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Original Article

Association of Gender, Age, and the Effect of Seasonal Variation on the Frequency of *Helicobacter pylori* Infection in Sabratha City, Libya

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Abstract

Background: Helicobacter pylori (H. pylori) infection is one of the most widespread infections, a very common bacterial infection affecting approximately half the world's population. It is prevalent globally and a major cause of disease. It is closely associated with gastrointestinal disorders such as gastritis, peptic ulcers, dyspepsia, and stomach cancer aims: This study aimed to estimate the prevalence of Helicobacter pylori (H. pylori) infection among patients in Sabratha, Libya, and to investigate the relationship between infection with this bacterium and sex, age, and seasonality Methods: One hundred and sixty-six adults were tested at the Al-Razi Laboratory in Sabratha, Libya, between January and December. Blood samples were collected to detect IgG antibodies against H. pylori using the CHORUS-Trio ELISA-based test. The data were statistically analyzed using SPSS software **Results:** The study included 166 individuals, 96 of whom tested positive for Helicobacter pylori (H. pylori), representing a prevalence of 57.8%. The highest prevalence was observed in the spring (66.6%) and the lowest in the summer (51.3%). The highest infection rate was recorded in the 20-39 age group (38.5%), while in the 40-59 age group, women were more likely to be infected than men. The study revealed a relatively high prevalence of infection within the studied population **Conclusion** Numerous studies assessing and analyzing the global prevalence of Helicobacter pylori (H. pylori) infection have highlighted variations between regions, and even within the same country. Most of these studies indicate that more than half of the world's population is infected with this bacterium, resulting in significant differences linked to environmental, economic, and other factors.

Keywords. Helicobacter Pylori, Gender, Age, Prevalence, Risk Factors, Seasonal Variations

Introduction:

Helicobacter pylori (H. pylori) is one of the most widespread bacteria in the world and is associated with chronic bacterial infections of the digestive system, where it colonizes the gastric mucosa. This infection, which often begins in childhood and persists into adulthood, is a major problem. [1] This bacterium colonizes the stomach and can survive there thanks to specialized mechanisms of resistance to acidity and factors that promote its colonization. It is estimated to infect approximately 50% of the world's population. [2] Helicobacter pylori infection is one of the most common and widespread chronic infections, affecting approximately half of the world's population.[3] The Helicobacter pylori bacterium is linked to approximately 75% of stomach cancer cases and 5.5% of all cancers worldwide. The World Health Organization and numerous studies and research classify Helicobacter pylori as a carcinogen. [4, 2] Numerous epidemiological studies have shown that this bacterium infects approximately 4.4 billion people worldwide. [5,6] Helicobacter pylori has specific characteristics; it is a Gram-negative aerobic bacterium with a microbial morphology. [7] This bacterium belongs to the Helicobacter family. This genus currently includes more than 30 species classified into two lineages: infectious and non-infectious, or enterohepatobacterial, [6]. Helicobacter pylori causes inflammation of the gastric mucosa through several mechanisms. This bacterium secretes toxins that damage the mucosa due to its ability to survive and multiply in the acidic environment of the stomach. This leads to an increased immune response and, consequently, chronic gastritis. Helicobacter pylori can damage the gastric mucosa, and the infection thus persists [8]. Global studies on Helicobacter pylori indicate that infection rates vary considerably from continent to continent, which can be attributed to differences in economic status, sanitary conditions, education, dietary habits, and the varying results of different research studies. According to available data, the prevalence of Helicobacter pylori is highest in Africa, reaching up to 90% in Libya, Egypt, Nigeria and other countries.

[9]. The prevalence of this bacterium varies: 30.0% in the United States, 80% in South America, 72% in China

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and other countries around the world [10]. It all began in 1983, when researchers first succeeded in isolating Helicobacter pylori from gastric mucosal biopsies taken from patients with chronic gastritis. It is a Gram-negative, anaerobic, spiral-shaped bacterium that requires specific conditions to grow [11]. Despite progress in understanding the characteristics of Helicobacter pylori, its transmission mechanisms remain poorly understood. Infection can occur directly between individuals or through exposure to environmental contaminants. Furthermore, poor sanitation and hygiene practices can contribute to its spread. Some studies also indicate that Helicobacter pylori bacteria are usually contracted during childhood [12].

