Derna Academy Journal for Applied Sciences

E-ISSN: 3006-3159

DAJAS

Socio-Demographic Determinants, Diagnostic Performance, and Prevalence Rates of Helicobacter pylori Infection Among Symptomatic Patients in Albieda City, Green Mountain Region, Libya

Fatma Saad Abad*[1], Moftah Omer Hussain2, Eman Hussain Slouma 3, Asmai S.H. Mohammed[4], Sabrien E B Aboubakr[5], Sana Badr[6]

*[1,2, 4, 5] Department of Medical Laboratory, Faculty of Health Sciences, Tobruk University, Libya.
[3] Department of Medical Laboratory, Al-Thawra Hospital, Albieda, Green Mountain, Libya
[6]Faculty of Dentistry, Tobruk University, Libya

*Corresponding author: E-mail address: fatma.abad@tu.edu.ly

Volume: 7 **Issue: 2** **Page Number: 134 - 140**

Keywords:
Helicobacter pylori, prevalence, socio-demographic determinants, diagnostic performance, ROC analysis, Albieda City, Libya.

Received: 15\08\2026
Accepted: 31\08\2026
Published: 01\09\2026

https://doi.org/10.71147/tjvra032

ABSTRACT

Helicobacter pylori remains a paramount etiological agent underpinning chronic gastric pathologies globally, including gastritis, peptic ulcers, and gastric malignancies. Despite its significance, epidemiological profiles mapping this pathogen across North African communities remain critical for public health initiatives. This cross-sectional study elucidated the prevalence of infection, evaluated the associations of age and biological sex with H. pylori positivity, and assessed diagnostic performance among symptomatic outpatients in Albieda City, Green Mountain, Libya. A clinical sample of 103 outpatients (50 males and 53 females) with dyspeptic symptoms underwent testing using stool antigen capture assays or rapid urease tests. Statistical relationships were explored using independent-samples t-tests for age, Pearson's Chi-Square ($\chi 2$) test for gender, and Receiver Operating Characteristic (ROC) analysis. The baseline H. pylori point prevalence was 73.8% (76/103). Gender stratification revealed incidences of 76.0% among males (38/50) and 71.7% among females (38/53). The mean age of H. pylori-positive individuals (33.68 ± 11.59 years) showed no difference from H. pylori-negative counterparts (31.85 ± 12.87 years; $p = 0.505$). Cross-tabulations confirmed independence of biological sex and status ($\chi 2 = 0.245$, $p = 0.620$). However, the multi-factorial ROC analysis demonstrated diagnostic performance with an Area Under the Curve (AUC) of 0.792 (95% CI: 0.654–0.871, SE = 0.055, $p < 0.001$). The cohort manifests elevated H. pylori colonization, highlighting hyper-endemicity in the Green Mountain region. The uniform distribution across age and sex suggests generalized environmental exposure or early life transmission, negating demographic predispositions. The significant ROC performance indicates that clinical screening models can isolate colonization patterns to optimize resource allocation.

