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A cross-sectional Study of H. pylori Bacteria Among Peptic Ulcer Patients in Tarhouna and Emsllatah Cities

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دراســة مقطعية لبكتيريا الملتوية البوابية عند مرضى القرحة المعــدية في مدينتي ترهونة ومســلاتة

إبراهيم مفتاح علي الطرشاني[1*]، عائشــة عمــاد ســالم بلحـــــاج [2] ، مــلاك عبدالباسط علي عبدالجليل[2] ، امتنـــان بشير ســالم الفيتوري[2] ، إيمـــان ســعد الله علي الـدبـــو[2]
[1] أستـاذ مساعد ، قسم المختبرات الطبية ، كلية التقنية الطبية ، جامعة الزيتونة ، ترهونة ، ليبيا.
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Abstract

The prevalence of H. pylori infection in Tarhuna and Emsllatah cities is the main focus of this study, which was carried out between March and June 2025. Finding associated risk factors is another goal. Participants with gastric ulcers provided 450 samples in total, including stool samples to look for bacteria and blood samples to detect IgG antibodies. The Immuno Chromatography test cartridge was one of the diagnostic tools used. Personal interviews and the completion of a specially created questionnaire were also used in the data collection process. SPSS version 22 was then used for data analysis. In the blood and stool samples, 335 out of 450 participants (74.4%) tested positive for Helicobacter pylori (H. pylori), indicating a high prevalence of the infection. Gender, age, weight, and the type and location of housing are risk factors that affect this prevalence. Of the participants, 25.6% tested negative for the infection, with 91.1% having a diagnosis of peptic ulcer disease and 8.9% having non-peptic ulcers. The conclusion underlined the significant correlation between ulcer recurrence and psychological stress, gender, and the length of the injury. Longer injury durations increase recurrence likelihood, while psychological stress shows a weaker connection to lower recurrence rates. Gender has a weak yet significant effect, whereas age, type of residence, and smoking do not significantly influence recurrence rates.

Keywords: Peptic ulcer, H.pylori, prevalence of infection, and Occurrence.

الملخص:
يُعد انتشار عدوى الملوية البوابية (H. pylori) في مدينتي ترهونة ومسلاتة محور التركيز الرئيسي لهذه الدراسة، التي أُجريت في الفترة من مارس إلى يونيو 2025. كما يهدف البحث إلى تحديد عوامل الخطر المرتبطة بالعدوى. قدّم المشاركون المصابون بقرحة المعدة 450 عينة إجمالية، شملت عينات براز للكشف عن البكتيريا وعينات دم للكشف عن الأجسام المضادة من نوع IgG. وكانت خرطوشة اختبار الكروماتوغرافيا المناعية من بين الأدوات التشخيصية المستخدمة. كما تضمنت عملية جمع البيانات إجراء مقابلات شخصية وإكمال استبيان مُصمم خصيصاً لهذا الغرض. بعد ذلك، تم تحليل البيانات باستخدام برنامج SPSS الإصدار 22. أظهرت نتائج عينات الدم والبراز أن 335 مشاركاً من أصل 450 (74.4%) كانت نتيجتهم إيجابية للملوية البوابية(H. pylori) ، مما يشير إلى انتشار مرتفع للعدوى. وتُعد عوامل الخطر التي تؤثر على هذا الانتشار: الجنس، والعمر، والوزن، ونوع وموقع السكن .
من بين المشاركين، كانت نتيجة 25.6% سلبية للعدوى، حيث كان 91.1% منهم مصابين بقرحة هضمية و8.9% بقرحة غير هضمية. أكدت الخلاصة على وجود علاقة ذات دلالة إحصائية بين تكرار القرحة والضغط النفسي، والجنس، ومدة الإصابة. فكلما طالت مدة الإصابة، زاد احتمال التكرار، بينما يُظهر الضغط النفسي ارتباطاً أضعف بمعدلات تكرار أقل. للجنس تأثير ضعيف لكنه ذو دلالة إحصائية، في حين أن العمر ونوع السكن والتدخين لا تؤثر بشكل ملحوظ على معدلات التكرار.

الكلمات المفتاحية: : القرحة الهضمية، الملوية البوابية، انتشار العدوى، الحدوث.

1.Introduction

The genus Helicobacter is a microaerophilic pathogen distinguished by its motility and gram-negative helical or curved rod morphology. It is classified under the family Helicobacteraceae (Mao et al., 2021).To date, approximately 35 species of Helicobacter have been identified, including the non-gastric, enterohepatic, and gastric types. Certain non-H. pylori species have been documented to be transmissible to humans, where they may induce or exacerbate gastric conditions and are associated with various non-gastric diseases (Akhlaghi et al., 2024). Non-pylori Helicobacter species exhibit distinct features compared to H. pylori, including differences in cell morphology, spiral shape, and arrangement and number of flagella. These variations present a valuable opportunity to explore how such structural differences influence motility within this bacterial genus (Van der Mee-Marquet et al., 2017). H. pylori is transmitted through fecal–oral, oral–oral, and gastric–oral routes, with the fecal–oral pathway being recognized as the most common. Although oral–oral transmission also plays a role, its prevalence remains uncertain. The gastrooral route is most frequently observed in children and individuals who are prone to vomiting. Human-to-human and foodborne transmission are the primary patterns of H. pylori infection, and stringent environmental and occupational restrictions are linked to exposure of animals to humans and workplace settings (Mladenova, 2021). Helicobacter pylori (~2– 3.5µm×0.5 1.0 µm) is the most clinically significant species and is identified as a causative agent of active chronic gastritis, peptic and duodenal ulcers, gastric neoplasia, and mucosa-associated lymphoid tissue malignancies in humans (Mladenova, 2021). This bacterium is proficient in colonizing the human gastric environment and its high prevalence has a substantial impact on human health. It is associated with various gastric and extragastric conditions including gastric cancer. Colonization by H. pylori induces significant alterations in the gastric microenvironment, which subsequently affects the

