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The Prevalence of *Helicobacter pylori* Infection among Patients of Msallatah and Al-Khoms Cities

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معدل انتشار الإصابة بعدوى الملوية البوابية بين المرضى في مدينتَي مسلاتة والخمس

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Abstract

Helicobacter pylori is a spiral, gram-negative bacterium that colonizes the gastric mucosa and constitutes the most common chronic bacterial infection worldwide, predisposing to peptic ulcer disease, chronic gastritis, and gastric malignancies. This descriptive cross-sectional study was conducted between December 2024 and April 2025 at random Laboratories in Msallatah and Al-Khoms cities, Libya, to determine the seroprevalence of *H. pylori* infection and its association with age, gender, and residence. A total of 250 patients (102 males, 148 females; age range 10–75 years) undergoing physician-requested serological testing were enrolled. Venous blood samples were processed for serum and analyzed using ELISA kits to detect anti-*H. pylori* IgG/IgM antibodies. Statistical analysis was performed with SPSS version 25. Overall, 44.8% of participants tested positive for *H. pylori* antibodies. Seroprevalence was slightly higher in Al-Khoms (24.8%) than in Msallatah (20.0%), and greater among females (27.2%) than males (17.6%). Age-specific prevalence peaked in the 32 - 42 year group (59.4%) and was lowest in the 65 – 75 year group (42.3%). These results reveal a substantial burden of *H. pylori* infection in Msallatah and Al-Khoms, with demographic disparities by age and gender, underscoring the need for better diagnostic access and targeted public health interventions.

Keywords: *H. pylori*, seroprevalence, infection, population, transmission routes.

الملخص

تُعد الملوية البوابية (H. pylori) بكتيريا حلزونية سلبية الغرام تستوطن الغشاء المخاطي للمعدة، وتشكل أكثر أنواع العدوى البكتيرية المزمنة شيوعاً على مستوى العالم، مما يزيد من احتمالية الإصابة بالقرحة الهضمية، والتهاب المعدة المزمن، وأورام المعدة الخبيثة. أُجريت هذه الدراسة المقطعية الوصفية في الفترة ما بين ديسمبر 2024 وأبريل 2025 في عدة مختبرات بمدينة مسلاتة ومدينة الخمس في ليبيا، وذلك بهدف تحديد معدل الانتشار المصلي لعدوى الملوية البوابية وعلاقتها بمتغيرات العمر والجنس ومكان السكن. شملت الدراسة 250 مريضاً (102 من الذكور و148 من الإناث، تتراوح أعمارهم بين 10 و75 عاماً) ممن خضعوا لفحوصات مصلية بناءً على طلب الأطباء. تم معالجة عينات الدم الوريدي واستخلاص المصل وتحليله باستخدام تقنية الإليزا (ELISA) للكشف عن الأجسام المضادة (IgG/IgM) الخاصة بالملوية البوابية، كما أُجري التحليل الإحصائي باستخدام الإصدار 25 من برنامج (SPSS).

أظهرت النتائج الإجمالية أن 44.8% من المشاركين كانت نتائجهم إيجابية للأجسام المضادة للملوية البوابية. وكان معدل الانتشار المصلي أعلى قليلاً في مدينة الخمس (24.8%) مقارنة بمدينة مسلاتة (20.0%)، كما كان الانتشار بين الإناث (27.2%) أعلى منه بين الذكور (17.6%). وفيما يخص الفئات العمرية، بلغ معدل الانتشار ذروته في الفئة العمرية 32-42 عاماً بنسبة (59.4%)، بينما سجل أدنى مستوياته في الفئة العمرية 65-75 عاماً بنسبة (42.3%). وقد كشفت هذه النتائج عن عبء كبير لعدوى الملوية البوابية في مدينتي مسلاتة والخمس، مع وجود تفاوتات ديموغرافية مرتبطة بالعمر والجنس، مما يؤكد الحاجة الملحة لتحسين سبل الوصول إلى التشخيص وتنفيذ تدخلات صحية عامة موجّهة.

الكلمات المفتاحية: الملوية البوابية، (H. pylori)، الانتشار المصلي، العدوى، السكان، طرق الانتقال.