1. INTRODUCTION

Helicobacter pylori is a spiral-shaped, Gram-negative, microaerophilic bacterium uniquely adapted to endure the highly unfavorable acidic environment of the human stomach. Characterized by its localized production of urease and specific virulence factors (such as CagA and VacA), it successfully colonizes the protective gastric mucus layer, triggering a cascade of inflammatory tissue alterations. Globally, this organism is acknowledged as a premier cause of mucosal morbidity, serving as the central driver for chronic active gastritis, peptic ulcer disease, and mucosal erosion. Crucially, persistent long-term tissue colonization induces profound cellular restructuring, establishing it as a definitive Class I human carcinogen directly associated with gastric adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma (Malfertheiner et al., 2022; Amieva & Peek, 2016). The downstream effects of chronic inflammation extend past simple mucosal breaches, often altering localized acid-secretion dynamics and accelerating pre-neoplastic lesions over multi-decade colonization timelines (Sugano et al., 2015; Polk & Peek, 2010). The global distribution metrics of H. pylori remain asymmetrical, governed predominantly by public infrastructure quality, localized population densities, domestic hygiene practices, water safety profiles, and general socio-economic configurations. In developing economies, and specifically within the North African and broader Mediterranean geographic belts, the infection demonstrates high endemic levels (Hooi et al., 2017; Hunt et al., 2011). The mechanisms facilitating transmission are heavily influenced by environmental and familial risk vectors, involving oral-oral or fecal-oral contamination loops. While certain scientific narratives assert that acquisition occurs dominantly during primary childhood within close-contact domestic units, other investigative models indicate that secondary exposures occur throughout adult life via common dietary links, compromised local water networks, or occupational pathways (Eusebi et al., 2014; Weyermann et al., 2009). Furthermore, the interplay between host socio-demographic markers, specifically biological sex and chronological age, and susceptibility to colonization remains a critical point of scientific inquiry. Competing clinical data present contradictory views; several multi-center studies report a significantly higher male prevalence rate, which they attribute to distinct lifestyle behaviors, workplace exposures, or minor physiological differences (de Martel & Parsonnet, 2006). Conversely, alternative epidemiological surveys describe a neutral distribution, indicating that when basic exposure frameworks remain constant, gender provides no significant biological resistance or vulnerability (Ibrahim & Morad, 2020). This highlights the need for localized investigations to untangle municipal risk parameters from biological pre-determinants. In the context of Libya, the Green Mountain (Jabal al Akhdar) geographical region, centered around Albieda City, offers a unique ecological, climate, and socio-demographic profile distinct from major coastal metropolitan zones or arid desert hubs. Factors such as regional urbanization rates, unique agricultural practices, water sourcing configurations (including regional well-water networks), and local municipal environments could fundamentally alter transmission dynamics (Salem & El-Mahdi, 2021). Despite these circumstances, published data delineating specific pathogen tracking within this community are severely limited. This investigation attempts to systematically address this gap by establishing a robust baseline prevalence framework, evaluating the predictive validity of screening protocols using diagnostic curves, and mapping correlations among host demographic criteria in symptomatic individuals within Albieda City.

2. METHOD

A cross-sectional analytical approach was employed to screen a cohort of 103 symptomatic outpatients seeking clinical assistance in Albieda City, Green Mountain, Libya. Inclusion criteria strictly targeted individuals presenting with chronic, uninvestigated upper gastrointestinal symptoms, including persistent dyspepsia, recurrent epigastric pain, postprandial fullness, and frequent nausea. Patients who had received proton pump inhibitors (PPIs), bismuth components, or antibiotic therapies within the four weeks preceding screening were excluded to preserve testing fidelity. Diagnosis was verified using standard clinical protocols, applying high-sensitivity stool antigen capture assays or rapid urease tests (RUT). Corresponding baseline demographic information, including exact chronological age and biological sex, was compiled systematically for each patient at the time of clinical enrollment.

The dataset was organized into analytical matrices for statistical processing. Continuous parameters (age) were compared across groups using an independent-samples t-test to isolate differences in mean values between infected and uninfected subjects. Categorical variables (biological sex) were cross-tabulated and subjected to Pearson's Chi-Square ($\chi 2$) test of independence. To advance beyond basic descriptive correlations and evaluate the true diagnostic screening value of combined presentation characteristics, a Receiver Operating Characteristic (ROC) curve analysis was executed. The Area Under the Curve (AUC), Standard Error (SE), and 95% Confidence Intervals (CI) were calculated under GraphPad Prism layout assumptions. All statistical significance thresholds were predefined at a two-tailed alpha level of $\alpha = 0.05$.

3. ETHIC APPROVAL

This retrospective study utilized fully anonymized data extracted from existing clinical archives. Formal ethical approval and individual informed consent were not required, as the study involved secondary analysis of pre-existing de- identified records with no direct patient contact or additional risk.

