



## Research Article

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## Prevalence of *Helicobacter pylori* and Associated Risk Factors in Yemeni Patients with Gastritis in the City of Aden: A Cross-Sectional Study

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### Abstract

**Introduction** *Helicobacter pylori* (*H. pylori*) have a significant impact on healthcare services, especially in developing countries. *H. pylori* was linked with gastritis, peptic ulcers, and cancer. This study was aimed to evaluate the rate of *H. pylori* infection in adult symptomatic patients with gastritis and its relationship with associated factors in Aden City, Yemen. **Methods:** The current Cross-sectional investigation enrolled 200 patients aged 18 years and over who were clinically diagnosed with gastritis during the period from February to May 2024. **Result:** The prevalence rate of *H. pylori* infection in our study sample was 69%. Although there was no significant difference in the rates of infection among age and sex groups, the highest rate was reported in the 29-38 years age group, while the lowest was demonstrated in the ≥ 59 years cohort. On other hands, it demonstrated association between the rate of *H. pylori* infection and educational level, previous history of infection, history of previous treatment, chewing Khat, and hand washing. While this study did not prove an association between *H. pylori* infection and smoking. Additionally, upon investigating the association between *H. pylori* infection and dietary habits, we found that the infection was more common in individuals who consumed fried food compared to those who ate grilled food. Moreover, the study revealed that the number of family members, the number of rooms per family, and the monthly income were impactful factors that may affect the prevalence rate of infection in our community. The data from this study also established a significant association between hemoglobin levels, lymphocyte counts, and *H. pylori* infection. Conversely, our investigation did not find an association between total white blood cells counts, neutrophil counts, eosinophil counts, monocyte counts, and *H. pylori* infection. **Conclusion:** The rate of *H. pylori* infection is high in adult people in Aden city. The associated factors may play a key role in the infection rate of *H. pylori* especially in unstable countries that suffered from civil wars. Furthermore, health awareness in the media about the harmful effects of chewing Khat may contribute to a decrease in the infection rate of *H. pylori*. Additional coupling the hematological parameters and *H. pylori* test result may help in diagnosis and management of chronic *H. pylori* infection. There is an indication of antimicrobial resistance in *H. pylori* among the Yemeni community that needs further studies and more public health response and awareness.

**Keywords:** Gastritis, Aden, Yemen, *Helicobacter pylori*, Associated factors.

### INTRODUCTION

*Helicobacter pylori* (*H. pylori*) infection poses public health challenges in many parts of the world. It's prevalent in over half the global population, showing varied rates between rural (over 80%) and urban (less than 40%) areas due to socio-economic and hygienic factors; typically acquired in childhood, it often remains asymptomatic, but around 30% may develop upper gastrointestinal conditions [1,2]. Although numerous individuals infected with *H. pylori* may remain asymptomatic, there are instances where it can contribute to health issues [3]. *H. pylori* is primarily transmitted through person-to-person contact. The most common routes of transmission include oral-oral and fecal-oral transmission. Contaminated food, water, or utensils can serve as vehicles for the bacteria. Additionally, close contact with an infected individual, especially within households, increases the likelihood of transmission[1]. Factors such as poor sanitation and crowded living conditions also may play a role in facilitating the spread of *H. pylori*. It is important to note that the exact mechanisms and sources of transmission may vary, but overall, person-to-person contact remains a key factor in the dissemination of *H. pylori* infections [4]. *H. pylori* gastritis is common in infected individuals, linked to the activation of pattern recognition receptors on various cells. Complex interactions between the gastric epithelium and immune responses allow *H. pylori* to persist, shifting the balance between inflammation and immunity to a more severe state due to continuous stimuli [5]. While many infected people remain asymptomatic, the bacterium is associated with many type of

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diseases conditions such as pernicious Anemia, peptic ulcers, gastritis, and gastric cancer [3,6,7] Diagnosis of *H. pylori* infection involves various invasive and non-invasive techniques with the urea breath test and stool antigen detection are two of the most frequently employed non-invasive procedures [4]. A positive stool antigen test for *H. pylori* is a strong indicator of current infection, as it detects antigens shed in the stool. Due to rapid clearance after successful treatment, a positive result confirms ongoing infection [8]. Early detection and management are crucial for preventing complications associated with *H. pylori* infection [9].