1.Introduction

The most prevalent long-term bacterial infection in people is *Helicobacter pylori* (*H. pylori*) (Suerbaum & Michetti, 2002). It has been proven in people of all ages and all over the world. According to conservative estimates, 50% of people worldwide are impacted. Compared to industrialized countries, infection is more common and acquired earlier in life in underdeveloped countries (Farah et al., 2018). The frequency in adults peaks at over 80% by the age of 50 in poor countries, where most children contract the disease by the age of 10. It has been linked to several significant upper gastrointestinal (GI) disorders, such as gastric cancer, peptic ulcer disease, and chronic gastritis. Because socioeconomic circumstances directly affect H. pylori prevalence, developing nations are more likely to have this illness than industrialized ones such as the US (Everhart, 2000; Alhadad, 2022).

H. pylori is a gram-negative bacillus with a spiral shape. It primarily infects the stomach and duodenum. Furthermore, the organism exhibits catalase, oxidase, and urease activity. Urease is important for its survival and colonization. It is abundant, accounting for almost 5% of the organism's protein weight. Bacterial urease activity is the key for diagnosing infections using several assays, both invasive and noninvasive (Narayanan et al., 2018).

The spread of *H. pylori* between individuals remains unknown (Stone, 1999). It appears to be transmitted directly between individuals via oral or fecal routes (Mladenova & Durazzo, 2018). Humans are the most common reservoirs of infection.

Infection rates have been established to be greater in resource-poor settings along with developing countries, with rates of infection exceeding 70% recorded in Africa, the highest globally (Hooi et al., 2017; Emhmd et al., 2022), whereas industrialized countries vary between 25 and 40% (Hooi et al., 2017; Bruce & Maaroos, 2008). The high frequency in underdeveloped nations has been connected with low socioeconomic position, overcrowding, inadequate housing, poor sanitation (both individual and environmental hygiene), dirty water supplies, accumulations of animal feces, and food contamination.

There are a few *H. pylori* prevalence studies that have been done in Libya, (Eldaffri *et al.,* 2023) conducted a study called "Prevalence of *Helicobacter pylori* Infection in El-Beida City." The study used stool antigen testing to establish the prevalence of *H. pylori* and its age-sex distribution in a community sample of 1,600 people from five laboratories. Overall, 24.1% tested positive, with equal proportions in men (24.6%) and women (23.9%). The age-specific prevalence peaked at 27.9% in the 51–60-year cohort and was lowest (15.6%) in the 61–70-year group and highest stool antigen rates in 31–40-year-olds (25.8%) (Eldaffri et al., 2023)

Alajwad *et al.,* 2024 published a paper titled "Exploring *Helicobacter pylori* Infection Rates and Associated Risk Factors in Dyspeptic Individuals from Brack Al-Shati, Southern Libya." The study used ELISA to examine *H. pylori* IgG seroprevalence and CagA status in 100 dyspeptic patients aged 18– 72 years. The overall infection rate was 73.0%, with 68.2% of samples testing positive for the CagA protein. A multivariable study revealed that household congestion, untreated water consumption, and bacterial virulence characteristics were all significant predictors of infection (Alajwad et al., 2024). (Salem *et al.,* 2025)published a paper named "Prevalence of *Helicobacter pylori* Infection in Relation to Gender and Age in the Population of AL-Ajailat, Libya." The study's goal was to assess *H. pylori* seroprevalence and its relationship to gender and age among clinic participants between January and July 2023. ELISA detection of anti-*H. pylori* IgG/IgM in 413 subjects (127 males and 255 females; ages 1-89 years) found an overall prevalence of 84.7%. Females had a greater seropositivity (70.3%) than men (29.7%; $p = 0.001$). The 30-39 and 40-49 year age groups had the highest prevalence (18.9% and 21.4%, respectively), while age was not significantly linked with infection status ($p = 0.256$) (Salem et al., 2025).