Materials and Methods:

Sample collection:

The present study was conducted at the Al-Razi laboratory in Sabratha, Libya, during the period from January to December 2025. The study sample consisted of 166 participants from different age groups, including 110 women and 56 men. Venous blood samples were collected from participants using sterile syringes and placed in tubes without anticoagulant. The serum was then centrifuged and stored for analysis. The presence of IgG antibodies against Helicobacter pylori infection was investigated. Use of the manufacturer's CHORUS_CHORUS-Trio device. DIESSE Diagnostica Senese The test is based on the ELISA (enzyme-linked immunosorbent assay) technique, where the device detects specific antibodies against bacteria in blood serum through the reaction between the antigen and the antibody. The results are then interpreted as positive or negative according to the reference values approved by the reagent manufacturer.

Sample Size Calculation:

The required sample size was calculated using the single proportion formula with a 95% confidence level, 80% power, an expected prevalence of 50% (based on previous Libyan studies), and a margin of error of 7%. The calculated minimum sample size was 196 participants. However, due to logistical constraints and the availability of patients during the study period, a total of 166 participants were included. This limitation is acknowledged in the interpretation of the findings.

Statistical Methods:

The collected data were entered, coded, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS V27). Descriptive statistics were used to summarize the study data. Categorical variables, including gender, age group, season, and *Helicobacter pylori* infection status, were presented as frequencies and percentages.

Inferential statistical analyses were performed using the Pearson chi-square (χ^2) test to examine associations between categorical variables, including the relationship of *H. pylori* infection with gender, age group, and season, as well as the distribution of infected cases across age groups and seasons. All statistical tests were two-tailed, and a *p*-value of less than 0.05 was considered statistically significant.

Ethical Approval:

This study was conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments. Ethical approval for this study was obtained from the relevant Institutional Review Board (IRB) / Ethics Committee (Approval Reference: 2026).

All participants were fully informed about the purpose of the study, the procedures involved, and their right to withdraw at any time without any consequences. Written informed consent was obtained from each participant prior to blood sample collection. All data were anonymized and kept confidential to ensure participant privacy.

Results:

Of the 96 positive cases, 58 (60.4%) were females and 38 (39.6%) were males. The prevalence rate was 52.7% (58/110) among females and 67.9% (38/56) among males. The highest infection rate was recorded in the 20-39 age group (38.5%), across all age groups, while in the 40-59 age group, women were more likely to be infected than men. Across the four seasons, spring saw the highest number of infections (34 cases).

Table 1. Distribution of cases among different months:

Season	Number of samples	Frequency	Percent	Chi square	P value
Winter	43	24	55.8%	6.250	0.100
Spring	51	34	66.6%		
Summer	37	19	51.3%		
Autumn	35	19	54.2%		
Total	166	96	57.8%		

Table 1 presents the distribution of *Helicobacter pylori* infection according to season among the 166 patients included in the study. Overall, 96 patients tested positive for *H. pylori*, corresponding to an overall prevalence of 57.8%. The highest prevalence was observed during the spring season (66.6%), followed by winter (55.8%), autumn (54.2%), and summer (51.3%).A chi-square test was conducted to examine the association between season and *H. pylori* infection. The results indicated that the observed differences in infection prevalence across the four seasons were not statistically significant, $\chi = 6.25$, $p = .100$. Therefore, the findings suggest that the frequency of *H. pylori* infection did not vary significantly according to season among the study population.

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Table 2. Distribution of cases according to gender:

gender	Number of samples	negative samples	Frequency	Percent	Chi square	P value
Male	56	18	38	39.6	4.167	0.041
Female	110	52	58	60.4		
Total	166	70	96	100%		

Table 2 presents the distribution of Helicobacter pylori infection according to gender among the 166 study participants. Of the total positive cases, 60.4% occurred among females and 39.6% among males. However, when considering the sample size of each gender, the prevalence rate was 67.9% (38/56) among males and 52.7% (58/110) among females. The chi-square test revealed a statistically significant association between gender and infection status (χ^2 = 4.167, p = 0.041), indicating that male participants had a significantly higher prevalence of H. pylori infection compared to female participants in this study population.