There is limited published data about *H. pylori* infection in the community of Aden City. Therefore, this investigation aimed to determine the prevalence rate of *H. pylori* in patients suffering from gastritis in Aden City and to evaluate certain associated risk factors that may enhance the infection in the study group

## MATERIALS AND METHODS

### Research Design and Sample size

The current study was conducted using a cross-sectional design involving symptomatic adult with gastritis who attended the Internal Medicine clinics at Hospital of 22<sup>nd</sup> May, Al- Shifa Clinic, Al- Daar Clinics (Public sectors), and Alwaly hospital (Private sector). Two hundred symptomatic adults aged 18 and over underwent screening to determine the prevalence of *H. pylori*, utilizing the Stool Antigen test. The participants provided informed consent after a thorough explanation of the study's purpose and procedures. The consent assured them that their data would be kept confidential and used for research purposes only. They were also informed of their right to withdraw from the study if they do not like. The Questionnaire was used to collect data on various associated factors, including age, gender, educational background, nutritional habits, smoking, Khat chewing, sanitation behavior, and monthly income.

### Laboratory Method

The fecal specimens were received from participants and tested for the presence of *H. pylori* antigen by Chromatography assay technique, following the manufacturer's instructions (ABON<sup>TM</sup>, Hong Kong). Blood specimens were collected from enrolled patients specifically for conducting a complete blood count. The analysis was carried out using a complete blood count analyzer (MEK-1301, Nihon Kohden, Japan), which counted and categorized various blood components, including red blood cells (RBCs), white blood cells (WBCs), and platelets.

### Ethical Issue

The research granted an ethical approval certificate (EACNUA 6.1.024) from Ethical Approval Committee at the College of Medical Science, National University, Aden, Yemen.

### Statistical Analysis

The data analysis was conducted using the IBM SPSS Statistics for Windows, Version 22.0 software (SPSS V 22). Frequency and proportions were utilized to describe the characteristics of the study population regarding relevant variables, while chi-square was employed to evaluate association between individual independent variables and *H. pylori* infection. Throughout the analysis, a p-value of 0.05 or lower, in addition to a 95% confidence interval, was considered indicative of statistically significant findings.

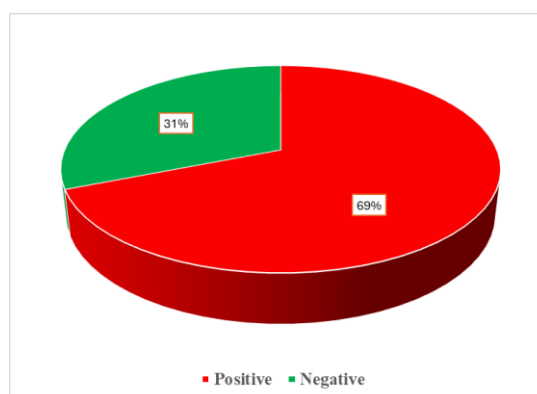
## RESULT

The investigation targeted two hundred symptomatic patients with gastritis, the males represented. 45% of sample size and the females accounted for 55%. The average age of participants was reported at 35.8 years and the standard deviation at 13.2 years (Table 1).

The current study demonstrated that the prevalence rate of *H. pylori* infection among patients with gastritis in Aden City is 69% (Figure 1).

**Table 1:** The descriptive statistics of Participants according to Gender and Age

Characters	Frequencies (%)	Total (%)	
Male	90 (45.0)	200(100.0)	
Female	110(55.0)		
Age groups		Mean	Std. Deviation
18-28 years	66(33)	35.8	13.2
29-38 years	64(32)		
39-48 years	33(16.5)		
49-58 years	21(10.5)		
≥ 59years	16(8)		



**Figure 1:** Prevalence of *H. pylori* Infection Based on the Fecal Antigen Detection Test

Although the prevalence of *H. pylori* was higher in females (40.5%) than in males (28.5%), this difference was not statistically significant. While our study showed that the highest rates of positive antigen test result occurred in younger age groups, with a peak prevalence in individuals aged 29 to 38, these differences in prevalence between age groups were also not statistically significant. Furthermore, the data indicated that the non-educated group had a significantly higher rate of *H. pylori* infection (49%) compared to (20%) the educated cohort (Table 2).