The study "Prevalence and Hematological Effects of *Helicobacter pylori* Infection in Tobruk, Libya: A Cross-Sectional Study" was carried out by (Abdulkarim *et al.,* 2025) . Determining

the seroprevalence of *H. pylori* among Tobruk people in October 2023 and evaluating its effect on hematological parameters were the objectives of the study. 48.1% of the 362 patients who underwent stool antigen and serology testing had positive results, 49.2% had negative results, and 2.8% had questionable results. Male hemoglobin (55%) and mean corpuscular hemoglobin (45%) were significantly lower in 50 seropositive patients, but mean platelet volume (45%) and plateletcrit (50%) increased. While other hematological parameters were within acceptable levels, the mean platelet volume and plateletcrit in females increased by 83.3% .

Agaeeb *et al.* (2022) [13] did research named "Environmental Risk Factors Associated with *Helicobacter Pylori* Infection Among Dyspeptic Patients." The study sought to determine *H. pylori* seroprevalence and environmental factors in 350 dyspeptic children and adults at Al-Komes Teaching Hospital. Using ELISA for anti-*H. pylori* IgG and structured questionnaires, the overall prevalence was 41%, which increased to 77% in adults and 23% in children. Subjects who used private, untreated well water had much higher infection rates than those who used commercial water supply. Male gender and advancing age were additional risk variables. These findings relate water source variability and sociodemographic variables to *H. pylori* transmission in rural Libyan populations, leading targeted preventive efforts (Agaeeb et al., 2022)

There is still conflicting evidence about the relationship between gender and *H. pylori* infection, with some research showing greater rates in females and others in males. *H. pylori* seroprevalence also increases with age, especially in low-socioeconomic-status environments where early-life acquisition is prevalent. Although IgA and IgM assessments have also been confirmed, serological tests that detect anti-*H. pylori* IgG antibodies are used in the majority of prevalence estimations. Thus, the purpose of this study was to ascertain the prevalence of *H. pylori* infection and how it related to age and gender in patients in the Libyan cities of Msallatah and Al-Khoms.

2. METHODS

A. Study Design and Setting

This study employed a descriptive cross-sectional design to determine the prevalence of *Helicobacter pylori* infection among patients in two cities in Libya. The cross-sectional approach provided a snapshot of *H. pylori* prevalence at a specific time point, allowing for assessment of disease burden and identification of associated demographic factors. The study was conducted between December 2024 and April 2025 across several healthcare facilities in Msallatah and Al-Khoms.

B. Sample Size and Participant Selection

A convenience sampling approach was employed to recruit 250 participants from both healthcare facilities. Sample size distribution reflected the relative patient volumes of each facility: 80 participants (32%) from Msallatah and 170 participants (68%) from Al-Khoms. Participants were recruited from patients who presented to these laboratories with physician-ordered *H. pylori* testing requests, representing a symptomatic population seeking diagnostic evaluation.

Inclusion criteria comprised patients of all ages and both genders who presented with physician referrals for *H. pylori* serological testing. The study population encompassed diverse age groups to capture varying patterns of *H. pylori* acquisition and seroprevalence across different demographic strata. No specific exclusion criteria were applied, ensuring broad representation of the target population seeking *H. pylori* diagnostic services.

C. Blood Sample Collection and Processing

Venous blood specimens (5–10 mL) were drawn by sterile venipuncture into plain vacutainer tubes and allowed to clot upright at room temperature for 30–60 minutes to ensure complete

coagulation. Samples were then centrifuged at 3,000 rpm (≈1,000 g) for 10 minutes at ambient temperature using a Hettich benchtop centrifuge, after which the clear serum supernatant was carefully pipetted into labeled microtubes and stored at –20 °C until ELISA testing (Tuck et al., 2009).

D. Serological Testing

Serological detection of *Helicobacter pylori* antibodies was performed using the ELx800 automated ELISA reader (Bio-TEK, USA) following the manufacturer's instructions. Thawed serum (–20 °C) was diluted 1:100 in buffer and incubated in antigen-coated wells at 37 °C for 60 min, washed, incubated with HRP-conjugated anti-human IgG/IgM for 30 min, and developed at 450 nm. All ELISA reagents— including antigen-coated plates, calibrators, and controls—were obtained from BIOS (USA) to ensure lot-to-lot consistency [15].