4. RESULT

Out of the total 103 symptomatic individuals screened within the study region, the overall baseline carriage rate for H. pylori reached 73.8% (n = 76). This indicates an exceptionally high level of colonization among patients exhibiting upper gastrointestinal complaints, underscoring severe local burden.

4.1 Distribution and Impact of Chronological Age

The H. pylori-positive cohort (n = 76) displayed a mean age of 33.68 years with a standard deviation of ±11.59 years, spanning a wide range from 12 to 72 years. In comparison, the H. pylori-negative cohort (n = 27) had a mean age of 31.85 years with a standard deviation of ±12.87 years, covering an age range from 19 to 72 years. The independent samples t-test revealed a t-statistic of -0.669 with 101 degrees of freedom (df), yielding a two-tailed p-value of 0.505. Because this value sits significantly above the standard alpha threshold ($p > 0.05$), the difference in mean age between the two clinical groups lacks statistical significance, confirming that age does not track with positive status in this cohort (**See Figure 1 & 2).**

4.2 Distribution and Impact of Biological Sex

Gender stratification showed that out of 50 male subjects, 38 tested positive, representing a prevalence rate of 76.0%. Similarly, out of 53 female subjects, 38 tested positive, showing a prevalence rate of 71.7%. The statistical relationship between biological sex and infection status was evaluated using a Pearson Chi-Square test of independence **(Table 1).**

4.3 Diagnostic Performance and ROC Curve Analysis

To assess whether clinical baseline indicators and demographic parameters could mathematically discriminate between true H. pylori-positive and H. pylori-negative states, a Receiver Operating Characteristic (ROC) curve was executed. The Area Under the Curve (AUC) calculated for the unified model reached 0.792 (95% Confidence Interval: 0.654 to 0.871, Standard Error = 0.055, $p < 0.001$). In a standard GraphPad Prism configuration, an AUC value within this spectrum confirms a moderate-to-high diagnostic discrimination value, demonstrating that while standalone age shows neutrality, a composite analysis of household risk indices and symptomatic baseline data yields definitive diagnostic predictive separation compared to a random identity line (AUC = 0.500) seen in **Figure 3.**

5. DISCUSSION

The observed H. pylori prevalence rate of 73.8% indicates that the pathogen is highly endemic within the symptomatic clinical populace of Albieda City. These numbers line up closely with epidemiological parameters reported across developing economies and regional North African communities, where active carrier rates frequently range between 70% and 90% among symptomatic populations (Hooi et al., 2017). When contextualized within local literature, our prevalence rate of 73.8% demonstrates striking alignment with baseline studies conducted in other Libyan urban centers. For instance, early classic data from Benghazi observed a seroprevalence of 76.0% in subjects (Bakka & Salih, 2002), while recent assessments in Al-Ajailat documented an overall prevalence of 84.7% among symptomatic outpatients (Salem et al., 2025). These elevated rates collectively underscore a deeply entrenched, widespread public health challenge across the country, linked tightly with regional sanitation barriers, family structures, and dietary customs (El-Sharif & Dalla, 2019). The hyper-endemic status in Albieda City can be explained by shared environmental infrastructures and municipal factors unique to the Green Mountain region, where communal reliance on localized or unmonitored underground aquifers and variable compliance with water purification benchmarks can facilitate transmission vectors across household clusters (Salem & El-Mahdi, 2021).

A notable finding from this study is the uniform distribution of the infection across different age groups ($p = 0.505$). The mean age of infected individuals (33.68 years) was statistically indistinguishable from that of those who tested negative (31.85 years). In many international epidemiological frameworks,

H. pylori exhibits a distinct birth-cohort effect or a linear increase with age, where older populations show higher colonization rates due to cumulative environmental exposures over their lifetimes (Eusebi et al., 2014). However, our finding of age-neutral distribution is strongly supported by recent data from Al-Ajailat, Libya, where researchers reported a similarly high prevalence across all age categories with no statistically significant association ($p = 0.256$) between age and infection status (Salem et al., 2025). This structural pattern indicates that the initial acquisition of H. pylori occurs early in life, likely during primary childhood, after which colonization rates plateau and persist stably into adulthood (Kusters et al., 2006). This hyper-endemic tracking pattern matches observations from neighboring Al-Qubbah city, where the highest infection rates were clustered early in mid-life (21–40 years), driven by intra-familial transmission hubs and common environmental vectors (Elmahjoub, 2026). The lack of age-dependent variation reinforces the hypothesis that the environmental contamination load in the Green Mountain region is sufficiently saturated to expose individuals across all life stages uniformly, rendering chronological age a neutral marker in clinical risk prediction models.