gastrointestinal microbiota by modulating gastric acidity, host immune responses, antimicrobial peptides, and virulence factors (Fiorani et al., 2023). Thereby contributing to the pathogenesis of H. pylori. H. pylori infection is one of the most prevalent infections globally, affecting an estimated 4.4 billion individuals, with cases reported in 2015 across both developing and developed countries (Doulberis et al., 2018). Clinically, > 80% of infections are asymptomatic, and previous studies have indicated that the risk of H. pylori infection varies according to ethnicity, household characteristics, and geographical location. Socioeconomic status is a significant risk factor for H. pylori infection (Ozbey and Hanafiah, 2017). H. pylori infection is associated with numerous risk factors, including demographic characteristics, socioeconomic status, environmental hygiene and sanitation standards, dietary habits, and lifestyle behaviors (Zeng et al., 2024). The incidence of H. pylori infection exhibits considerable heterogeneity, with prevalence rates ranging from 7.3% to 92.0% depending on factors such as geographical location, age, and socioeconomic conditions (Balas et al., 2022). Numerous studies conducted throughout the Americas have indicated a general H. pylori infection prevalence of approximately 50%. In contrast, the prevalence in Africa is notably higher, at approximately 70% (Al-mashhadany, 2018). Previous epidemiological studies have shown a higher incidence of H. pylori infections in developing countries, with certain regions such as Bhutan and Myanmar reporting rates as high as 90% (Sjomina et al., 2018; Al-Brefkani et al., 2021).

Problem Statement:

Helicobacter pylori is a major causative agent of gastric ulcers and other gastrointestinal diseases. Despite effective eradication therapies, reinfection remains a significant challenge. Recurrence of H. pylori infection after treatment affects patient outcomes and increases healthcare costs. The underlying causes of reinfection are not fully understood, and recurrence rates vary across populations and regions. Therefore, further investigation is needed to identify the factors contributing to reinfection and to improve treatment strategies.

Rationale:

H. pylori reinfection is influenced by multiple factors, including patient adherence to treatment, antibiotic resistance, socio-economic status, and lifestyle habits. Resistance to antibiotics, such as clarithromycin, complicates eradication efforts and contributes to high reinfection rates. Environmental factors like contaminated water and food also play a role in reinfection. Additionally, genetic differences in host immune response may influence susceptibility to reinfection.

Significance of the Study:

This study aims to provide a better understanding of the factors contributing to H. pylori reinfection. By identifying these factors, the findings will support the development of more effective treatment and prevention strategies, reduce reinfection rates, and improve patient outcomes. The study will also address the role of antibiotic resistance and genetic factors in reinfection, which are critical for enhancing treatment protocols. Overall, the research could inform public health policies and help reduce the global burden of H. pylori-related diseases.

Objective of the study:

General Objective: This study assesses the relationship between gastric ulcers and Helicobacter pylori reinfection with the goal of determining risk factors and improving treatment and prevention methods to lower recurrence.

Specific Objectives:

-To estimate the prevalence of Helicobacter pylori reinfection among patients diagnosed with gastric ulcers in Tarhona and Emsllatah Cities.

-To investigate the association between demographic variables (including age, gender, residency, type of residency, period of injury, smoking, psychological stress, socio-economic status and the recurrence of infection.
-To assess the influence of lifestyle factors (such as dietary habits, smoking, and medication usage) on the recurrence of H. pylori infection.

MATERIALS AND METHODS: THIS STUDY DEPENDS ON DETECTING AND CHARACTERIZING HELICOBACTER PYLORI BACTERIA AMONG PATIENTS WITH PEPTIC ULCER DISEASE USING MULTIPLE DIAGNOSTIC APPROACHES.

1 - Type of Study:
An analytical cross-sectional study.

2 - Area of Study:
Tarhouna and Emsllatah Districts, Libya.

3 - Duration of Study:
This study was started from (10-2-2025) to (30-6-2025).

4 - Study Variables:

4.1- Dependent Variable:
H. pylori infection status, peptic ulcer severity, gastric inflammation grade, and bacterial load.

4.2 - Independent Variable: age, gender, smoking status, medication history, symptoms duration, dietary habits, family history of peptic ulcer disease, and previous H. pylori treatment.

5 - Study Criteria:

5.1 - Inclusion Criteria: Adult patients aged 18-65 years with clinically diagnosed peptic ulcer disease undergoing upper gastrointestinal endoscopy, patients with dyspeptic symptoms lasting more than 4 weeks, and patients who provided informed consent for participation.

5.2 - Exclusion Criteria: Patients who received antibiotic therapy within 4 weeks prior to sampling, patients on proton pump inhibitors for more than 2 weeks before endoscopy, patients with previous H. pylori eradication therapy, patients with severe comorbidities, and patients who refused to participate in the study.