F. Statistical Analysis

Statistical analysis was performed with SPSS version 25 using descriptive statistics to characterize the study population and determine *H. pylori* prevalence rates. Categorical variables were summarized using frequencies and percentages, while continuous variables were described using appropriate measures of central tendency and dispersion.

3. Results

A. Participant Characteristics

A total of 250 patients were enrolled, of whom 102 (40.8%) were male and 148 (59.2%) were female. Eighty participants (32.0%) attended the laboratory in Msallatah, while 170 (68.0%) attended the laboratory in Al-Khoms (Table 1).

Table 1: Demographic distribution of study participants

Gender	Clinic of Msallatah	Clinic of Alkhoms	Total
Male	30(29.4%)	72(70.6%)	102 (40.8%)
Female	50(33.8%)	98(66.2%)	148 (59.2%)
Total	80(32%)	170(68%)	250(100%)

B. Age Stratification

Participants were categorized into six age groups: 10–20, 21–31, 32–42, 43–53, 54– 64, and 65–75 years. The largest age stratum was 10–20 years (64; 25.6%), and the smallest was 54–64 years (16; 6.4%) (Table 2).

Table 2: Age distribution of study participants

Categories of the age	Clinic of Msallatah	Clinic of Alkhoms	Total
10-20	21(32.8%)	43(67.2%)	64 (25.6%)
21-31	18(30.5%)	41(69.5%)	59(23.6%)
32-42	15(46.9%)	17(53.1%)	32(12.8%)
43-53	21(39.6%)	32(60.4%)	53(21.2%)
54-64	2(12.5%)	14(87.5%)	16(6.4%)
65-75	3(11.5%)	23(88.5%)	26(10.4%)
Total	80 (32%)	170 (68%)	250(100%)

C.Seroprevalence of H. pylori

Overall, 112 of 250 patients (44.8%) tested positive for anti–*H. pylori* antibodies. Site-specific prevalence was 20.0% (50/250) in Msallatah and 24.8% (62/250) in Al-Khoms (Table 3) (Figure 1).

Table 3: Prevalence *of H. pylori* among collected specimens

Test	Msallatah lab N=80		Alkhoms lab N=170		Total N=250	
Anti- H. pylori IgG and IgM	Positive	Negative	Positive	Negative	Positive	Negative
	50 (20%)	30 (12%)	62 (24.8%)	108 (43.2%)	112 (44.8%)	138 (55.2%)

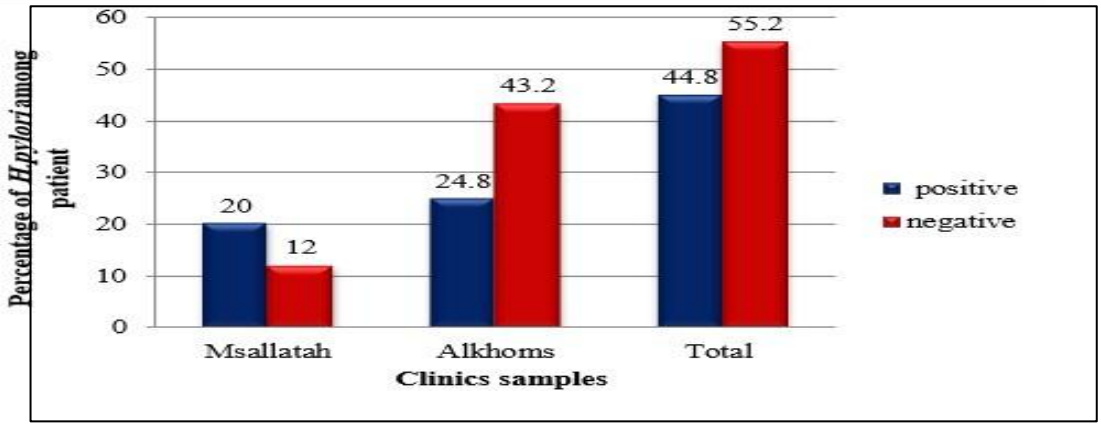

Figure 1: Prevalence of *H. pylori* infection by site

D. Gender-Specific Prevalence

Among seropositive cases (n = 112), 44 (39.3%) were male and 68 (60.7%) were female. In the full cohort, 17.6% (44/250) of males and 27.2% (68/250) of females were positive (Figure 2).