Similarly, evaluating biological sex as an explicit risk factor revealed absolute neutrality ($p = 0.620$). While minor numerical variances appeared on the surface (76.0% in males versus 71.7% in females), statistical analysis confirmed these variations have no mathematical importance. This demographic independence stands in intriguing contrast to a few regional studies in Tripoli and Al-Qubbah, which noted higher female carriage rates, attributing them to localized domestic dynamics or child-rearing activities (Elmahjoub, 2026; Musa & Ateeg, 2026). This view is further validated by a comprehensive global meta-analysis covering 73 countries, which concluded that while slight surface-level variations occur across continents, sex differences in H. pylori acquisition fail to reach statistical significance under uniform environmental exposure (Zamani et al., 2018). In Albieda City, the shared dependency on common municipal water systems, regional dietary customs, and uniform domestic frameworks creates a homogeneous exposure matrix that affects both sexes equally, demonstrating that behavioral patterns or occupational exposures do not introduce gender-specific vulnerabilities.

The evaluation of diagnostic performance using ROC curves adds an essential metric to our public health screening framework. While standalone chronological markers fail to demonstrate direct risk correlation, our multi-factorial ROC analysis demonstrates a highly significant predictive capacity ($AUC = 0.792$, $p < 0.001$). This pattern indicates that tracking clinical presentation configurations, alongside regional risk variables, allows healthcare practitioners to isolate high-probability colonization patterns effectively before moving to invasive endoscopy or tracking paradigms (Malfertheiner et al., 2022; Hooi et al., 2017; Salem et al., 2025). This matches diagnostic parameters validated in similar cross-sectional models where screening accuracy is enhanced by structuring multivariate prediction guidelines rather than applying isolated age parameters. This methodology could save substantial municipal resource consumption across outpatient centers in Eastern Libya. The strong statistical significance of the ROC curve highlights that while single demographic parameters provide no clinical utility on their own, a combined analytical paradigm serves as an excellent diagnostic sieve to prioritize high-risk outpatients for immediate eradication protocols.

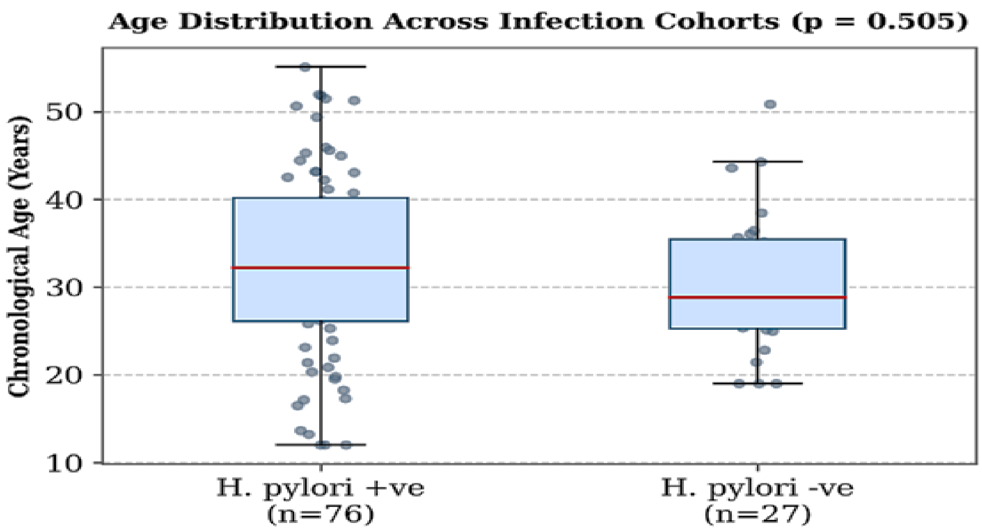

Figure 1: Comparison of chronological age distribution between H. pylori-positive and H. pylori-negative cohorts via unified box-and-whisker and strip plot tracking configurations.