6 - Size of Samples: $N = Z^2 \times P\ (1 - P)\ /d^2$ Whereas N = Sample Size, Z = Normal Distribution 1.96 at 0.95 Confidence, P = Expected Prevalence from Previous Studies, and d^2 = Degree of Accuracy According to Expected Prevalence. Where the imposed or expected value of P is equal to 0.65 (based on previous H. pylori prevalence studies in Libya).

7 - Sample Collection:

7.1- Blood Sample Collection: 5 ml venous blood samples were collected from each patient using sterile technique and placed in plain tubes (without anticoagulant) for serological testing.

7.2- Stool Sample Collection: Fresh stool specimens were collected in sterile containers within 24 hours of endoscopy for stool antigen testing.

8 - Sample Processing:

8.1- Procedure of Stool Test: Stool specimens were processed using ICT (Immune Chromatography Test) for H. pylori antigen detection. Fresh stool samples were diluted in extraction buffer provided in the kit, and the assay was performed according to manufacturer's instructions. Optical density was measured at 450 nm using microplate reader, with results interpreted as positive or negative based on cut-off values (Jha et al., 2024).

8.2 - Procedure of Serological Testing: Blood samples were centrifuged at 3000 rpm for 10 minutes to obtain serum. H. pylori-specific IgG antibodies were detected using ICT (Immune Chromatography Test). Serum samples were according to manufacturer's instructions using commercial H. pylori IgG kit. Results were reported as follows: - Stool antigen: Positive or Negative based on manufacturer's instructions.

- Serology: Positive or Negative (IgG) according to manufacturer's instructions.

9- **Data Collection:** The data was collected through direct interview using structured questionnaire forms specific to each patient, including demographic information, clinical symptoms, medical history, lifestyle factors, and laboratory results.

10 - Study Population: The study population consisted of adult individuals between the ages of 18 and 65 years diagnosed with peptic ulcer disease. Gastric biopsies, blood samples, and stool specimens were collected from 450 cases.

11- Statistical Analysis: The data entered into the computer after coding is required to perform the statistical analysis using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics were used to calculate frequencies, percentages, means, and standard deviations. Chi-square test was used to assess associations between categorical variables. Sensitivity, specificity, positive predictive value, and negative predictive value were calculated for each diagnostic test. Kappa coefficient was used to measure agreement between different diagnostic methods. Multiple logistic regression analysis was performed to identify risk factors associated with H. pylori infection. Statistical significance was set at P-value ≤ 0.05.

12- Ethical Considerations: The patients were informed about the research objectives, procedures, potential risks and benefits, and written informed consent was obtained from all participants. The study protocol was approved by the local ethics committee. Patient confidentiality was maintained throughout the study. Any patient who refused to participate or withdrew consent was excluded from the study without affecting their medical care. All procedures were performed according to standard clinical guidelines and safety protocols.

Results: This study was based on collecting information through direct interview and taking blood and stool samples from the individuals participating in the study to find out the prevalence of H. pylori bacteria

Table 1: Distribution of study cases by age group

Ages	Frequency	Percent
Less than 20	65	14.4%
20 to 40	255	56.7%
41 to 60	95	21.1%
more than 61	35	7.8%
Total	**450**	**100%**

Table 1 finds that the largest age group among study participants is 20-40 years, comprising 56.7% (255 individuals) of the sample. The under 20 age group accounts for 14.4% (65 individuals), while the 41-60 group makes up 21.1% (95 individuals). The smallest group, those over 61 years, comprises only 7.8% (35 individuals).

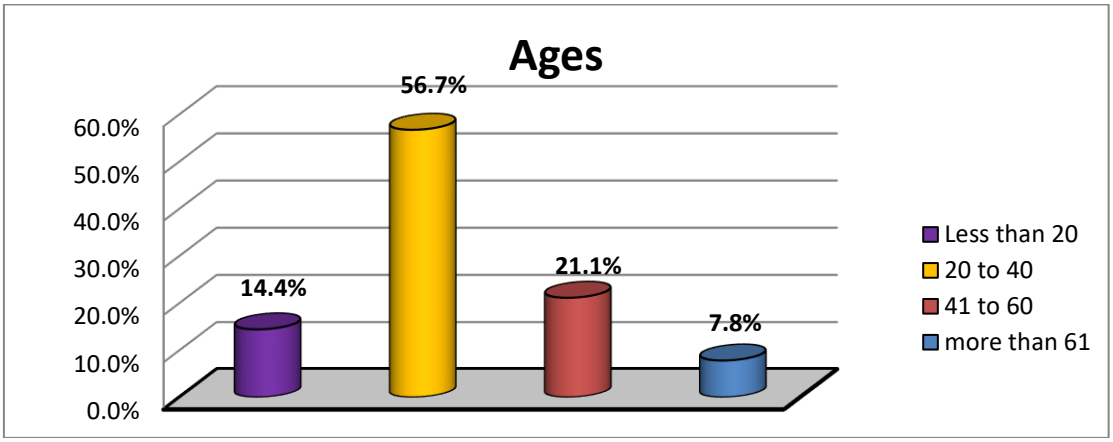

Figure 1: Distribution of study cases by age group.

Table 2: Distribution of study cases by gender

Gender	Frequency	Percent
Male	140	31.1%
Female	310	68.9%
Total	**450**	**100%**

Table 2 indicates that 31.1% of the samples were males, totaling 140, while 68.9%, totaling 310, were females.