Table 3. Distribution of H. pylori cases according to age group and gender:

Age group (years)	Male	Female		Percent	Chi square	P value
< 20	4	7	11	11.5%	8.017	0.046
20 - 39	9	28	37	38.5%		
40 - 59	16	18	34	35.4%		
> 60	9	5	14	14.6%		
Total	38	58	96	100%		

Table 3 presents the distribution of *Helicobacter pylori* infection according to age group and gender among the 96 infected patients. The highest proportion of infected cases was observed in the 20–39 years age group (38.5%), followed by the 40–59 years group (35.4%). Lower proportions were recorded among patients older than 60 years (14.6%) and those younger than 20 years (11.5%). Across all age groups except 40–59 years, females accounted for more infected cases than males.

Among the 96 infected patients, the highest proportion was observed in the 20–39 years age group (38.5%). However, because data on H. pylori-negative individuals within each age group were not available, we could not confirm whether age is an independent risk factor. This analysis only describes the age distribution of positive cases.

Discussion:

The prevalence of *H. pylori* infection has changed since its emergence. Relatively stable between 1991 and 2010, it declined significantly between 2011 and 2022. Numerous published studies have demonstrated that this decline was substantial and particularly pronounced in the WHO African Region, especially among young people. These findings have spurred further research into strategies for preventing *H. pylori* infection [13]. Many factors determine the spread of this bacterium, such as socio-economic status depending on the country and region, and the individual himself, as well as varying environmental conditions [14]. Despite varying statistics from country to country, statistics in developing countries and those with low economic income have shown an increase in infections [15]. Approximately 50% of the world's population suffers from bacterial stomach infections [16]. Following this infection, 17% of these infections develop into stomach ulcers and sometimes progress to more serious symptoms, including stomach cancer, which is responsible for approximately 700,000 deaths per year worldwide [17]. Numerous studies continue to explore the transmission routes of *H. pylori*, as these have not yet been fully identified. Libya, like other countries, requires extensive research to determine the main modes of transmission and limit the spread of the bacterium. Therefore, the study of *H. pylori* within the Libyan population requires ongoing surveillance and is essential for maintaining public health [18].

This study was designed to observe the incidence of *H. pylori* infection and its relationship with sex, age groups, and season. The results indicated that the prevalence in Sabratha reached an overall rate of 57.8%, which is consistent with other Libyan studies [19]. The study indicated that the prevalence was 31.3% in the Tobruk region, with varying percentages, while the infection rate was 50% in a study conducted in Gharyan, Libya [18]. Regarding the percentage of men and women, 55% were women in the city of Bani Waleed in Libya [20]. In the Sebha region, tests revealed a progressive increase in the percentage with age, reaching 14.1% in those aged 38-48. In the Tripoli region, *H. pylori* infection was detected in 45% of people aged 40 and over [21, 22]. Meanwhile, this percentage was 46.1% in the Asir region of Saudi Arabia [16, 23].

Although documented findings in the Sabratha region showed that the 20-39 age group had the highest percentage of infections, at 37 out of 96 cases (38.5%), this high prevalence in this age group is attributed to

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wastewater contamination, particularly by individuals infected with the bacterium. However, it is important to interpret this finding with caution, as our analysis was based only on positive cases and did not compare them with negative cases across age groups. Therefore, we cannot conclusively confirm age as an independent risk factor based on the current data. Other contributing factors include the use of public restrooms, lifestyle changes, smoking, and other unhealthy habits. These factors significantly contribute to the spread of this bacterium, posing a major public health challenge to control or prevent its transmission. This study also revealed a correlation between *H. pylori* infection rates and seasonal variations. The highest prevalence was recorded in spring (66.6%), followed by winter (55.8%), consistent with previous findings [19, 24]. However, its prevalence during autumn (54.2%) compared to summer (51.3%) does not agree with [19, 25]. No statistically significant difference was observed between seasons regarding the incidence of *H. pylori* infection in Yemen [6, 26]. While a study has shown an increase in the infection rate, from 70% during the dry season to 96% during the rainy season, this was observed only in children. No statistically significant correlation with the season was found in adults.

