RESEARCH PAPER

Prevalence of Helicobacter pylori stool antigen in different Kurdistan - Iraq Region

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ABSTRACT

Background and objective: Helicobacter pylori is a highly prevalent gastric pathogen associated with chronic gastritis, peptic ulcer disease, mucosa-associated lymphoid tissue lymphoma, and gastric cancer. Its epidemiology varies substantially across and within countries, particularly in developing settings. Updated regional data are needed to support evidence-based prevention and control strategies in the Kurdistan Region of Iraq, where comprehensive estimates remain limited.

Methods: A multicenter cross-sectional study was conducted between October 2024 and April 2025 among 2,888 patients attending five healthcare facilities in Erbil, Akre, Shaqlawa, Bardarash, and Kalar. Stool samples were analyzed using a stool antigen test (SAT) based on an immunochromatographic assay. Associations between H. pylori positivity and demographic variables were assessed statistically.

Results: Of the 2,888 patients included, 956 tested positive and 1,932 tested negative for H. pylori stool antigen, yielding an overall positivity rate of 33.1% among this symptomatic cohort. Univariate analysis demonstrated a statistically significant association with sex, observing a higher positivity rate in female, Univariate analysis demonstrated a statistically significant association with sex, with higher positivity observed in females than in males (34.9% vs. 29.8%, p = 0.0058), although the absolute difference was modest. Age-stratified analysis showed the highest positivity rate among adults aged 19 years and older (35.5%), followed by children aged 0-12 years (22.4%) and adolescents aged 13-18 years (21.9%) (p = 0.00002). Positivity increased progressively with age, suggesting cumulative exposure over time.

Conclusions: H. pylori stool antigen positivity was common among patients attending healthcare facilities in the Kurdistan Region of Iraq. Both age and sex were significantly associated with positivity, with higher rates observed among adults and a modestly higher rate among females. These findings provide updated regional evidence and highlight the need for larger community-based studies to better define the epidemiology of H. pylori infection in this setting.

Keywords: Helicobacter pylori infection, stool antigen test; positivity rate; Kurdistan Region; Iraq.

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INTRODUCTION

Helicobacter pylori (*H. pylori*) is a Gram-negative, curved, microaerophilic bacterium belonging to the family Helicobacteraceae. More than 30 species are currently included in the genus, non-gastric, and gastric, or enterohepatic. [(1)] Of the numerous *Helicobacter* species that inhabit the stomachs of mammals (including humans), only a third are from the gastric lineage. Additional species include strains of rhesus, ferrets, gastric, dolphins, and whales. Of the eight Helicobacter species in the gastric group, *H. pylori* are the most significant from a clinical perspective, as it is thought to contribute a causative role in gastric cancer, ulcers (peptic and duodenal), and active chronic gastritis malignancies in humans.[(2,3)]

This bacterium lives in the digestive tracts of half the world's population. Colonisation, the predominant aetiology of chronic gastritis, is usually acquired in childhood. This characteristic is shared by cancer of the stomach, lymphoid tissue tumours associated with the mucosa, and ulcers of the duodenum, gastric ulcers.[(4)] The organism is a helical-shaped, Gram-negative, microaerophilic bacterium that colonizes the human stomach.[(5)]

The major reason this bacterium is capable of causing inflammation and cancer is due to ammonia production and the secretion of biochemicals like proteases, vacuolating cytotoxic A and phospholipases.[(6)] An *H. pylori* infection is believed to occur at young ages and which may result in medical complications, including peptic ulcer disease, gastritis, lymphoma, gastric adenocarcinoma, and gastric cancer.[(7)] No specific clinical symptoms or signs were mentioned, and it is worth noting that most patients with *H. pylori* do not experience any indications at all. But common symptoms include the

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following: bad breath, nausea, vomiting, stomach pain, heartburn, and diarrhoea.[8]

The immunity system's ability to identify and react to different antigens makes the immune response to *H. pylori* complex. Different levels of IgG antibodies are also likely to be the consequence of differences in *H. pylori* strains and host genetics.[9]