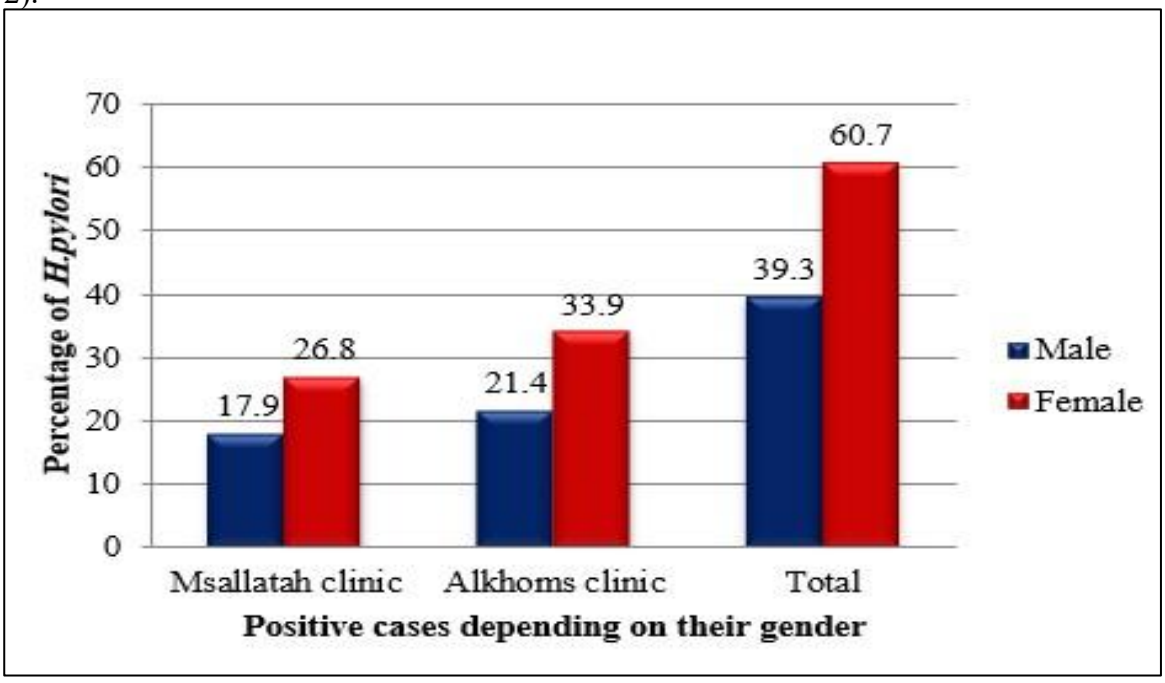

Figure 2:*H. pylori* seropositivity by gender

E. Age-Specific Prevalence

Seropositivity increased from 40.6% in the 10–20-year group to 59.4% in the 32–42-year group, then declined to 42.3% in the 65–75-year group (Table 3; Figure 3).

Table 3: *H. pylori* seropositivity by age group

Age	Positive samples	Negative samples	Total
10-20	26(40.6%)	38(59.4%)	64 (25.6%)
21-31	25(42.4%)	34(57.6%)	59 (23.6%)
32-42	19(59.4%)	13(40.6%)	32 (12.8%)
43-53	23(43.4%)	30(56.6%)	53 (21.2%)
54-64	8(50%)	8(50%)	16 (6.4%)
65-75	11(42.3%)	15(57.7%)	26 (10.4%)
Total	112(44.8%)	138(55.2%)	250(100%)