Our study identified an association between the history of previous *H. pylori* infection and the current prevalence. Individuals with a past infection had a much higher infection rate (57%) compared to those without a prior infection (12%). Similarly, there was a significant difference in the rate of *H. pylori* infection among those who had a history of treatment (48.5%) compared to those who did not (20.5%). In addition, there was no significant association between smokers and non-smokers cohorts, the prevalence of *H. pylori* infection in smokers was 21.5% and 47.5% among non-smokers. Moreover, the analysis of khat chewing revealed a significant association with *H. pylori* infection. Among individuals who chewed khat, 51.5% tested positive for *H. pylori*, while 8.5% tested negative. In contrast, among individuals who did not chew khat, 17.5% tested positive and 22.5% tested negative for *H. pylori* (Table 3).

The analysis of diet as an associated factor of infection revealed a clear connection between certain types of food and *H. pylori* infection. There was a significant difference in the rate of *H. pylori* infection among people who habitually consumed bland fried food with those who did not, with the highest infection rate at 45.5%, compared to 23.5% in non-consumers. Interestingly, a similar trend was observed for those who regularly consumed spicy fried foods, with an infection rate of 42.5% for consumers and 26.5% for non-consumers. In contrast, there was no significant difference in the rate of infection between those who consumed spicy grilled food (38%) and non-consumers (31%).

**Table 2:** The association between gender, age, education levels, and *H. pylori* infection in gastritis patients of Aden City

Characteristics		<i>H. pylori</i> antigen Test		P value
		Positive (%)	Negative (%)	
Gender	Males	57(28.5)	33(16.5)	0.079
	Females	81(40.5)	29(14.5)	
Age Group	18-28 years	45(22.5)	21(10.5)	0.214
	29-38 years	47(23.5)	17(8.5)	
	39-48 years	25(12.5)	8(4)	
	49-58 years	10(5)	11(5.5)	
	≥ 59 years	11(5.5)	5(2.5)	
Education levels	Educated	40 (20)	46(23)	0.000
	Non-educated	98(49)	16(8)	

**Table 3:** The association between Sociodemographic factors and *H. pylori* infection in our sample

Associated factors		<i>H. pylori</i> antigen Test		P value
		Positive (%)	Negative (%)	
Previous infection	Yes	114(57)	6(3)	0.000
	No	24(12)	56(28)	
History of previous treatment	Yes	97 (48.5)	4 (2.0)	0.000
	No	41 (20.5)	58 (29.0)	
Smoking	Yes	43(21.5)	19(9.5)	1.000
	No	95(47.5)	43(21.5)	
Khat Chewing	Yes	103(51.5)	17(8.5)	0.000
	No	35(17.5)	45(22.5)	
Spicy Grilled Food	Yes	76(38)	29(14.5)	0.277
	No	62(31)	33(16.5)	
Bland Fried Food	Yes	91(45.5)	23(11.5)	0.000
	No	47(23.5)	39(19.5)	
Spicy Fried Food	Yes	85(42.5)	28(14)	0.03
	No	53(26.5)	34(17)	
Hand washing	Always	34(17)	43(21.5)	0.000
	Most often not	104(52)	19(9.5)	
Number of Family Members	2	8(4)	13(6.5)	0.05
	3	34(17)	13(6.5)	
	≥4	96(48)	36(18)	
Number of Rooms per Family	1	119(59.5)	39(19.5)	0.000
	≥ 2	19(9.5)	23(11.5)	
Monthly Income	<70000	111(55.5)	20(10)	0.000
	≥70000	27(13.5)	42(21)	