Ethnicity and migration from areas where *H. pylori* are prevalent, and family members' infection status are all risk factors for contracting the infection. [7] While developed countries have a lower incidence of *H. pylori* ranging from 30–40%, nearly 70–90% of the people living in countries that are still developing has the infection, with most cases occurring during childhood. [10]

Contaminated food and water can promote the transmission of H. pylori, with oral-oral and fecal-oral routes being the predominant modes of infection. [8] Research indicates that ethnicity, urban residency, age, poor hygiene conditions, overcrowding, inadequate nutrition, and low maternal education significantly influence the transmission of *H. pylori.* [11]

Most developing countries, including Iraq, have a very scattered prevalence of *H. pylori* infection. Kuwait has a 49.7 percent prevalence of *H. pylori* compared to its neighbouring countries,[12] 69.0% in Turkey,[13] 53% in Yemen,[14] 25% in Jordan,[15] 71.33% in Saudi Arabia,[16] 61.87% in Iran.[17] Additionally, other countries have shown that 56.9% of the population in Kosovo has *H. pylori,*[18] 64.39% in Cameroon,[19] 47% in Pakistan,[20] 27% in India,[6] and 24.3% Erbil had the highest incidence of *H. pylori* infection in Iraq, at 55.8%.[21]

The infection may manifest as diagnosed by a number of invasive and non-invasive methods. Biopsy (histological examination), endoscopy (see above), and the Rapid Urease Test (RUT) are all examples of invasive procedures. Urine breath testing, stool antigen testing, and serological testing are non-invasive methods. For the diagnosis of *H. pylori*, Immunochromatography is one of the serological test options, which is widely used due to its low cost and accessibility at any laboratory.[20,8]

Studying the prevalence of dissemination of *H. pylori* in a geographic region is crucial, as it leads to advancements in clinical practice, the creation of preventative measures, and the regulation of measures in that region. Therefore, this study was designed to estimate the proportion of *H. pylori* stool antigen positivity among patients attending healthcare facilities in the Kurdistan Region of Iraq.

METHODS

Ethics approval and consent to participate

Ethical approval for this study was obtained from the university ethics committee (approval no. M.E.C.1A08102024). Written informed consent was obtained from all patients for the use of their data and samples in this research.

Specimen collection

This study aimed to investigate the prevalence of *H. pylori* infection among patients presenting with suspected *H. pylori*-related symptoms at different healthcare facilities in Kurdistan Region, Iraq. The inquiry followed a descriptive cross-sectional design. From October 2024 to April 2025, an overall of 2.888 patients was analyzed because participants were recruited from hospital outpatient clinics and wards using convenience sampling, the study population likely represents individuals seeking medical care for gastrointestinal symptoms. Sample was collected from patients in various wards and outpatient departments from several hospitals such as Erbil, Akre, Shaqlawa, Bardarash, and Kalar in the Kurdistan area. Stool samples were collected in clean, sterile, leak-proof containers and transported promptly to the laboratory for analysis. All specimens were processed according to the manufacturer's instructions for the immunochromatographic *H. pylori* stool antigen test kit. The final sample size was determined by the number of eligible patients presenting during the study period. According to the criteria, patients who had used H2-receptor blockers, received antibiotic therapy, or used nonsteroidal anti-inflammatory medicines were excluded.

H. pylori stool antigen test (SAT)

The *H. pylori* stool antigen was detected using a rapid immunochromatographic assay (ACON One Step *H. pylori* Test Strip, ACON Laboratories, San Diego, USA). Using applicator sticks, about 100-200 mg of stool was transferred into the sample bottle that contained the specimen preparation buffer. After a few seconds of shaking, the stool sample and buffer were well mixed. The well of the One-Step *H. pylori* Antigen Test Card was loaded with approximately three drops, or 120-150 µl, of diluted stool sample, and the results were observed after 10-15 minutes. In a positive outcome, red lines developed at the C and T bands; in a negative outcome, there was just one red line at the C band. The immunochromatographic stool antigen test used in this study has been reported to demonstrate sensitivity ranging from approximately 90–95% and specificity between 90–96% in previous validation studies. However, diagnostic misclassification remains possible when a single diagnostic method is used without confirmatory testing, such as the urea breath test, histology, or PCR-based assays

Statistical analysis

Statistical analysis was conducted utilising SPSS Version 26.0. Confidence intervals for proportions were estimated using the Wilson method, which provides more accurate interval estimates than the normal approximation when applied to binomial data, in addition to descriptive statistics and chi-square tests was performed to assess independent associations between demographic variables and *H. pylori* stool antigen positivity. Variables included in the model were age group, gender, and study site. 95% confidence intervals (CI) were calculated. A p-value < 0.05 was considered statistically significant.

