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Original article

Association of *Helicobacter pylori* Infection with Gender and Age Among Peptic Ulcer Patients at Al-Khoms Educational Hospital

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Helicobacter pylori is a Gram-negative bacterium commonly associated with gastrointestinal disorders, particularly peptic ulcer disease. *H. pylori* is one of the most common bacterial infections around the world. They are the most prevalent cause of peptic ulcer disease and gastric cancer. Many studies have been conducted to identify and detect the causes and develop therapeutic drugs that limit their risks to humans. This study was performed to determine the relationship between *Helicobacter pylori* infection and its relation to age and gender in a population of Al-Khoms Educational Hospital, Libya. The study was a retrospective cross-sectional study conducted in the Al-Khoms Educational Hospital from November 2024 to May 2025 to determine the seroprevalence of *H. pylori* infection. A total of one hundred eighty (n=180) participants (112 females and 23 males, aged between 1 and 90 years) were collected from the microbiology unit of the main medical laboratories of the previously mentioned hospital. For the detection of *H. pylori*, enzyme-linked immunosorbent assay kits were utilized. In contrast, the absence of both antibodies (IgG and IgM) resulted in the designation of *H. pylori*-negative status. Anti-*H. pylori* immunoglobulin (Ig)G/IgM>22 IU/L were classified as *H. pylori* positive. The analysis was performed by using the statistical package for the social sciences, SPSS version 27. The overall prevalence of H. pylori infection was 75%. *H. pylori* infection prevalence was higher in females than in men (81.8% vs53.5%, p = 0.0004) The highest prevalence of *H. pylori* infection is observed in the age groups of 41–50 years age group shows the highest number (42) of positive cases, compared with the other age groups, but a p-value of 0.833 suggests that there is no statistically significant association between age and *H. pylori* infection status. The prevalence of *H. pylori* infection was high in this study. *H. pylori* infection seroprevalence was higher in females than males, and middle-aged people are more vulnerable to *H. pylori* infection. To the best of our knowledge, this study represents the first seroprevalence assessment of *H. pylori* infection in a population of Al-Khoms City, Libya.

Introduction

Helicobacter pylori, formerly referred to as *Campylobacter pylori*, is a gram-negative, flagellated at one end that helps to penetrate the mucosa and colonize on the surface of the gastric antrum, and is, spiral bacterium that can occasionally exhibit a slightly curved rod shape. This bacterium infects human gastric mucosa, causing long-term colonization and inflammation. It has a helix shape, which is thought to have evolved to penetrate the mucoid lining of the stomach [1,2]. *H. pylori* is the etiologic factor for Peptic Ulcer Disease (PUD) in most patients and may develop gastric carcinoma in many individuals [3,4].

Helicobacter Pylori is the commonest bacterial infection worldwide. The prevalence of *Helicobacter pylori* infection varies significantly across different countries and ethnic groups. High infection rates are reported in parts of Africa, such as Nigeria (87.7%), as well as in several developing countries in Asia. In contrast, industrialized and Western nations, like Switzerland, exhibit considerably lower prevalence rates (18.9%) [5]. Numerous studies have consistently shown that *H. pylori* infection is more widespread in developing regions compared to developed ones, with reported rates ranging from below 20% in some European countries to over 80% in certain Eastern Mediterranean areas [6,7]. Although the majority of infected individuals remain asymptomatic, a small proportion may experience gastrointestinal symptoms [8].

H. pylori infection is the primary cause of peptic ulcers, being responsible for 90% of duodenal ulcers and around 50–80% of gastric ulcers [9,10]. It is classified as a Group 1 carcinogen, meaning it has the potential to cause stomach cancer and primary gastric B-cell lymphoma [11,12]. A decline in the prevalence of the *H. pylori* infection in most countries has been associated with a parallel decline in peptic ulcer disease and gastric cancer [13,14]. Approximately 90% of non-cardia gastric cancer worldwide is estimated to be