The prevalence of *H. pylori* varies between developed and developing countries (from 30% to 80%). In developed countries (Japan, Germany, the Netherlands, and the United States), it ranges from 6% to 12%. In developing countries (Chile, Venezuela, and Nigeria), the infection rate is high (from 26% to 66%). In Lebanon, Egypt, Saudi Arabia, and Iran, it ranges from 12% to 18% [6, 27].

Summary of Results:

A total of 166 patients were included in this study. Overall, 96 patients tested positive for *H. pylori*, resulting in an overall prevalence of 57.8%. The distribution across seasons showed numerical variation (highest in spring at 66.6%, lowest in summer at 51.3%), but these differences were not statistically significant. When comparing prevalence rates by gender, males showed a higher infection rate (67.9%) than females (52.7%), with a statistically significant association ($p = 0.041$). The highest proportion of infected patients belonged to the 20–39-year age group (38.5%), followed by 40–59 years (35.4%), with a significant association between age and infection. No significant association was found between age group and season among infected patients.

Conclusion:

1. *Helicobacter pylori* infection is highly prevalent among patients in Sabratha City, with an overall prevalence of 57.8%.
2. Seasonal variation was not significantly associated with the occurrence of *H. pylori* infection.
3. Male participants exhibited a significantly higher prevalence rate (67.9%) of H. pylori infection compared to female participants (52.7%), suggesting that gender may be a contributing factor to infection risk in this study population.
4. Adults aged 20–39 years and 40–59 years constituted the majority of infected cases in this sample, but this finding is descriptive only. Future studies with complete data on negative cases are needed to confirm whether age is an independent risk factor.
5. The distribution of infected cases across age groups remained consistent throughout the different seasons, suggesting that season does not substantially influence the age pattern of infection.
6. The findings highlight *H. pylori* as an important public health concern in Sabratha and emphasize the need for appropriate screening and preventive measures.

Recommendations:

1. Implement community-based awareness programs to educate the public about the transmission, prevention, and complications of *H. pylori* infection.
2. Encourage routine screening for *H. pylori*, particularly among adults aged 20–59 years and individuals presenting with persistent gastrointestinal symptoms.
3. Promote hygienic practices, including safe food preparation, improved sanitation, and access to clean drinking water, to reduce transmission of the bacterium.
4. Conduct larger multicenter studies involving different regions of Libya to obtain more representative estimates of *H. pylori* prevalence and associated risk factors.
5. Future studies should include additional demographic, socioeconomic, environmental, lifestyle, and clinical variables to better identify determinants of *H. pylori* infection.
6. Future analyses should compare infected and non-infected individuals within each age and seasonal category to more accurately assess the effects of age and season on infection risk.
7. Healthcare providers should consider *H. pylori* infection in the differential diagnosis of patients with gastrointestinal complaints and follow evidence-based guidelines for diagnosis and eradication therapy.

References:

1- Xie, L., Liu, G. W., Liu, Y. N., Li, P. Y., Hu, X. N., He, X. Y., ... & Guo, H. J. (2024). Prevalence of Helicobacter pylori infection in China from 2014-2023: A systematic review and meta-analysis. World journal of gastroenterology, 30(43), 4636. DOI: 10.3748/wjg.v30.i43.4636

2- Mladenova, I. (2021). Clinical relevance of Helicobacter pylori infection. *Journal of Clinical Medicine*, *10*(16), 3473. https://doi.org/10.3390/ jcm10163473

3- Dewayani, A., Fauzia, K. A., Alfaray, R. I., Waskito, L. A., Doohan, D., Rezkitha, Y. A. A., ... & Miftahussurur, M. (2021). The roles of IL-17, IL-21, and IL-23 in the

Received: 25-06-2026-**Accepted:** 27-06-2026 -**Published:** 06-08-2026

Helicobacter pylori infection and gastrointestinal inflammation: a review. Toxins, 13(5), 315. https://doi.org/10.3390/ toxins13050315

4- International Agency for Research on Cancer; World Health Organization. Infection with Helicobacter pylori. In Schistosomes, Liver Flukes and Helicobacter pylori; IARC: Lyon, France, 1994; pp. 177–202

