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RESEARCH ARTICLE

HELICOBACTER PYLORI INFECTION AND ANEMIA IN DYSPEPTIC PATIENTS – A CROSS SECTIONAL STUDY

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ABSTRACT

Objective: *To determine the association between Helicobacter pylori infection and anemia.*

Study Design: *Analytical cross sectional study*

Place and Duration of Study: *Combined Military Hospital Rawalpindi for 6 months from 02 Jan 2025 to 10 Jun 2025.*

Materials and Methods: *After informed consent, demographic and clinical information was obtained in 285 patients. Four cc blood was drawn for complete blood count. Anemia was defined as hemoglobin level < 12 g/dl in women and < 13 g/dl in men. The Helicobacter pylori rapid antigen test was done on stool samples. Saline stool preparation was checked for the presence of parasites. Bivariate regression analysis and Chi square tests were conducted to find association amongst variables. P value of < 0.05 was considered statistically significant.*

Results: *Of 285 participants, 113 (39.6%) were male and 172 (60.4%) were female. The H. pylori infection was present in 44.9% (128/285) patients and anemia was present in 25.3% (72/285). Among anemic patients, 48/72 (66.7%) were H. pylori-positive compared to 80/213 (37.5%) non-anemic patients. H. pylori infection was significantly associated with anemia (P < 0.001), older age, smoking, and type of water source.*

Conclusion: *H. pylori infection was significantly associated with anemia in dyspeptic patients. Older age, smoking, and unsafe water sources were also significantly associated with the infection.*

Keywords: *Anemia, Dyspepsia, Helicobacter pylori*

INTRODUCTION

Globally, anemia is a public health issue, it affects about 32.9% of people of all age groups, in developing and developed countries, with Sub-Saharan Africa bearing the greatest burden.[1] It poses serious health risks and also impacts social and economic progress. Anemia weakens the immune system, reduces physical stamina, and negatively affects work productivity in adults.[2]

Helicobacter pylori (H pylori) infection is ubiquitous in the world population. Its prevalence is higher in the developing countries 50.8%, as compared to advanced countries 34.7%.[3] *H pylori* is a spiral shaped flagellated Gram-negative microaerophilic organism that has evolved to survive in the hostile acidic stomach environment for extended periods and contribute to its natural microbial environment. It can trigger chronic inflammation with conditions like atrophic gastritis, micro-erosions, and gastroduodenal ulcers.[4] It is classified as class I carcinogen by World Health organization (WHO) as it can lead to gastric adenocarcinoma and mucosa associated lymphoid tissue (MALT) lymphoma.[4] *H pylori* treatment is the standard of care in early stage MALT lymphoma.[5] Despite its association with these conditions, over 80% of those infected do not exhibit any symptoms.[6]

The exact pathway by which *Helicobacter pylori* infection causes iron shortage and/or anemia is not yet completely known. The several proposed processes are: a rise in pH, and drop in ascorbic acid level in stomach secretions both of which impair dietary iron intake, chronic blood loss due to micro-erosions in the gastric lining, the direct uptake of iron by the bacteria and elevated production of hepcidin, a key hormone that

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regulates iron balance by reducing its absorption in the small intestine.[7]

There are many diagnostic tests available to identify *Helicobacter pylori* infection. Non-invasive techniques are 13C urea-based tests, and the stool antigen test. Polymerase Chain Reaction (PCR) is reserved for research settings and checking antibiotic resistance. In contrast, invasive procedure, such as endoscopy paired with appropriate tissue samples, tend to offer higher diagnostic accuracy.[8]

Despite extensive global research regarding *H pylori* and anemia, there are limited data from the Pakistani population on whether *H. pylori* infection is independently associated with anemia in dyspeptic patients. A study from Quetta reported that among *H. pylori* positive cases, anemia was present in 45% Younus et al., 2025.[9] Another recent Pakistani study found H. pylori infection in 64.8% of dyspeptic patients, with significant associations including low hemoglobin levels (P = .02) and low socioeconomic status (P ⩽ .01) Shahzad et al., 2025.[10] However, neither study simultaneously examined the role of age, water source, smoking, and anemia together in an analytical cross-sectional design. The objective of this study was to determine the association between *Helicobacter pylori* infection and anemia among dyspeptic patients and also to analyze the effects of confounding variables such as: age, smoking, alcohol intake, residence, educational level, and water source.