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explained by this infection [10]. Several studies have confirmed that humans are the main host of *H. pylori*. The bacteria can spread through gastro-oral and oral-oral transmission. Moreover, research shows that it may also survive in milk and the stomachs of certain animals, such as sheep and cats [15].
Peptic ulcer and gastric cancer occur more frequently in men [16,3]. Therefore, a particular interest subsists in whether there is a specific gender predilection in *H. pylori* infection, since both peptic ulcer disease and gastric cancer have a high male-to-female ratio. However, the relationship between gender and the prevalence of *H. pylori* infection is still controversial [17]. On the other hand, indicated that the difference in the prevalence of *H. pylori* infection in the same geographic area over time might be due to the birth cohort effect. However, the effect of the birth year on *H. pylori* prevalence has not been examined by Joinpoint regression analysis [18].
The association between gender and *H. pylori* infection remains debated [19]. Studies show that the infection rate tends to increase with age, and it develops more rapidly in communities with low socioeconomic conditions [8]. Detection of *H. pylori* (whether in fresh or stored serum) is commonly done using serological tests that identify immunoglobulin G (IgG) antibodies. However, IgA and IgM antibodies have also been used in some cases [20]. Therefore, this study aimed to assess the prevalence of *Helicobacter pylori* infection and explore its correlation with age and gender among the population of Al-Khoms City, Libya.

Methods

Study design and setting

A retrospective cross-sectional study was conducted in the central Al-Khoms Educational Hospital, Libya (Laboratory Department) from November 2024 to May 2025, to determine the seroprevalence of *H. pylori* infection. A total of 180 participants (112 females and 23 males, aged between 1 and 90 years) were included in this study. For the detection of *H. pylori,* enzyme-linked immunosorbent assay kits were utilized. In contrast, the absence of both antibodies (IgG and IgM) resulted in the designation of *H. pylori*-negative status. Anti-*H. pylori* immunoglobulin (Ig)G/IgM>22 IU/L were classified as *H. pylori* positive.

Collection of specimens

About 2-3 ml of venous blood was collected from participants in a plain tube, and sera were separated and further analyzed. Finally, serum samples of 180 participants (112 females and 23 males) were available for analysis.

Determination of Helicobacter pylori Status

The presence of anti-*H. pylori* IgG and IgM antibodies were assessed using a specific enzyme-linked immunosorbent assay (ELISA) for *H. pylori* IgG and IgM, in accordance with the manufacturer's guidelines. Patients were considered *H. pylori*-positive if the level of anti-H. *pylori* immunoglobulins (IgG/IgM) exceeded 22 IU/L. Conversely, the absence of both antibodies indicated a *H. pylori*-negative status.

Principle of the Enzyme-Linked Immunosorbent Assay Kit

The antigen-antibody complex is formed when antibodies specific to *H. pylori* in the sample bind to the immobilized antigen. The solid phase is then washed to eliminate any unbound components. A second antibody, which targets human IgG antibodies and is conjugated with horseradish peroxidase, is subsequently added. This conjugate binds to the complex. Any excess conjugate is washed away. A colorless substrate is then added and converted into a blue product by the enzyme-labeled complex. The intensity of the color developed reflects the concentration in the sample.

Statistical analysis

Statistical analysis was performed using One-Way ANOVA in SPSS software, version 27. A Chi-square test was employed to compare the different groups concerning categorical variables. Statistical significance was defined as $P \leq 0.05$.

Results

One hundred eighty (n=180) samples were collected from the microbiology unit of the main medical laboratories of the previously mentioned hospital. As presented in Table 1, the relationship between *Helicobacter pylori* infection and gender in patients with peptic ulcer. The statistical analysis revealed a significant association between gender and infection status. Among males, 23 cases (53.5%) were positive compared to 20 negative cases (46.5%), while among females, 112 cases (81.8%) were positive compared to 25 negative cases (18.2%). The Chi-square test yielded a value of 12.48 with a P-value of 0.0004, which is well below the conventional threshold of statistical significance (0.05). These findings indicate that there is

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a statistically significant difference between males and females in terms of infection rates, which may reflect biological or behavioral factors associated with gender.

Table 1. The Relationship of Helicobacter pylori infection with gender in patients with peptic ulcer.

Gender	Positive Cases		Negative Cases		Chi-Square	P-value
	Count	%	Count	%		
Male	23	53.5%	20	46.5%	12.48	0.0004
Female	112	81.8%	25	18.2%		
Total	135	75%	45	25%		

Table 2 shows the relationship between *Helicobacter pylori* infection and age in patients with peptic ulcer. Although the percentage of positive cases varies across different age groups, ranging from 64.71% to 100%, the Chi-square test result ($x^2 = 4.26$) and the high P-value (0.833) indicate that there is no statistically significant association between age and *H. pylori* infection ($P > 0.05$). This suggests that age does not play a major role in determining the likelihood of infection among these patients. Therefore, other factors besides age might be more influential in the prevalence of *H. pylori* infection in peptic ulcer cases.

Table 2: The relationship of Helicobacter pylori infection with age in patients with peptic ulcer.