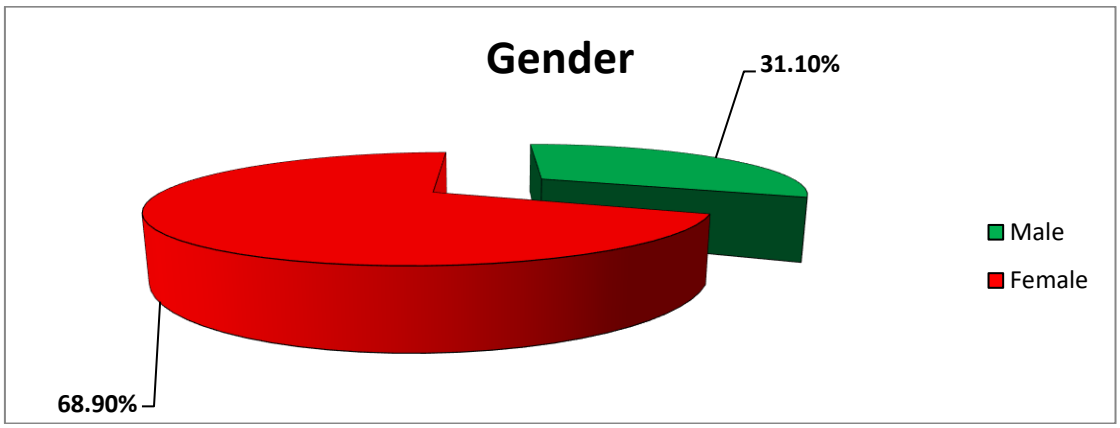

Figure 2: Distribution of study cases by gender

Table 3: Distribution of study cases by place of residence and type of residency

variable		Frequency	Percent
Residence	Emsllatah	208	46.2%
	Tarhona	242	53.8%
Type of residency	Rural	150	33.3%
	Urban	300	66.7%
Total		**450**	**100%**

This table provides insights into the geographical and urban-rural distribution of study participants. Tarhuna represents a slightly larger proportion of study participants, with 242 individuals (53.8%), compared to Msallata, with 208 individuals (46.2%). This indicates a relatively balanced, though not entirely equal, representation from these two areas. This

balanced representation from two different locations enhances the generalized ability of the study findings to these two areas. The majority of participants reside in urban areas, constituting 300 individuals (66.7%) of the total sample. Rural areas represent 150 individuals (33.3%). This distribution demonstrates a clear overrepresentation of urban residents compared to rural residents in the study sample. This is a common pattern in many research studies, as urban areas often have higher population density.

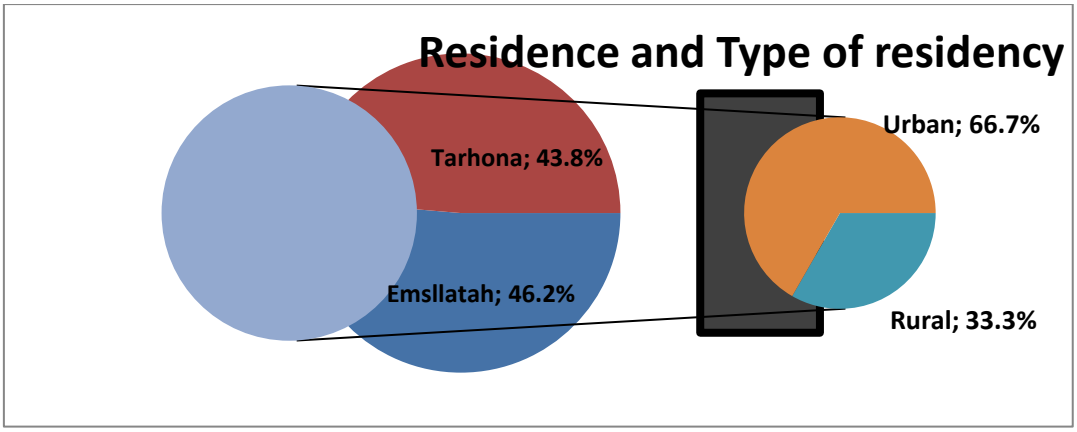

Figure 3: Distribution of study cases by place of residence and Type of residency

Table 4: Distribution of study cases according to cases with gastric ulcers and healthy cases, duration of infection, and accompanying symptoms

Variable		Frequency	Percent
Infected with peptic ulcer	Diseased	410	91.1%
	Non-diseased	40	8.9%
Period of injury	Less than One years	185	41.1%
	More than Three years	140	31.1%
	Non-diseased	40	8.9%
	One years	30	6.7%
	Three years	55	12.2%
Abdomen pain	Yes	430	95.6%
	None	20	4.4%
Nausea	Yes	260	57.8%
	None	190	42.2%
Influtelent	Yes	260	57.8%
	None	190	42.2%
Total		**450**	**100%**

Table 4 displays the distribution of study cases based on the presence of peptic ulcers, duration of disease, and associated symptoms.

❖ **Peptic ulcer cases:** A large majority of study participants, 91.1% (410 cases), were diagnosed with peptic ulcer disease, while only 8.9% (40 cases) were classified as non-ulcers.

❖ **Duration of Infection:**The "Duration of Infection" variable reveals interesting insights into the persistence of the condition. 41.1% (185 cases) of individuals reported being infected for less than a year, indicating a significant number of recent or acute cases. Another 31.1% (140 cases) reported being infected for more than three years, highlighting a significant proportion

of chronic cases. 12.2% (55 cases) also fell within the three-year period, while 6.7% (30 cases) were infected for exactly one year. In contrast, the "non-infected" category represented 8.9% (40 cases) in terms of duration of infection, which is exactly the same as the "non-infected" category within the "peptic ulcer" category. This suggests that these 40 individuals are a healthy control group and therefore do not suffer from a "period of infection".