5- Hooi, J. K., Lai, W. Y., Ng, W. K., Suen, M. M., Underwood, F. E., Tanyingoh, D., ... & Ng, S. C. (2017). Global prevalence of Helicobacter pylori infection: systematic review and meta-analysis. Gastroenterology, 153(2), 420-429. http://dx.doi.org/10.1053/ j.gastro.2017.04.022

6- Almashhadany, D. A., Mayas, S. M., Mohammed, H. I., Hassan, A. A., & Khan, I. U. (2023). Population-and gender-based investigation for prevalence of Helicobacter pylori in Dhamar, Yemen. *Canadian Journal of Gastroenterology and Hepatology*, *2023*(1), 3800810. https://doi.org/10.1155/2023/3800810Digital Object Identifier (DOI)

7- Khalleefah, M., Hasen, Y., Elfituri, Z., Edeeb, M., & Alreeshi, K. (2023). Prevalence of H. pylori Infection among Patients with Chronic Gastric Symptoms and The Role of Gastric Biopsy in its Diagnosis and Management. *AlQalam Journal of Medical and Applied Sciences*, 788-793. *https://doi.org/10.5281/zenodo.10342260*

8- Lipatova, I., Kulnickaitė, I., Jacikė, Ž., & Korsakovė, I. (2023). The impact of sex, age, and season on the prevalence of Helicobacter pylori infection in Lithuania. Biologija, 69(2). DOI: https://doi.org/10.6001/biologija.2023.69.2.4

9- Sathianarayanan, S., Ammanath, A. V., Biswas, R., Sukumaran, S., & Venkidasamy, B. (2022). A new approach against Helicobacter pylori using plants and its constituents: A review study. *Microbial pathogenesis*, *168*, 105594.

10- Ren, S., Cai, P., Liu, Y., Wang, T., Zhang, Y., Li, Q., ... & Jin, G. (2022). Prevalence of Helicobacter pylori infection in China: A systematic review and meta-analysis. *Journal of gastroenterology and hepatology*, *37*(3), 464-470. https://doi.org/10.1111/jgh.15751Digital Object Identifier (DOI)

11- Li, J., Shi, H., Zhou, F., Xie, L., & Lin, R. (2024). The efficacy and safety of regimens for Helicobacter pylori eradication treatment in China: a systemic review and network meta-analysis. *Journal of clinical gastroenterology*, *58*(1), 12-23.

12- Lupu, A., Miron, I. C., Cernomaz, A. T., Gavrilovici, C., Lupu, V. V., Starcea, I. M., ... & Fotea, S. (2023). Epidemiological characteristics of Helicobacter pylori infection in children in Northeast Romania. Diagnostics, 13(3), 408. https://doi.org/10.3390/diagnostics13030408

13- Li, Y., Choi, H., Leung, K., Jiang, F., Graham, D. Y., & Leung, W. K. (2023). Global prevalence of Helicobacter pylori infection between 1980 and 2022: a systematic review and meta-analysis. *The lancet Gastroenterology & hepatology*, *8*(6), 553-564. DOI: 10.1016/S2468-1253(23)00070-5

14- Lu, C., Yu, Y., Li, L., Yu, C., & Xu, P. (2018). Systematic review of the relationship of Helicobacter pylori infection with geographical latitude, average annual temperature and average daily sunshine. *BMC gastroenterology*, *18*(1), https://doi.org/10.1186/s12876-018-0779-x

15- Usarov, K., Ahmedov, A., Abasiyanik, M. F., & Na'im Ku Khalif, K. M. (2022). Forecasting of infection prevalence of Helicobacter pylori (H. pylori) using regression analysis. *IIUM Engineering Journal*, *23*(2), 183-192. *DOI: https://doi.org/10.31436/iiumej.v23i2.2164*

16- Al Mutawa, O. A., Izhari, M. A., Alharbi, R. A., Sindi, A. A. A., Alqarni, A. M., Alotaibi, F. E., ... & Athathi, A. I. (2023). Helicobacter pylori (H. pylori) infection-associated anemia in the Asir Region, Saudi Arabia. *Diagnostics*, *13*(14), 2404. **https://doi.org/10.3390/diagnostics13142404**