Age in years	Positive cases		Negative cases		Chi Square	P-value
	Count	%	Count	%		
1-10	12	70.59	5	29.41	4.26	0.833
11-20	11	68.75	5	31.25		
21-31	26	86.67	4	13.33		
31-40	24	75.0	8	25.0		
41-50	42	73.68	15	26.32		
51-60	11	64.71	6	35.29		
61-70	5	83.33	1	16.67		
71-80	3	75.0	1	25.0		
81-90	1	100.0	0	0.0		

The bar chart presents the number of *H. pylori*-positive and negative cases across different age groups among patients with peptic ulcer (Figure 1). Each age group is represented by two bars: one indicating the number of positive cases and the other representing the number of negative cases. The 41–50 years age group shows the highest number of positive cases (42), followed by the 21–31 and 31–40 age groups. This suggests that middle-aged individuals are more frequently diagnosed with H. pylori in this study population. On the other hand, the 81–90 years group has the fewest cases, likely due to the smaller number of elderly patients attending the hospital. This chart highlights the age groups that are most affected and may benefit from targeted screening and preventive healthcare strategies.

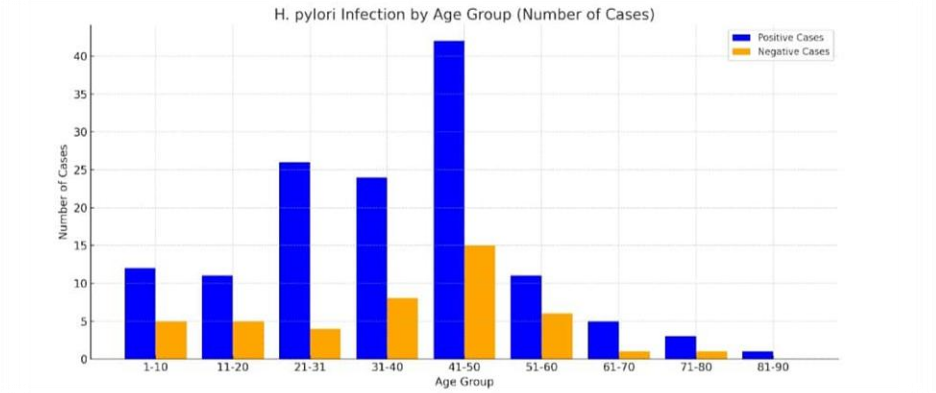

Figure 1. The number of Helicobacter pylori positive and negative cases across different age groups among patients with peptic ulcer.

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Figure 2 illustrates the distribution of patients infected or suspected to be infected with *Helicobacter pylori* based on age groups. It is evident that the 41–50 years age group represents the largest proportion of cases, accounting for approximately 31.7% of the total sample. This indicates that this age group was the most represented in the study. It is followed by the 31–40 years and 21–31 years groups, highlighting that the majority of cases are concentrated in middle-aged individuals. In contrast, older age groups, such as 81–90 years, constitute a very small portion of the sample (around 0.6%), which may reflect limited hospital visits by the elderly or their smaller number in the studied population. This distribution emphasizes the importance of targeting middle-aged populations for screening and awareness campaigns, as they appear to be the most affected.

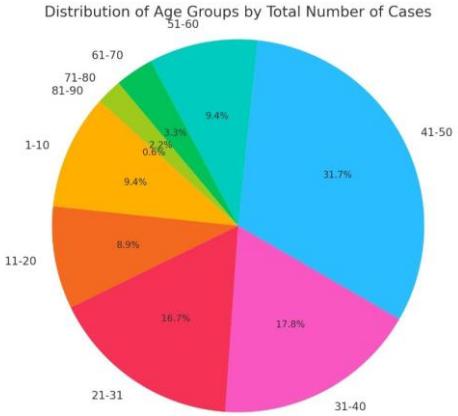

Figure 4: The distribution of patients infected or suspected to be infected with Helicobacter pylori based on age groups.

Discussion

Helicobacter pylori (H. pylori) is a Gram-negative bacterium, colonizes the human stomach. commonly associated with gastrointestinal disorders, particularly peptic ulcer disease. *H. Pylori* is the etiologic factor for PUD in most patients and may develop gastric carcinoma in many individuals [3,4]. While various risk factors such as hygiene, socioeconomic status, and lifestyle have been implicated in *H. pylori* transmission, the role of age in infection prevalence remains unclear [21,22]. The present study represents the first seroprevalence assessment of *H. pylori* infection in a population of Al-Khoms City, Libya. The overall prevalence of *H. pylori* infection in our study was 75%. The findings of this study agree with numerous previous scientific studies from several Libyan cities, e.g., Benghazi, where the authors found healthy individuals (71.4%) infected with *H. pylori* [23], while in AL-Ajailat, where the authors found healthy individuals (84.7%) infected with *H. pylori* [8].