**Table 4:** Hematological Parameters of Gastritis Patients Infected by *H. pylori* in Aden City

Hematological Parameters		<i>H. pylori</i> antigen Test Result		P value
		Positive (%)	Negative (%)	
Hemoglobin Level	<12 gm/dl	73(36.5)	21(10.5)	0.01
	12-17.2 gm/dl	65 (32.5)	41(20.5)	
Total White Blood Cells Count	$3.9 \times 10^3/\mu\text{l}$	17(8.5)	6(3)	0.214
	between 4 & $11 \times 10^3/\mu\text{l}$	111(55.5)	55(27.5)	
	$> 11 \times 10^3/\mu\text{l}$	10(5)	1(0.5)	
Neutrophil	< 40%	35(17.5)	7(3.5)	0.18
	40-70%	102(51)	51(25.5)	
	>70%	1(0.5)	4(2)	
Lymphocyte	<22%	3(1.5)	4(2)	0.000
	22-44%	38(19)	44(22)	
	>44%	97(48.5)	14(7)	
Eosinophil	0-8%	138(69)	62(31)	-
	>8%	0	0	
Monocyte	<4%	65(32.5)	25(12.5)	0.592
	4-11%	72(36)	36(18)	
	>11%	1(0.5)	1(0.5)	
Platelets	$< 150 \times 10^3/\mu\text{l}$	8(4)	2(1)	0.286
	150 - $450 \times 10^3/\mu\text{l}$	126(63)	60(30)	
	$> 450 \times 10^3/\mu\text{l}$	4(2)	0(0)	

Alongside, our findings underscore the importance of hand hygiene in potentially reducing *H. pylori* infection in impoverished communities. Specifically, the study demonstrated that individuals who always washed their hands had an infection prevalence of 17%, while those who did not wash their hands frequently had a notably higher prevalence of 52%.

When considering the number of family members as a socioeconomic factor, the study found that the prevalence of *H. pylori* infection increased with the number of family members. The highest infection rate (48%) is observed in families with four or more members, while the lowest rate (4%) is found in families with two members. While considering the number of rooms per family, the study demonstrated significant differences in the prevalence of *H. pylori* infection. Families living in a single room had a much higher infection rate (59.5%) compared to those living in two or more rooms (9.5%). Additionally, the study found significant differences in infection rates based on monthly income, indicating that income may affect the prevalence of *H. pylori* infection. Among families with a monthly income of less than 70,000 Yemeni Rials, the infection rate was 55.5%, compared to 13.5% in families with a monthly income of 70,000 Yemeni Rials or more (Table 3).

The study did not show significant differences between the *H. pylori* antigen positive and antigen-negative groups for total white blood cell counts (p value 0.214), neutrophil levels (p 0.18), monocyte levels (p value 0.592), and platelet counts (p value 0.286). However, it reveals significant differences in several other hematological parameters. Among individuals with different hemoglobin (Hb) levels, the highest positive rate was reported in those with Hb levels below 12 gm/dl, where 36.5% tested positive for *H. pylori*, compared to 10.5% who tested negative. In contrast, among individuals with Hb levels between 12 and 17.2 gm/dl, 32.5% tested positive for *H. pylori*, while 20.5% tested negative. The difference in infection prevalence between the two hemoglobin level groups was statistically significant (p value 0.01). Additionally, individuals with lymphocyte levels < 22%, 1.5% tested positive for *H. pylori*, compared to 2% who tested negative. In the 22-44% lymphocyte level group, 19% tested positive for *H. pylori*, while 22% tested negative. While in cohort with lymphocyte levels > 44%, 48.5% tested positive for *H. pylori*, compared to 7% who tested negative. The difference in infection prevalence across the lymphocyte level groups was statistically significant (Table 4).

## DISCUSSION

Epidemiological surveillance of *H. pylori* infection is essential for developing effective public health strategies by providing data to identify high-risk populations and customize interventions to reduce and manage infection in the community [10]. The current investigation showed that the prevalence of *H. pylori* was high (69%) among symptomatic patients with gastritis in Aden city. The rate was much higher than that demonstrated by Almashhadany and Mayass 2020 among adult patients of Dhamar City, Yemen [11]. On other hand our result was slightly lower than what was reported among Yemeni people under 18 years old in Dhamar City [12]. However, the findings of our study were somewhat consistent with the intentions outlined by Habbash et al. (2022) in their research on Bahraini adults and with Zandian et al., 2023 among Irani patients [13,14]. During the journey of study for the association between *H. pylori* infection and sex, the findings of this investigation aligned with the results of Almashhadany et al. (2023), which also found no association between a positive *H. pylori* antigen test and the gender of the participants [15]. In another vein, a statistically significant association was observed between educational level and a positive antigen test result. This aligns with the research conducted by Habbash et al. (2022) who reported similar findings [13]. Also, there was no association between the age of patients and positive results of the *H. pylori* infection in our investigation. This result was in line with the findings of Almashhadany and Mayass (2018) among Yemeni patients [11]. By contrast to Al-Badaii

and has colleagues among younger than 18 years in Yemen, we found association between the education level and *H. pylori* infection in our study participants, this may be explained by the difference in the age of our sample and their sample [12]. However our finding was in similar to the finding of Habbash et al 2022 among adults Bahraini patients in respect of educational level [13].