17- Kim, N. (2024). Prevalence and transmission routes of H. pylori. In *Helicobacter pylori* (pp. 3-21). Singapore: Springer Nature Singapore. doi.org/10.1007/978-981-97-0013-4_1

18- *Mahdawi, N., Karim, I., Abdulazez, Z., ALmsagrei, N., & Alaswad, N. (2024). Study of Correlation between H. pylori, Life Habits, and Risk Factors among Adult Patients in Gharyan, Libya. AlQalam Journal of Medical and Applied Sciences, 1141-1145. DOI: https://doi.org/10.54361/ajmas.247433*

19- Bougafa, F., Amhamed, A., Hayder, A., & El Shreef, A. (2025). Seasonal Variation in The Frequency of Helicobacter Pylori Infection in Tobruk City, Libya. *Libyan Medical Journal*, 87-92. *DOI: https://doi.org/10.69667/lmj.2517114*

20- Eisay, Z. M., Grimida, S., Abdoarrahem, M. M., Alnaqrat, R. A., & Zobeida, A. (2023). The Study of Helicobacter Pylori Bacteria Infection in Bani Waleed city-Libya. *International Journal of Multidisciplinary Sciences and Arts*, *2*(2), 1-6. *DOI: https://doi.org/10.47709/ijmdsa.v2i1.2245*

21- Nami, A., Grima, N., Almadni, M., Huwiage, G., Shahlol, A. M., & Khalifallah, H. M. (2019). Helicobacter pylori infection in healthy and dyspeptic adult populations resident in Tripoli and Sabha of Libyan cities: A seroepidemiologic study. *Journal of Pure & Applied Sciences*, *18*(4). https://doi.org/10.51984/jopas.v18i4.438

22- Hunt, R. H., Xiao, S. D., Megraud, F., Leon-Barua, R., Bazzoli, F., Van der Merwe, S., ... & Le Mair, A. (2011). Helicobacter pylori in developing countries. *J Gastrointestin liver dis*, *20*(3), 299-304.

23- Liu, M., Gao, H., Miao, J., Zhang, Z., Zheng, L., Li, F., ... & Sun, J. (2024). Helicobacter pylori infection in humans and phytotherapy, probiotics, and emerging

Received: 25-06-2026-**Accepted:** 27-06-2026 -**Published:** 06-08-2026

Libyan Journal of Medical Research

www.lmjr.ly/ eISSN: 2413-6096

therapeutic interventions: a review. *Frontiers in microbiology*, *14*, 1330029. DOI 10.3389/fmicb.2023.1330029

24- Liu, Z., Chen, X., Sun, D. J., Zhao, W. W., Kou, L., Zheng, W. W., ... & Gao, F. Y. (2024). Comparison of vonoprazan-based dual therapy with vonoprazan-based bismuth quadruple therapy for treatment-naive patients with Helicobacter pylori infection: A propensity score matching analysis. Medicine, 103(10), e37476.

25- O. A., Izhari, M. A., Alharbi, R. A., Sindi, A. A. A., Alqarni, A. M., Alotaibi, F. E., ... & Athathi, A. I. (2023). Helicobacter pylori (H. pylori) infection-associated anemia in the Asir Region, Saudi Arabia. *Diagnostics*, *13*(14), 2404. https://doi.org/10.3390/diagnostics13142404

26- Huwiage, G. M., Nami, A. A., & Akadh, A. H. (2020). stool antigen (hpsa) test in detection of helicobacter pylori infection among adult dyspeptic patients in tripoli, Libya. *International Journal of Medicine and Medical Research (IJMMR)*, *2*(5), 5-14. DOI 10.11603/ijmmr.2413-6077.2019.2.10334 *https://doi.org/10.11603/ijmmr.2413-6077.2019.2.10334*

27- Sözen, S. İ., Kovancı, H., Dalkılıç, M. S., & Sözen, S. (2023). Nutrition and Helicobacter py-lori infection in gastric disease. *World J Adv Res Rev*, *18*(3), 21-30. *DOI: https://doi.org/10.30574/wjarr.2023.18.3.1005*

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