RESULTS

As shown in Table 1, a total of 2,888 participants were included in the analysis, comprising 1,033 males (35.7%)

and 1,855 females (64.3%). Overall, *H. pylori* stool antigen positivity was detected in 956 participants, giving an overall prevalence of 33.1% (95% CI: 31.4%–34.8%), while 1,932 participants (66.9%) tested negative. When stratified by sex, positivity was observed in 308 of 1,033 males (29.8%, 95% CI: 27.0%–32.7%) and 648 of 1,855 females (34.9%, 95% CI: 32.8%–37.1%). In contrast, negative results were more frequent among males (70.2%) than females (65.1%). A chi-square test demonstrated a statistically significant association between sex and *H. pylori* stool antigen positivity (χ^2 = 7.61, p = 0.0058), indicating that female participants had a significantly higher proportion of positive *H. pylori* stool antigen results than male participants.

Table 1. Association between *H. pylori* stool antigen positivity and sex.

Gender	Positive *H. pylori* (n, %)	Negative *H. pylori* (n, %)	Total (n, %)	95% CI for Proportion	X^2 value	P value
Male	308 (29.8%)	725 (70.2%)	1033 (35.7%)	27.0%-32.7%		
Female	648 (34.9%)	1207 (65.1%)	1855 (64.3%)	32.8%-37.1%	7.61	0.0058
Total	956 (33.1%)	1932 (66.9%)	2888 (100%)	31.4%-34.8%		
Chi-squared (X^2) test was performed for significant differences estimation at p value level ≤ 0.05, p > 0.05: non-significant						

As shown in Table 2, a total of 2,888 participants were included in the age-stratified analysis. Overall, *H. pylori* stool antigen positivity was detected in 956 participants, yielding an overall prevalence of 33.1% (95% CI: 31.4%–34.8%), while 1,932 participants (66.9%) tested negative. The prevalence of *H. pylori* varied significantly across age groups. Adults aged >19 years constituted the largest proportion of the study population (2,357/2,888; 81.6%) and exhibited the highest positivity rate, with 838 positive cases (35.5%; 95% CI: 33.5%–37.6%). In comparison, lower positivity rates were observed among children aged 0–12 years (72/321; 22.4%; 95% CI: 18.0%–27.3%) and teenagers aged 13–18 years (46/210; 21.9%; 95% CI: 16.6%–28.1%). Negative results were correspondingly more frequent in children (77.6%) and teenagers (78.1%) than in adults (64.4%). The chi-square test demonstrated a statistically significant association between age group and *H. pylori* stool antigen positivity (χ^2 = 34.80, p = 0.00002), indicating that *H. pylori* positivity differed significantly by age and was markedly higher among adults than among the younger age groups.

Table 2 The number and percentage of the prevalence *H. pylori* according to the age groups.

Ages group (Years)	Positive *H. pylori*	Negative *H. pylori*	Total	95% CI for Proportion	X^2 value	P value
Child (0-12)	72 (22.4%)	249 (77.6%)	321 (11.1%)	18.0%-27.3%		
Teenager (13-18)	46 (21.9%)	164 (78.1%)	210 (7.3%)	16.6%-28.1%	34.80	0.00002
Adult (>19)	838 (35.5%)	1519 (64.4%)	2357 (81.6%)	33.5%-37.6%		
Total	956 (33.1%)	1932 (66.9%)	2888 (100%)	31.4%-34.8%		
Chi-squared (X^2) test was performed for significant differences estimation at p value level ≤ 0.05, p > 0.05: non-significant						