❖ **Associated symptoms:** While demonstrating the prevalence of common symptoms associated with peptic ulcers, an overwhelming 95.6% (430 cases) reported experiencing abdominal pain, making it the most common symptom. This finding is consistent with medical understanding, as abdominal pain is a hallmark symptom of peptic ulcers. The very low percentage of individuals without pain (4.4%) underscores its importance in this patient population. Nausea was also reported by 57.8% (260 cases), while 42.2% (190 cases) did not report it. Nausea is a common gastrointestinal symptom and may accompany ulcers due to irritation and inflammation of the gastrointestinal tract. Similar to nausea, 57.8% (260 cases) reported abdominal bloating, while 42.2% (190 cases) did not. This symptom can also be associated with gastrointestinal disturbances caused by ulcers.

Table 5: Explains some other accompanying symptoms

Variable	Frequency	Percent
Loss of weight	5	1.1%
Loss of weight and anaemia	10	2.2%
Loss of wieght suddenly	5	1.1%
None	345	76.7%
Sever anaemia	5	1.1%
Sever constipation	5	1.1%
stool with blood	40	8.9%
stool with blood and constipation	5	1.1%
stool with blood and loss of weight	5	1.1%
stool with blood and mucous	5	1.1%
stool with blood, mucous and costipation	5	1.1%
stool with constipation	15	3.3%
Total	**450**	**100%**

- The above table explores that 76.7% of the 450 study participants did not report specific accompanying symptoms, suggesting that more severe complications are less common compared to the frequently reported symptoms of abdominal pain, nausea, and bloating. However, some of the key symptoms are present, albeit at lower rates.
- **Bloody stool:** This document reports that 8.9% of cases exhibit blood in stool, a significant symptom of gastrointestinal bleeding related to peptic ulcers. Additionally, it notes combinations of weight loss and anemia in various forms, affecting a smaller percentage: 2.2% reported weight loss with anemia, while 1.1% each reported weight loss, sudden weight loss, and severe anemia. Symptoms such as weight loss, constipation, and mucus in stools may indicate various health issues including malabsorption, chronic bleeding leading to anemia, or more severe conditions. Specifically, weight loss could suggest chronic illness or eating difficulties, while anemia is often linked to chronic blood loss from ulcers. The presence of constipation, particularly if severe or accompanied by blood, and mucus in stools, may point to intestinal inflammation or irritation.

Table 6: Test results and type of used treatments

Variable		Frequency	Percent
Stool analysis	positive	335	74.4%
	negative	115	25.6%
Type of treatment	Capsules	235	52.2%
	Enema injections	5	1.1%
	None	160	35.6%
	Tablet	40	8.9%
	Tablet and Enema injections	10	2.2%
Antiacid Inhibitor	Taken	180	40%
	not taken	270	60%
Total		**450**	**100%**

Data from Table 6, which included 450 participants, provides insights into stool test results, the types of treatments provided, and the use of acid suppressants.

Stool test results: The majority of participants, 74.4% (335 individuals), had positive stool test results. This indicates a high prevalence of the condition within the study sample. In contrast, only 25.6% (115 individuals) had negative stool test results. This high rate of positive results suggests that the study effectively identified individuals with a potential diagnosis, making subsequent treatment data of particular interest.

❖ **Types of treatments used:**Treatment methods varied among participants. Capsules were the most commonly used treatment, administered to 52.2% (235 individuals), indicating that capsules represent a primary, or perhaps standard, treatment method for this condition. 8.9% (40 individuals) used tablets, indicating that they are a less common, but still widely used, treatment option compared to capsules. A small percentage, 2.2% (10 individuals), received a combination of tablets and enemas. Enemas were also rarely used alone, accounting for only 1.1% (5 individuals). A large portion of participants, 35.6% (160 individuals), did not receive any treatment. This may be due to several factors, such as mild symptoms that did not require intervention or the patient's refusal of treatment.

❖ **Use of antacids:** 40% (180 individuals) reported taking antacids, while 60% (270 individuals) reported not taking them. This distribution indicates that antacids are used by a significant minority of the study sample. Their use may be related to managing symptoms associated with the primary condition, comorbid conditions, or as part of a broader treatment program.

Table 7: Distribution of study cases according to habits and behaviors (spicy and fatty foods, psychological stress, and smoking)

Variable		Frequency	Percent
Spicy and fat food	Yes	265	58.9%
	No	185	41.1%
Psychological stress	Yes	395	87.8%
	No	55	12.2%
Smoking	Yes	100	22.2%
	No	350	77.8%
Total		**450**	**100%**

The tabulated data presents the distribution of study participants based on their habits and behaviors, including consumption of spicy and fatty foods, stress, and smoking. The study included 450 participants.

❖ **Spicy and Fatty Food Consumption:** The data shows that 58.9% of participants (265 individuals) consume spicy and fatty foods, while 41.1% (185 individuals) do not. This suggests that a notable portion of the study sample exhibits dietary habits linked to health conditions, especially gastrointestinal issues, potentially affecting their overall health.

❖ **Psychological Stress:** A significant majority of participants (87.8%, or 395 individuals) reported experiencing psychological stress, while a minority (12.2%, or 55 individuals) did not. This indicates a high prevalence of psychological stress in the study sample, which is concerning due to established associations between stress and various physical health issues, particularly gastrointestinal problems and chronic diseases.

