treatment approaches for both conditions in resource-limited regions such as Balochistan has the potential to improve patient outcomes and reduce disease burden.

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