The study found a significant difference in the rate of *H. pylori* infection among those with a previous history of infection, those with a history of treatment, and those without. These findings may reflect the resistance of *H. pylori* in Aden city as documented in many pervious research [16,17]. Although the connection between smoking and *H. pylori* infection has been documented in many research, the current investigation did not find a link between smoking and a positive *H. pylori* antigen test [18-19]. Khat chewing is a well-established habit in Yemen and various African nations. Several studies have established a potential association between Khat consumption and gastrointestinal diseases, including dental problems, gastritis, and constipation [20,21]. Our study found an association between habitual khat chewing and *H. pylori* infection in our study sample, this finding is similar to the finding of Alyahawi and colleagues 2018 [18].

In terms of dietary habits, numerous global studies have examined the link between dietary habits and *H. pylori* infection. Some of these studies have found that consuming certain types of foods can elevate the risk of *H. pylori* infection [12,22,23]. We found statistically significant differences in *H. pylori* rates between consumers and non-consumers of fried food. These findings are consistent with Al-Badaii et al. (2021) in their study among Yemeni students [12]. On the other hand, there was no association between spicy grilled food and *H. pylori* infection in our study, as demonstrated by Li and his colleagues (2020) among patients suffering from chronic gastritis [24].

This study found a notably lower prevalence (17%) of *H. pylori* infection in the regular handwashing group compared to the non-regular handwashing group (57%). This result was similar to the findings of Thorat et al., 2024 [25].

In relation to the number of family members (p value 0.05), number of rooms per family (p value 0.000), and monthly income (p value 0.000), this study demonstrated an association between these factors and *H. pylori* infection among the cohorts exposed to these factors and those who were not, this result consistent with many previous studies in different regions of the world [14,26-27].

*H. pylori* infection can alter numerous hematological parameters, which are associated with various hematological diseases. Treating *H. pylori* significantly improves these conditions [19]. In the current study, we demonstrated differences in the rates of *H. pylori* infection among patients with low hemoglobin (Hb) levels compared to those with normal Hb levels. The association between hemoglobin levels and *H. pylori* infection has been confirmed in numerous previous research publications [6, 28-29]. Furthermore, there were significant differences in the prevalence rate of infection among patients with varying levels of lymphocyte counts. This finding is consistent with the results reported by Elkhalifa et al. (2021) in their case-control study conducted in Sudan [30]. On other hands, our study did not find significant difference between the total white blood cells neutrophils, monocytes and eosinophil counts and prevalence rate of *H. pylori* as demonstrated by man previous studies [19,31-32]. Similarly, this investigation did not find significant differences in the platelet count and *H. pylori* infection among cohorts of the study. This finding also pointed out in may previous research studies [19,29,32].

## CONCLUSION

The prevalence of *H. pylori* among adults in Aden city is alarming (69%) that need more awareness. The associated factors may play a vital role in increasing the *H. pylori* infection in countries that have ongoing civil war. The public health sector should intervene to increase awareness

and response by highlighting the risks of associated factors that may enhance *H. pylori* infection in society, using media campaigns. The hematological parameters may enhance the management of *H. pylori* infection, especially in chronic cases. The study provides strong clues about *H. pylori* antimicrobial resistance, showing a significant difference in infection rates among those who had a previous history of treatment and those who did not. There are limitations in our study because it relies solely on the *H. pylori* antigen test for diagnosis and did not use the urea breath test. Additionally, the impact of civil war may affect the results. We recommend that international health organizations, funding agencies, and health authorities in Yemen prioritize *H. pylori* infection by actively encouraging research in this field.

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#### Conflict of Interest

The authors declare no conflicts of interest.

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