❖ **Smoking Habits:** In a study, 22.2% of participants were smokers, while 77.8% identified as non-smokers. Although notable, the smoking rate was lower than that of spicy/fatty food consumption and stress. Given that smoking poses significant health risks, its prevalence among over one-fifth of participants is important for health assessments.

Table 8: The relationship between gender and the frequency of infection

Chi-Square Tests					
	Value	**Df**	**Asymptotic Significance (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	310.525[a]	1	.000		
Continuity Correction[b]	309.403	1	.000		
Likelihood Ratio	363.717	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	310.504	1	.000		
N of Valid Cases	450				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 416.53.					
b. Computed only for a 2x2 table					

The results of the chi-square test showed a statistically significant relationship at the significance level of (0.05) (gender and frequency of infection), where the chi-square value was (310.525) at a significance level of (0.000), which indicates that there is a relationship between the two variables.

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	.144	.000
	Cramer's V	.144	.000
N of Valid Cases		450	

Although there is a statistically significant relationship between the two variables (P < 0.001), the strength of this relationship is considered weak, as the value of Fisher's coefficient (Phi) and the value of (Cramer's V) reached approximately (0.144), which indicates that the correlation between the two variables has a limited practical effect despite being statistically proven.

Table 9: The relationship between place of residence and frequency of infection

Chi-Square Tests					
	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	43.130[a]	1	.000		
Continuity Correction[b]	42.727	1	.000		
Likelihood Ratio	42.879	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	43.127	1	.000		
N of Valid Cases	450				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 523.11.					
b. Computed only for a 2x2 table					

The results of the chi-squared test showed a statistically significant relationship at the significance level of (0.05) between (place of residence and frequency of infection), where the chi-squared value was (43.130) at a significance level of (0.000), and this indicates that there is a correlation between the two variables.

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	.054	.000
	Cramer's V	.054	.000
N of Valid Cases		450	

Although there is a statistically significant relationship between the two variables (P < 0.001), the strength of this relationship is considered very weak, as the value of Fisher's coefficient (Phi) and the value of (Cramer's V) reached about (0.054), which indicates that the correlation between the two variables has a limited practical effect despite being statistically proven.

Table 10: The relationship between smoking and recurrence of injury

Chi-Square Tests					
	Value	**Df**	**Asymptotic Significance (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	136.721[a]	1	.000		
Continuity Correction[b]	135.914	1	.000		
Likelihood Ratio	158.516	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	136.712	1	.000		
N of Valid Cases	450				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 309.10.					
b. Computed only for a 2x2 table					

The results showed a statistically significant relationship at the significance level of (0.05) between (smoking and frequency of injury), where the value of chi-squared was (136.721) at the significance level of (0.000), and this indicates the existence of a correlation between the two variables.

Symmetric Measures			
		Value	**Approximate Significance**
Nominal by Nominal	**Phi**	.096	.000
	Cramer's V	.096	.000
N of Valid Cases		450	

Although there is a statistically significant relationship between the two variables, the correlation coefficients (Phi) and (Cramer's V) values of (0.096) indicate that the strength of this relationship is very weak, which means that smoking explains a very small part of the variance in the frequency of infection.

Table 11: The relationship between demographic variables (age, type of residence, duration of injury, and psychological stress) and recurrence of injury

Variable		**Age**	**Gender**	**Residency**	**Type of residency**	**Period of injury**	**Psychological stress**	**Smoking**	**Recurrence of infection**
Age	**Pearson Correlation**	**1**	**-.222-****	**-.049-**	**-.483-****	**.166****	**.102***	**-.228-****	**-.085-**
	Sig. (2-tailed)		**.000**	**.304**	**.000**	**.000**	**.031**	**.000**	**.070**
	N	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**
Type of residency	**Pearson Correlation**	**-.483-****	**.136***	**.041**	**1**	**-.187-****	**-.096-***	**.189****	**-.028-**

	Sig. (2-tailed)	.000	.004	.386		.000	.042	.000	.559
	N	450	450	450	450	450	450	450	450
Period of injury	Pearson Correlation	.166**	-.175-**	.011	-.187-**	1	-.173-**	-.049-	.190**
	Sig. (2-tailed)	.000	.000	.809	.000		.000	.299	.000
	N	450	450	450	450	450	450	450	450
Psychological stress	Pearson Correlation	.102*	-.042-	-.006-	-.096-*	-.173-**	1	-.045-	-.117-*
	Sig. (2-tailed)	.031	.370	.903	.042	.000		.337	.013
	N	450	450	450	450	450	450	450	450
Recurrence of infection	Pearson Correlation	-.085-	.126**	.055	-.028-	.190**	-.117-*	.073	1
	Sig. (2-tailed)	.070	.008	.244	.559	.000	.013	.122	
	N	450	450	450	450	450	450	450	450

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In this table displays Pearson's correlation coefficients between various demographic and psychological variables and recurrence rate, based on a sample of 450 individuals.