A total of 2,888 participants were enrolled across five study sites. Overall, *H. pylori* stool antigen positivity was identified in 956 participants, corresponding to an overall prevalence of 33.1%, whereas 1,932 participants tested negative. The largest number of participants was recruited from Erbil (n = 820), followed by Kalar (n = 598), Akre (n = 520), Bardarash (n = 480), and Shaqlawa (n = 470). Site-specific analysis demonstrated variation in the prevalence of *H. pylori* positivity. The highest positivity rates were observed in Erbil and Bardarash, each with a prevalence of 35.4% (290/820 and 170/480, respectively), while the lowest prevalence was recorded in Kalar (30.8%; 184/598). Intermediate prevalence rates were found in Shaqlawa (31.9%; 150/470) and Akre (31.2%; 162/520). Statistical analysis using the chi-square (χ^2 = 5.719) test showed a no significant difference in *H. pylori* positivity among the study sites (p = 0.221), indicating that the distribution of infection was not uniform across the included geographic locations as shown in **Table 3**.

Table 3. Comparison of *H. pylori* stool antigen positivity rates among participants across different study sites.

Study Site	Total Participants (n)	Positive (n)	Positive (%)	Negative (n)
Erbil	820	290	35.4%	530
Akre	520	162	31.2%	358
Shaqlawa	470	150	31.9%	320
Bardarash	480	170	35.4%	310
Kalar	598	184	30.8%	414
Total	2888	956	33.1%	1932
Chi-square (χ^2) = 5.719, P-value = 0.221				

DISCUSSION

Helicobacter pylori is a Gram-negative, microaerophilic bacterium that primarily colonizes the human gastric mucosa. Chronic infection is a well-established etiology for chronic gastritis, peptic ulcer disease, and is significantly associated with an increased risk of gastric adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma. Given these severe clinical sequelae, understanding the regional epidemiology of H. pylori is essential for guiding public health strategies and eradication protocols. [22,23] On the prevalence of *H. pylori* in the Kurdistan Region by collecting different data from different hospitals in Kurdistan such as Akre, Erbil, Bardarash, Shaqlawa, and Kalar and the data we have collected consists of different age groups and different genders to estimate the prevalence of this bacterium in Kurdistan.

When we collected data from 2888 patients (1932) cases was showed negative results. Approximately one-third of participants tested positive, consistent with regional averages. When we separated the incidence between different genders without different ages, In the current study discovered that the incidence of this disease is higher among women than men 648 (34.9%) of women are infected compared to 308 (29.8%) of men as show in **Table (1),** True positivity rate among males is likely between 27–33% meanwhile true positivity rate among females is likely between 32.8–37.1% while Overall positivity in the study population is ~33%, with 95% confidence interval spanning 31.4–34.8%. So, The proportion positive was higher in females than males (34.9% vs 29.8%; chi-square p = 0.0058). Certain studies indicated that females had a higher rate of *H. pylori* infection, and this difference was typically statistically significant.[24,25,26,27] There is no significant correlation between gender and the frequency of *H. pylori* in this region compared to Baghdad-Iraq, Sulaimani-Iraq, and Misan-Iraq.[28, 29, 30] The observed higher positivity rate among females may reflect differences in healthcare-seeking behavior, exposure patterns, or other unmeasured biological or social factors. However, the cross-sectional design does not allow causal inference, and further studies are required to clarify these associations.

The percentage of antigen positivity our data indicate augmented with age groups from 838 (35.5%) in more than 19 years old to 72 (22.4%) in less than thirty years old, so the age effect of the infection increased markedly with age from ~22% in children to ~35% in adults as shown in Table (2), The higher positivity observed among adults compared with younger groups may reflect cumulative exposure over time or cohort effects; however, longitudinal studies are required to confirm these patterns. This outcome coincides with prior research indicating a significant prevalence of *H. pylori* infection over the past two decades.[32,33,35] in contrast to other research that have been carried out in Diyala-Iraq and Mosul-Iraq.[17, 34]

Water supply, and environmental condition may explain why the current results differ from those of the other studies.[30] Beside the infection is least prevalent in children, and Similar to children, infection remains low meanwhile prevalence rises substantially in adults.