PATIENTS AND METHODS

This analytical cross-sectional study was undertaken in our tertiary care center from Jan 2025 to Jun 2025. Prior approval from the Ethical Committee/Institutional Review Board was taken with reference no. 940. A sample size of 285 patients was obtained using World Health Organization (WHO) calculator; at 5% margin of error, 95% confidence interval (CI), and prevalence of anemia at 24.3%11. Non-probability consecutive method was used for patient registration.

The patients having following conditions such as malabsorption, hematemesis, melena, hematuria, heavy menstrual bleeding, gastro dudenol ulcers or celiac, suffering from chronic illness, having history of surgery or recent blood transfusion pregnancy, took antibiotics, proton pump inhibitors, or bismuth compounds within four weeks prior to enrollment were excluded from the study.

Patients gave written consent for participation in the study and confidentiality of data was maintained. Information on demographic characteristics including age, marital status, gender, tobacco use, education level, household income, and occupation, as well as risk factors linked to anemia, such as nutrition, dietary supplement use, history of parasites, deworming status, alcohol consumption, and whether participants drank boiled water or otherwise, its source, residence and socioeconomic status were included using a structured questionnaire. Following this, for complete blood count (CBC) ethylenediamine tetra-acetic acid (EDTA) vacutainer tubes were used to obtain 4 cc venous blood, and analyzed using automated hematology analyzer. Malaria parasites were identified using thick films examined under 1000 × magnification, stained with Giemsa stain for 20 minutes.

Sterile collection containers were distributed to participants, along with clear instructions on how to properly obtain around one gram of stool for sampling. *H pylori* in stools was tested by a commercially available rapid antigen kits (Murex) by ICT method with a sensitivity of over 95% and a specificity of 95.7%. Saline stool preparation were used to look for parasites.

Shapiro-Wilk test was used to assess the normal distribution of data. Categorical variables such as gender, educational level, smoking, alcohol intake, residence and water source were presented as percentages and frequencies. As age was not following normal distribution, being a continuous variable mean (SD) and median (IQR) were calculated. Chi square test was employed to check *H pylori* and anemia association in dyspeptic patients. Bivariate analysis of binary logistic regression was utilized for the relationship between *H pylori* and variables as above, with outcomes reported in odds ratio (OR) and 95% confidence interval (CI). P value of < 0.05 was deemed statistically significant. Statistical Product and Service Solutions (SPSS) version 24 was used for data analysis.

RESULTS

The study included 285 patients. Of these 172 (60.4%) were female and 113 (39.6%) were male. Patients' mean age was 31.12 (10.12) years and median age was 30 (22-40) years. The study populations' baseline characteristics are shown in Table -I. Malaria thick film examination was negative in all 285 participants, as were stool preparations for parasitemia.

Table-I: Demographic and Clinical Characteristics of Patients (n = 285)

Variables		Median, IQR
Age (years)		30 (22 - 40)
		n (%)
Gender	Male	113 (39.6%)
	Female	172 (60.4%)
Age (years)	18-22	74 (26%)
	23-27	57 (20%)
	28-32	48 (16.8%)
	33-37	27 (9.5%)
	38-42	30 (10.5%)
	>42	49 (17.2%)
Educational Level	None	24 (8.4%)
	Primary	136 (47.7%)
	Secondary	55 (19.3%)
	Higher Education	70 (24.6%)
Residence	Rural	189 (66.3%)
	Urban	96 (33.7%)
Smoking	No	237 (83.2%)
	Yes	48 (16.8%)
Alcohol Intake	No	249 (87.4%)
	Yes	36 (12.6%)
Water Source	Piped	175 (61.4%)
	Spring	76 (26.7%)
	Open Water	34 (11.9%)
Boil Drinking Water	No	167 (58.6%)
	Yes	118 (41.4%)
Anemic Status	Non-Anemic	213 (74.7%)
	Anemic	72 (25.3%)

The H pylori prevalence was 44.9% (128/285), as shown in Figure – 1.