In the current study, the relationship between gender and the prevalence of *H. pylori* infection was significant. Our findings indicated that there were statistically significant differences in the prevalence of *H. pylori* (81.8% in females and 53.5% in males), with a P-value of 0.0004. Several studies are in accordance with our findings, including those by [24,25,8]. Data on the association between gender and the prevalence of *H. pylori* infection are somewhat conflicting. Indeed, most studies reported no significant difference in *H. pylori* infection between men and women, both in adults and in children. There was no association between the H. pylori infection and sex. This may be due to the reduced statistical power associated with the small sample sizes of these studies [14,26]. How gender contributes to the different prevalence of *H. pylori* infection is unclear, though it is now becoming widely recognized that there are important sex differences in many diseases [27]. Women had higher IL-35 levels than men among *H. pylori*-infected peptic ulcer patients, *H. pylori*-infected asymptomatic subjects, and non-infected healthy subjects [28]. Female gender affects *Helicobacter pylori* eradication failure in chronic gastritis. Therefore, there may be other cofactors in addition to *H. pylori* that are important for the development of gastric cancer [29].

There is ongoing debate regarding the relationship between age and the prevalence of *Helicobacter pylori* infection, as reported by [30,15]. However, the current study demonstrated that the highest prevalence of *H. pylori* infection was observed in middle-aged individuals (41–50 years), a trend also reported in studies conducted in Libya [31,8]. These findings are in agreement with the results reported in previous studies, which similarly investigated the association between age and *H. pylori* infection and found the peak prevalence in the 40–49 age group. In contrast, the lowest prevalence rates were observed among the

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youngest (1–10 or 1–9 years) and oldest (81–90 or 80–89 years) age groups. This consistency across studies suggests a clear age-related pattern in the prevalence of *H. pylori*, with infection rates peaking in middle age and declining at the age extremes. In addition, the prevalence of *H. pylori* infection decreased with an increase in age up to 70 years. This finding agreed with a study in Tripoli, where they found a sharp drop in the percentage of *H. pylori* infection in the 60-69 and 80 years [32,8]. These findings are in line with those found in previous literature globally [33,25]. The number of older participants is limited; consequently, our results may be influenced. This has been explained as being due to a diminished serological response in older individuals and/or a reduced quantity of microorganisms resulting from gastric atrophy.

In agreement with this study by [25,8], the analysis demonstrates no statistically significant association between age and *Helicobacter pylori* infection among patients with peptic ulcer ($x^2 = 4.26$, $P = 0.833$). Despite variations in infection rates across age groups, the high P-value indicates that age is not a determining factor in the prevalence of *H. pylori* infection in this study population. The high P-value (> 0.05) confirms that age is not a significant risk factor for the prevalence of *H. pylori* among the studied population. These findings suggest that other variables, such as environmental factors, lifestyle, or immune status, may play a more critical role in infection rates.

The strength points of this study include a large sample size that gives the study enough statistical power. To the best of our knowledge, this study represents the first seroprevalence assessment of *H. pylori* infection in a population of Al-Khoms City, Libya. The results of the present study demonstrate that the prevalence of (75%) of individuals was high in Al-Khoms City, Libya.

Conclusion

This study demonstrated a high prevalence of *Helicobacter pylori* infection. The seroprevalence was notably higher among females compared to males, and middle-aged individuals appeared to be more susceptible to the infection. Continuous surveillance of *H. pylori* transmission, along with the provision of adequate sanitary infrastructure and improvements in educational awareness, particularly among adults, could serve as effective measures for controlling the spread of this infection.

Limitation

This study was limited by the absence of detailed clinical data, including individual risk factors and medical history. Additionally, information regarding the most recent H. pylori eradication therapy received by participants was not available. Future studies should consider incorporating these variables to provide a more comprehensive understanding of the infection dynamics.

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Conflict of Interests

The authors declare that they have no conflict of interest.

Authors contribution

SJA suggested the research point, all authors contributed toward data analysis, drafting, and critically revising the paper, and agree to be accountable for all aspects of the work. All the authors have read and approved the manuscript. All authors reviewed the article.

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