The incidence of bacterial infection among examined patients in this study was (33.1%), Previous reports from India corroborate this finding (27%),[6] and in Jordan (25%).[15] According to other research, most developing countries, including Iraq, have a very dispersed prevalence of *H. pylori* infection. Kuwait has the highest prevalence of *H. pylori* in its neighbouring countries, at 49.7%,[12] (69.0%) in Turkey,[13] (53%) in Yemen,[14] (71.33%) in Saudi Arabia,[16] (61.87%) in Iran.[17]

In addition, compared to other countries, the prevalence of *H. pylori* in Kosovo was estimated to be 56.9%,[18] (64.39%) in Cameroon,[19] (47%) in Pakistan,[20] and *H. pylori* infection rates in Iraq was (55.8%) in Erbil.[21] Causes for the observed variation in prevalence across nations and even cities within the same nation include variations in sanitation, social and economic development, overcrowding in households, and incorrect food handling practices.[36]

A total of 2,888 participants were enrolled across five study sites. Overall, *H. pylori* stool antigen positivity was identified in 956 participants, corresponding to an overall prevalence of 33.1%, whereas 1,932 participants tested negative. The largest number of participants was recruited from Erbil (n = 820), followed by Kalar (n = 598), Akre (n = 520), Bardarash (n = 480), and Shaqlawa (n = 470).

Site-specific analysis demonstrated slight variations in the prevalence of *H. pylori* positivity. The highest positivity rates were observed in Erbil and Bardarash, each with a prevalence of 35.4% (290/820 and 170/480, respectively), while the lowest prevalence was recorded in Kalar (30.8%; 184/598). Intermediate prevalence rates were found in Shaqlawa (31.9%; 150/470) and Akre (31.2%; 162/520).

However, statistical analysis using the chi-square test showed no significant difference in *H. pylori* positivity among the study sites ($\chi^2 = 5.719$, $p = 0.221$), indicating that the distribution of the infection is statistically similar and relatively uniform across the included geographic locations as shown in **Table 3.**

Several socio-environmental factors, including household crowding, sanitation conditions, and socioeconomic status, have been associated with *H. pylori* transmission in previous studies; however, these variables were not measured in the present study.

The observed variation in *H. pylori* positivity across study sites may reflect differences in environmental conditions, population characteristics, socioeconomic factors, sanitation practices, or healthcare access among the regions of the Kurdistan Region of Iraq. A statistically significant association was observed between study site and *H. pylori* stool antigen positivity (χ^2 test, $p < 0.05$), indicating variability in positivity rates across the different healthcare facilities.

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Another limitation of this study is that diagnosis relied on a single stool antigen test without confirmatory methods. Although stool antigen testing is widely used for epidemiological studies, the possibility of false-positive or false-negative results cannot be completely excluded. This research possesses certain limitations. First, our study relied only on stool testing to diagnose *H. pylori*. One important limitation of this study is that it was conducted among patients attending hospitals rather than a community-based population. Therefore, the results represent the proportion of *H. pylori* positivity among healthcare-seeking individuals and may not accurately reflect the true prevalence of infection in the general population of the Kurdistan Region. In addition, although the province and patient population can be considered reasonably representative, but the patterns of complications in different regions of Kurdstain region might not be similar.

A primary limitation of this study is its reliance on univariate statistical analysis (chi-square tests). Because multivariable regression was not performed, we could not control for potential confounding variables between age, sex, and geographic location. Therefore, the statistically significant associations observed—such as the higher positivity rate in females—must be interpreted with caution, as they represent crude associations rather than independent epidemiological risk factors. Unmeasured socio-environmental confounders, such as household crowding or socioeconomic status, may further influence these observed demographic differences

CONCLUSION

In conclusion, this descriptive analysis establishes a substantial *H. pylori* stool antigen positivity rate within the sampled healthcare-seeking population in the Kurdistan Region. The epidemiological landscape of the infection in this cohort was statistically associated with demographic characteristics, notably sex and age. A higher proportion of positivity was observed among female patients compared to males, and adult populations demonstrated a greater burden of the pathogen relative to pediatric demographics. Geographic distribution appeared relatively homogenous across the assessed municipalities. Ultimately, these findings provide an updated regional baseline that highlights the necessity for larger, community-based longitudinal studies that can control for confounding variables and further define true epidemiological risk factors in this setting.

Competing interests

There authors declare that they have no competing interests.

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