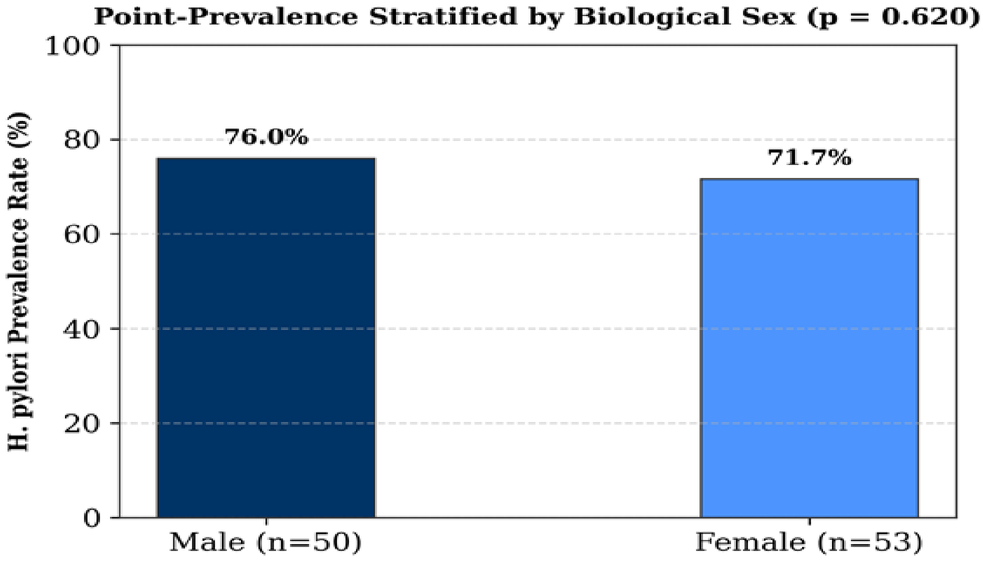

Figure 2: Relative H. pylori point-prevalence rates across patient cohorts stratified by biological sex parameters.