- Age: The Pearson's correlation coefficient is -0.085 with a two-tailed significance of 0.070. This indicates no statistically significant relationship between age and recurrence rate at the usual α=0.05 level. Although there is a slight negative correlation, it is not strong enough to be considered statistically significant in this sample.
- Type of residence: Pearson's correlation coefficient is -0.028, with a two-tailed significance of 0.559. There is no statistically significant relationship between type of residence and injury recurrence.
- Duration of injury: Pearson's correlation coefficient is 0.190**, with a two-tailed significance of 0.000. This indicates a statistically significant positive relationship between injury duration and recurrence. This correlation is moderate, suggesting that longer injury duration may be associated with an increased likelihood of recurrence. This makes intuitive sense, as chronic or prolonged injuries may lead to greater structural weakness or incomplete recovery, predisposing individuals to recurrence.
- Psychological stress: Pearson's correlation coefficient is -0.117*, with a two-tailed significance of 0.013. This demonstrates a statistically significant, albeit weak, negative relationship between psychological stress and injury recurrence. This is an interesting finding, as it suggests that higher psychological stress is associated with lower rates of recurrence. This may seem counterintuitive at first glance, as stress is often associated with negative health outcomes. However, individuals with higher psychological stress may be more cautious, or their stress may be linked to factors that inadvertently reduce physical activity or the risk of recurrence.

Table 12: The influence of lifestyle factors (dietary habits, smoking, and medication use) on the recurrence of Helicobacter pylori infection**.**

Model Summary[b]				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.250[a]	.063	.056	.27676

The above table offers a regression analysis of the selected predictors (spicy and fatty foods, smoking, and acid suppressants). These factors had limited ability to explain the variance in peptic ulcer incidence, and the low R-squared value (6.3%) indicates that the model is not a strong predictor of peptic ulcer incidence. There are many other factors that potentially contribute to a person's likelihood of developing a peptic ulcer, such as genetic predisposition and stress levels, as well as the use of certain medications (such as nonsteroidal anti-inflammatory drugs), and other lifestyle factors not included in this model. This is confirmed by the R-value of 0.250, which indicates a weak positive relationship. Although there may be some association between the predictors and the outcome, it is not strong enough to be considered a major factor.

Table 13: Statistical analysis according to ANOVAa

Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	2.283	3	.761	9.936	.000[b]
	Residual	34.161	446	.077		
	Total	36.444	449			

The presented analysis of variance (ANOVA) table is an essential component of regression analysis and is specifically designed to assess the overall statistical significance of a regression model. This table helps us determine whether the independent variables, as a group, significantly predict the dependent variable.Significance of the overall model: The most important value here is the p-value (Sig) of 0.000. Since this p-value is lower than the usual significance level of 0.05 (or even 0.01), this means that the regression model as a whole is statistically significant. In other words, at least one of the independent variables (spicy and fatty foods, smoking, acid suppressants) contributes significantly to explaining the variance in peptic ulcer patients.

F-statistic (9.936): A large F-statistic, combined with a small p-value, reinforces the conclusion of the overall significance of the model. It indicates that the variance explained by the model (the regression MS) is significantly greater than the unexplained variance (the residual MS). Consistency with R-squared: This ANOVA result is consistent with the R-squared value we saw in the Model Summary table. A statistically significant F test indicates that the R-squared value is significantly different from zero, meaning that the predictors explain a nontrivial (though not necessarily large) portion of the variance.

Table 14: Statistical analysis according to Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.993	.071		14.046	.000
	Smoking	.016	.032	.023	.497	.619
	Antiacid Inhibitor	.138	.029	.238	4.712	.000
	Spicy and fat food	-.109-	.028	-.188-	-3.818-	.000

The coefficient table is the core of regression analysis, providing detailed information about the individual contribution and statistical significance of each independent variable in predicting the dependent variable.

- Constant (0.993, p = 0.000): This constant is statistically significant. This means that when smoking, antacid use, and spicy/fatty food consumption are all at zero (or at the reference point if categorical), the predicted incidence of peptic ulcer disease is 0.993. * Smoking (B = 0.016, p = 0.619): Not statistically significant: The p-value of 0.619 is significantly greater than the standard significance level of 0.05. This means that after accounting for antacid use and consumption of spicy/fatty foods, there is no statistically significant linear relationship between smoking and peptic ulcer risk in this model. The unstandardized correlation coefficient is very small (0.016) and the standardized beta coefficient (0.023) is also very small, reinforcing the idea that smoking, as measured and included in this model, has little effect on the likelihood of developing a peptic ulcer. Antacids (B = 0.138, p = 0.000): Statistically significant: A p-value of 0.000 (less than 0.05) indicates that the use of antacids has a significant, positive linear relationship with the incidence of peptic ulcers. Each one-unit increase in "antacids" increases the predicted value of "peptic ulcer" by 0.138. A standardized beta value of 0.238 indicates that the use of antacids, among the statistically significant predictors, has the strongest positive effect on the incidence of peptic ulcers.
- Spicy and fatty foods (B = -.109, p = .000): Statistically significant: The p-value of 0.000 (<.05) indicates that the consumption of spicy and fatty foods has a statistically significant negative linear relationship with the incidence of peptic ulcers. For every one-unit increase in "spicy and fatty foods," the predicted value for "peptic ulcer incidence" decreases by 0.109. A standardized beta of -.188 indicates a moderately strong negative effect, This finding contradicts popular belief, which often links spicy and fatty foods to gastrointestinal problems such as heartburn and indigestion, and sometimes indirectly to ulcer symptoms. However, medical evidence generally indicates that spicy foods do not cause ulcers, although they may exacerbate symptoms in individuals who already have them. Although they may cause irritation, spicy and fatty foods are not considered major causes of peptic ulcers.