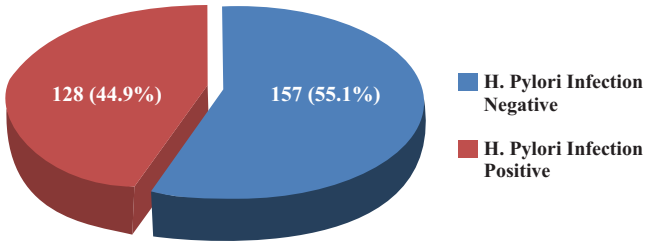

Figure – 1: *H pylori* infection prevalence in dyspeptic patients

Helicobacter pylori infection on bivariate analysis, had a statistically significant association with age, water source, smoking and anemia, as shown in Table-III. As compared to patients aged 18-22 years, those aged 28-32 years had greater odds of infection (OR = 2.63, 95% CI [1.07-6.45] P = .034). The association became even stronger in older age groups, with patients aged 38–42 years showing markedly higher odds (OR = 9.54, 95% CI [3.14–29.01] P < .001) and those above 42 years also at elevated risk (OR = 4.67, 95% CI [1.75–12.41] P = .002). Compared to those using piped water, individuals using spring water (OR = 2.75, 95% CI [1.36–5.59] P = .005) or open water sources (OR = 8.35, 95% CI [3.11–22.42] P < .001) had significantly higher odds of carrying infection. Smoking had quite significant association with *H pylori* infection than non-smokers (OR = 6.47, 95% CI [2.41-17.41] P = .001). Similarly anemic patients had increased odds of *H. pylori* infection as compared to non-anemic patients (OR = 2.73, 95% CI [1.33-5.61] P =.006). In contrast, *H. pylori* infection did not have statistically significant association with: gender, educational level, residence, practice of boiling drinking water, and alcohol intake.

Table-II: *Helicobacter pylori* Infection association with Anemia Status among Patients with Dyspepsia (n = 285)

Anemic Status	*H Pylori* Infection		Total	*P* value
	Negative	Positive		
Non-Anemic	133 (62.5%)	80 (37.5%)	213 (74.7%)	< .001
Anemic	24 (33.3%)	48 (66.7%)	72 (25.3%)	
Total	157 (55.1%)	128 (44.9%)	285 (100%)	

Values are presented as n (%). P value from Chi-square test.

Table III. Bivariate analysis of *H pylori* infection and variables in dyspeptic patients (n = 285)

Variable		Odds Ratio	95% CI	*P* value
Gender	Male	Ref		
	Female	0.85	0.39-1.81	.676
Age (years)	18-22	Ref		
	23-27	1.57	0.64-3.82	.319
	28-32	2.63	1.07-6.45	.034
	33-37	1.87	0.62-5.71	.270
	38-42	9.54	3.14-29.01	<.001
	>42	4.67	1.75-12.41	.002
Educational level	None	Ref		
	Primary	1.90	0.54-6.63	.312
	Secondary	0.72	0.19-2.68	.626
	Higher Secondary	3.00	0.80-11.19	.102
Boil Drinking Water	No	Ref		
	Yes	0.72	0.37-1.43	.357
Water Source	Piped	Ref		
	Spring	2.75	1.36-5.59	.005
	Open Water	8.35	3.11-22.42	<.001
Residence	Rural	Ref		
	Urban	1.32	0.69-2.53	.396
Smoking	No	Ref		
	Yes	6.47	2.41-17.41	.001
Alcohol Intake	No	Ref		
	Yes	0.70	0.26-1.90	.494
Anemic Status	Non-Anemic	Ref		
	Anemic	2.73	1.33-5.61	.006

DISCUSSION

H pylori infection is ubiquitous by this bacteria and almost half of people in the globe are affected. Of these, people in the developing countries are the most infected, with Africa reporting the highest prevalence exceeding 70%.[11] In contrast, developed nations show lower rates, typically between 25% and 40%. The infection also rises with age: approximately half of those over 60 are infected, compared to just 10% among individuals aged 18 to 30.[12] In most parts of the world, people tend to acquire this bacterial infection during early childhood.[13,14] Given this, it is plausible that long-standing *H. pylori* infections in older adults may contribute to anemia by increasing the risk of gastrointestinal mucosal damage.