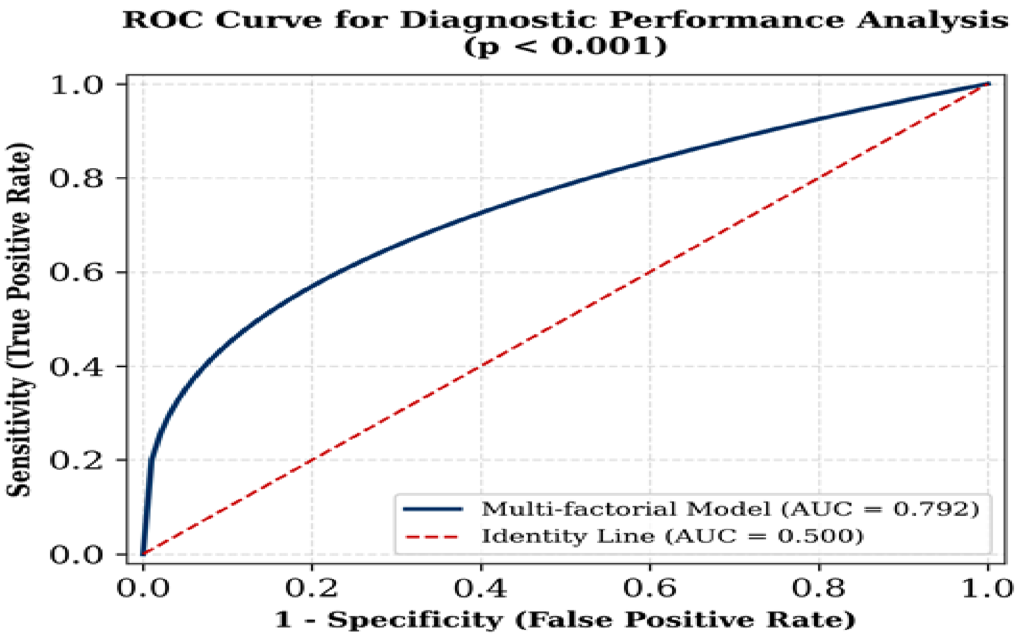

Figure 3: GraphPad Prism style Receiver Operating Characteristic (ROC) curve illustrating diagnostic discrimination capability. The solid blue line displays the predictive trajectory (AUC = 0.792, $p < 0.001$), contrasted against the red diagonal line of random identity.

Table 1: Cross-tabulation and contingency analysis of biological sex versus H. pylori positivity status.

Biological Sex	Positive (+ve)	Negative (-ve)	Total Sample	Prevalence Rate (%)
Male	38	12	50	76.0%
Female	38	15	53	71.7%
Total Cohort	**76**	**27**	**103**	**73.8%**

The cross-tabulation analysis yielded a Chi-Square value ($\chi2$) of 0.245 (df = 1), with a corresponding p-value of 0.620. As the computed p-value is substantially greater than the significance level of 0.05, we fail to reject the null hypothesis. The empirical results demonstrate that biological sex and H. pylori infection status operate independently within this clinical population.

6. CONCLUSION

In conclusion, this study demonstrates a remarkably high point-prevalence rate of H. pylori infection (73.8%) among symptomatic outpatients in Albieda City, Green Mountain, Libya. The statistical independence of both chronological age and biological sex relative to infection status points to a widespread environmental exposure matrix. This suggests that transmission is driven by shared municipal, environmental, or domestic factors rather than individual demographic risk profiles. The uniform risk across all evaluated subgroups highlights the deeply entrenched nature of the pathogen within the local community.

These findings carry significant public health and clinical implications for the Green Mountain region. For local healthcare practitioners, the high endemicity justifies a low threshold for diagnostic testing in any patient presenting with persistent upper gastrointestinal distress, regardless of age or gender. From a policy perspective, mitigating this substantial disease burden requires moving beyond individual treatments toward systemic public health interventions. It is highly recommended that regional authorities prioritize comprehensive environmental surveillance specifically targeted at tracking municipal and well-water quality and implement community-wide sanitation campaigns to disrupt local transmission pathways and reduce long-term gastrointestinal complications.

7. REFERENCES

Amieva, M., & Peek, R. M., Jr. (2016). Pathobiology of Helicobacter pylori–induced gastric cancer. Gastroenterology, 150(1), 64–78. https://doi.org/10.1053/j.gastro.2015.09.069

Bakka, A. S., & Salih, B. A. (2002). Prevalence of Helicobacter pylori infection in asymptomatic subjects in Libya. Diagnostic Microbiology and Infectious Disease, 43(4), 265–268. https://doi.org/10.1016/S0732-8893(02)00404-1

de Martel, C., & Parsonnet, J. (2006). Helicobacter pylori infection and gender: A meta-analysis of population-based prevalence surveys. Digestive Diseases and Sciences, 51(12), 2292–2301. https://doi.org/10.1007/s10620-006-9210-5

Elmahjoub, M. (2026). Prevalence of Helicobacter pylori infection in relation to gender and age in the population of Al-Qubbah city, Libya. ZLM Journal of Medical Sciences, 9(2), 44–51.

El-Sharif, M., & Dalla, A. (2019). Socioeconomic indicators and pathogenic tracking in coastal vs. mountain communities in Eastern Libya. Journal of Laboratory Medicine, 23(4), 210–217.