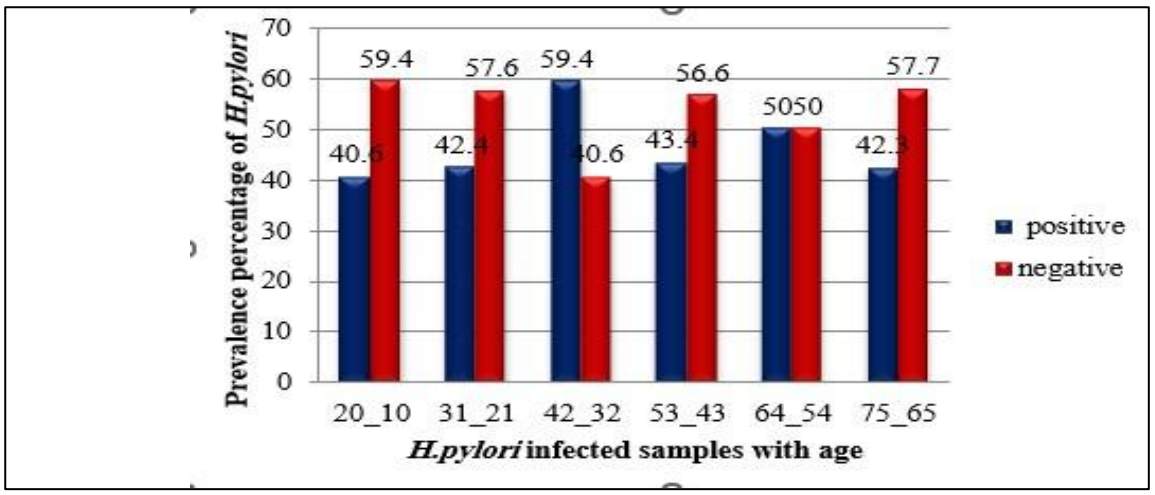

Figure 3: The prevalence of *H. pylori* among samples depending on their ages

4. DISCUSSION

The overall seroprevalence of *H. pylori* in Msallatah and Al-Khoms (44.8%) aligns with recent Libyan outpatient data from Abdulkarim *et al.,* 2025 (48.1%)[12] but is lower than rates reported in (Alajwad *et al.,* 2024) study (73.0%)and (Salem *et al.,* 2025) (84.7%).Variations likely reflect differences in diagnostic method (serology vs. stool antigen), healthcare access, and population selection (dyspeptic vs. general).

Female predominance in seropositivity (60.7%) mirrors findings from Al-Komes (77.0% adult seroprevalence, 56.0% male vs. 44.0% female). Higher female rates may result from care-seeking behaviors and hormone-mediated immune responses that influence antibody production (Agaeeb et al., 2022; Khoder et al., 2021)

Age-specific patterns showed peak prevalence in adults aged 32–42 years, consistent with the (Agaeeb *et al.* 2022) study's adult seroprevalence of 77% and

Eldaffri *et al.,* 2023 study (Eldaffri et al., 2023)greatest incidence of stool antigen in individuals aged 31–40 years (25.8%). Early childhood acquisition (40.6% in 10–20 years) underscores horizontal transmission within households and communal water sources, typical in low-resource settings.

Environmental factors such as untreated well water and household crowding have been implicated in Libyan cohorts. The slightly higher prevalence in AlKhoms (24.8% vs. 20.0% in Msallatah) may reflect localized water-source heterogeneity and urban–rural disparities in sanitation infrastructure (Agaeeb et al., 2022).

Clinically, high *H. pylori* burden warrants strengthening noninvasive diagnostics in peripheral clinics and targeted eradication protocols to mitigate risks of peptic ulcer disease and gastric malignancy (Liu et al., 2024).Public health strategies should prioritize water-quality interventions and hygiene education, especially among young adults and women.

Study limitations include the use of serology which cannot distinguish active from past infection, potential selection bias of symptomatic patients, and limited sample sizes in older age strata. Future research should employ urea breath or stool antigen tests for active infection confirmation, incorporate longitudinal cohorts to assess eradication outcomes, and explore molecular virulence profiling (e.g., CagA, VacA) in Libyan strains.

CONCLUSION

H. pylori remain highly prevalent in Msallatah and Al-Khoms, with demographic and environmental determinants paralleling regional trends. Enhanced diagnostic, therapeutic, and preventive measures are essential to reduce *H. pylori*– associated morbidity in these communities.

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