Out of total 285 dyspeptic patients *H. pylori* infection was present in 128 (44.9%). Our study is in line with studies by Baingana et al with 45.2% *H. pylori* prevalence; and Yan Xu et al with 43.9% respectively.[12,15] Nekaka et al reported *H. pylori* prevalence at 27.3%, lower than our study.[16] In contrast Aje et al described H pylori prevalence of 67.4%.[17] This difference in prevalence can be attributed to different geographic locations, study settings, design and variation in diagnostic techniques.

In our study 72 (25.3%) patients were anemic and 213 (74.7%) were non anemic and there was a statistically significant association between *H. pylori* infection and anemia. In numerical terms, anemic patients have slightly less than two times the risk of *H. pylori* infection (66.7%) as compared to non-anemic patients (37.5%) P < 0.001. From another perspective, in all *H. pylori* infected patients in our study, the prevalence of anemia was 48/128 (37.5%). On the other hand, in *H. pylori* uninfected patients the prevalence of anemia was 24/157 (15%). Our findings are consistent with those of Yan Xu et al., who reported that the prevalence of anemia 5.5% in H. pylori-infected subjects versus 5.2% in uninfected individuals (adjusted OR = 1.19; 95% CI: 1.03–1.39; P = 0.021).[15] Similarly, Kibru et al. found that the prevalence of anemia among *H. pylori*-infected patients (30.9%) was significantly higher than in uninfected patients (22.5%) P < 0.001.[18]

Our findings are consistent with recent Pakistani data. Younus et al. reported anemia in 45% of *H. pylori* infected patients, supporting the positive association we observed.[9] In a recent Pakistani study by Shahzad et al., mean hemoglobin levels were significantly lower in *H. pylori*-positive individuals (9.8 ± 3.1 g/dL) compared to *H. pylori*-negative individuals (10.7 ± 2.4 g/dL) (P = 0.02), although they also reported an association with male gender, which was not significant in our study.[10] These differences may reflect regional variations in socioeconomic and environmental exposures. However, Shak et al. and Santos et al. found no significant association between *H. pylori* and anemia.[19,20] This discrepancy may be explained by differences in study populations (rural Haiti and multi-country Latin America vs. urban Pakistani tertiary care setting), sample sizes, diagnostic methods (hemoglobin measured by finger stick, *H pylori* checked by serology, Shak et al, hemoglobin assessed by venous blood/finger prick, *H. pylori* by 13C urea breath test, Santos et al), and adjustment for confounders such as water source and smoking, which were significant in our study but not accounted for in theirs.[19,20] In the study by Asimwee et al, the *H. pylori* infection, age, anemia and parasites in

stools were all positively related.[3] There is greater preponderance of *H. pylori* infection with age, and use of less purified water. Studies have shown variable results between smoking and *H pylori.*[21] However, smoking definitely aggravates disease outcomes including risk of ulcers and cancer.

In our everyday clinical practice dyspepsia and anemia are commonly encountered. Based on findings of this study, it is recommended that clinicians should consider screening for *H. pylori* infection in dyspeptic patients presenting with anemia. Further investigation into modifiable risk factors such as water source and smoking may be warranted.

LIMITATIONS OF THE STUDY

This cross-sectional study was conducted in one center. Multicenter validation studies with control group should be designed to discern the elements leading to anemia in dyspeptic patients with *H pylori* infection.

CONCLUSION

This study affirms that in dyspeptic patients, there was high prevalence of *H pylori* infection and anemia; and both were strongly interrelated. It further infers that: age, smoking and source of water supply were also significantly associated with the infection. We recommend that dyspeptic patients should be checked for *H pylori* and if infected have their hemoglobin levels tested. Efforts should be undertaken for access to clean and safe water supply for population at large.

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DISCLAIMER

The study results and inferences are for educational and academic purposes only. These are not a replacement for sound medical consult in an individual patient.

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Authors' contributions:

Baseera Khan: Conception of study / Designing / Planning, Experimentation/ Study Conduction, Analysis/ Interpretation/ Discussion

Shahzad Ashraf: Conception of study / Designing / Planning, Analysis / Interpretation / Discussion, Critical Review

M. Fuad Ahmad Siddiqi:Critical Review, Facilitated for Reagents / Material Analysis

Ahmar Rashid: Analysis / Interpretation / Discussion

Abeera Maham Rana: Manuscript Writing

Muhammad Shafeh Shahzad: Manuscript Writing

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