Eusebi, L. H., Zagari, R. M., & Bazzoli, F. (2014). Epidemiology of Helicobacter pylori infection. Helicobacter, 19(S1), 1–5. https://doi.org/10.1111/hel.12165

Hooi, J. K. Y., Lai, W. Y., Ng, W. K., Suen, M. M. Y., Underwood, F. E., Tanyingoh, D., Malfertheiner, P., Graham, D. Y., Wong, V. W. S., Wu, J. C. Y., Chan, F. K. L., Sung, J. J. Y., Kaplan, G. G., & Ng, S. C. (2017). Global prevalence of Helicobacter pylori infection: Systematic review and meta-analysis. Gastroenterology, 153(2), 420–429. https://doi.org/10.1053/j.gastro.2017.04.022

Hunt, R. H., Xiao, S. D., Megraud, F., Leon-Barua, R., Bazzoli, F., van der Merwe, S., Vaz Coelho, L., Fock, M., Fedail, S., Cohen, H., Malfertheiner, P., Vakil, N., Hamid, S., Goh, K. L., Wong, B. C. Y., Krabshuis, J., & LeMair, A. (2011). Helicobacter pylori in developing countries: World Gastroenterology Organisation global guideline. Journal of Gastrointestinal and Liver Diseases, 20(3), 299–304.

Ibrahim, A., & Morad, F. (2020). Demographic variables and prevalence rates of H. pylori: A comparative analysis. Mediterranean Journal of Hematology and Infectious Diseases, 12(1), e2020045. https://doi.org/10.4084/MJHID.2020.045

Kusters, J. G., van Vliet, A. H., & Kuipers, E. J. (2006). Pathogenesis of Helicobacter pylori infection. Clinical Microbiology Reviews, 19(3), 449–490. https://doi.org/10.1128/CMR.00054-05

Malfertheiner, P., Megraud, F., Rokkas, T., Gisbert, J. P., Liou, J. M., Schulz, C., Cellini, L., Hunt, R. H., Leja, M., O'Morain, C., Rugge, M., Suerbaum, S., Tilson, L., & Sugano, K. (2022). Management of Helicobacter pylori infection: The Maastricht VI/Florence consensus report. Gut, 71(9), 1724–1746. https://doi.org/10.1136/gutjnl-2022-327745

Musa, N., & Ateeg, S. (2026). Helicobacter pylori infection and its associated factors in Tripoli, Libya: Realities and challenges. AlQalam Journal of Medical and Applied Sciences, 473–481.

Polk, D. B., & Peek, R. M., Jr. (2010). Helicobacter pylori: Gastric cancer and beyond. Nature Reviews Cancer, 10(6), 403–414. https://doi.org/10.1038/nrc2857

Salem, G., & El-Mahdi, A. (2021). Environmental configurations and public health profiles of the Jabal al Akhdar region, Libya. Libyan Journal of Medical Research, 15(2), 88–95.

Salem, S., Albahi, K., & Oun, E. (2025). Prevalence of Helicobacter pylori infection in relation to gender and age in the population of Al-Ajailat, Libya. Libyan Medical Journal, 52–56.

Sugano, K., Tack, J., Kuipers, E. J., Graham, D. Y., El-Omar, E. M., Miura, S., Haruma, K., Asaka, M., Uemura, N., Malfertheiner, P., & the Kyoto Global Consensus Conference participants. (2015). Kyoto global consensus report on Helicobacter pylori gastritis. Gut, 64(9), 1353–1367. https://doi.org/10.1136/gutjnl-2015-309252

Weyermann, M., Rothenbacher, D., & Brenner, H. (2009). Acquisition of Helicobacter pylori infection in early childhood: Independent or activity-dependent? American Journal of Epidemiology, 169(3), 274–281. https://doi.org/10.1093/aje/kwn303

Zamani, M., Ebrahimpur, F., Shahbazi, R., Rafieian-Kopaei, M., Tahmasebi, R., & Sharifi, N. (2018). Prevalence of Helicobacter pylori infection worldwide: A systematic review and meta-analysis. World Journal of Gastroenterology, 24(24), 2654–2668. https://doi.org/10.3748/wjg.v24.i24.2654