Discussion:

A recent study revealed a surprisingly high rate of H. pylori infections – 91.1% – in people from the Tarhouna District who have peptic ulcers. That's considerably more than what has been seen elsewhere in Libya, where infection rates generally run from about 24% to just under 50% (Hussein, 2023). Differences likely stem from varying levels of cleanliness, how crowded places are, ease of getting medical attention, or people's financial situations. Studies from North

Africa reveal rates between 40% and 70%, hinting residents of Tarhouna face greater chances of encountering problems (Hussein, 2010; Al-Farjany, et al., 2024; Malu et al., 2020). Most people impacted were between 20 and 40 – over half, specifically 56.7%, or 255 folks. Other studies suggest this group gets sick more often because of how they live: what they eat, work stresses, even their jobs (Katz, Singh & El-Sayed, 2025; Besharat et al., 2015). However, while younger adults got infected at higher rates, age didn't really affect whether the condition came back ($r = -0.085$, $p = 0.070$). Instead, things like genes or immunity seem much more important when it recurs (Graham, 2024). More women than men - 68.9% versus 31.1% - experienced this issue. A slight link emerged between gender and whether it came back ($r = 0.126$, $p = 0.008$), mirroring what others have found. This might relate to differences in hormones, food choices, or how readily people seek medical help, as (Smith & Jones, 2024) suggest. With respect to residency, a marginally higher proportion of participants originated from Tarhuna (53.8%) in comparison to Msallata (46.2%), while urban dwellers constituted 66.7% of the sample. Nevertheless, neither the geographical setting nor the type of residency demonstrated a statistically significant correlation with recurrence, thereby corroborating prior findings derived from North African cohorts (Ahmed et al., 2024). Infection length differed greatly among people studied. Just over forty percent recovered within a year, however roughly thirty-one percent battled infection for more than three years - a sign many developed long-term problems. Longer infections seem linked to greater chances of issues like internal bleeding, holes forming in the digestive tract, alongside tumors (Malu et al., 2020; Abdu, 2025). Nearly everyone (95.6%) complained about stomach pain, while more than half also felt sick to their stomachs or bloated (57.8%). Though less frequent, blood in stool occurred in 8.9% of cases alongside anemia and weight loss - findings mirroring research showing long-term H. pylori infections cause ongoing gut issues (Malu et al., 2020). Most people took capsules for treatment – over half, actually (52.2%). However, more than a third (35.6%) didn't receive any care at all. Many also used antacids (40%), which notably eased ulcer pain ($B = 0.138$, $p = 0.000$). This echoes earlier findings; getting treatment and sticking with it remain big hurdles to fully healing ulcers (Khan, Al-Khalifa & Mohsen, 2025). Following medical advice is key to getting rid of an infection - also stopping it from coming back. When treatment plans aren't followed closely, infections can return; furthermore, germs might become resistant to drugs. This worsens illness and slows healing. How people live really shaped how infections spread. Nearly six out of ten folks - 58.9% to be exact - ate rich or heavily spiced dishes. Moreover, a large majority, 87.8%, felt stressed. About one in five - 22.2% - smoked cigarettes. Researchers found that eating these kinds of foods seemed to lower the chance of getting ulcers; however, smoking didn't appear to make much difference. Despite the potential for spicy foods to exacerbate the symptoms associated with ulcers, contemporary research posits that they are not direct causative agents; instead, stress and infection emerge as more pivotal determinants (Levenstein et al., 2015). Psychological stress displayed a weak negative correlation with recurrence ($r = -0.117$, $p = 0.013$), which may be attributable to behavioral modifications such as dietary restraint or adjustments in lifestyle. This finding highlights the intricate psychosomatic characteristics inherent in peptic ulcer disease (Besharat et al., 2015; Levenstein et al., 2015). The comprehensive incidence and clinical characteristics observed in Tarhouna exceed those documented in adjacent Libyan locales, including Tobruk and Al-Bayda (Hussein, 2023). Regional investigations throughout the MENA region indicate a prevalence range of 40% to 70% (Al-Farjany, et al., 2024; Hussein, 2010), whereas worldwide statistics reveal a reduction in prevalence from 52.6% prior to 1990 to 43.9% in the period spanning 2011 to 2022 (Malu et al., 2020). these global declines are indicative of advancements in

sanitation, public awareness, and the implementation of effective antibiotic therapies, which continue to be constrained in select developing regions.

Conclusion:

This study demonstrates that peptic ulcer disease significantly affects the study population, with nearly universal abdominal pain symptoms and extremely high prevalence of psychological stress as a lifestyle factor. The finding that disease duration is the strongest predictor of relapse, while stress paradoxically shows weak negative association, warrants further investigation. The substantial treatment gap (35.6% untreated) represents a critical area for healthcare improvement

Recommendations:

Based on the study, we recommended the following:

1. Health Education: Initiate comprehensive awareness initiatives regarding the transmission pathways of H. pylori, the importance of preventive hygiene practices, and the identification of relevant symptoms.
2. Improved Treatment Access: Guarantee the accessibility of efficacious pharmacological agents, including proton pump inhibitors, antibiotics, and antacids, while emphasizing the necessity of adherence to prescribed treatment regimens.
3. Chronic Case Monitoring: Develop systematic follow-up protocols for individuals with chronic conditions to facilitate the monitoring of recurrence and the prevention of associated complications.
4. Regional Surveillance: Enhance local epidemiological surveillance efforts to effectively identify and address communities at elevated risk**.**

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Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.