Prevalence of *Helicobacter pylori* in Sabratha City and its Correlation with Age Groups

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Abstract:

Background: The prevalence of *Helicobacter pylori* infection varies significantly across different age groups, influenced by a range of factors including socioeconomic conditions, hygiene practices, and dietary habits. Generally, the prevalence tends to increase with age, peaking in middle adulthood, and then either stabilizing or decreasing in older age groups. **Objectives:** This study aimed to investigate age- and sex-related variations in IgG and IgM antibody responses associated with *H. pylori* infection. **Methods:** A total of 185 (129 females and 56 males) participants were classified into seven age groups, ranging from 0–10 years to over 60 years. Serum IgG and IgM concentrations were assessed according to age and sex. Antibody levels were evaluated using predefined cut-off values and categorized as negative, borderline, or positive. **Results:** IgG concentrations exhibited considerable variation across age groups, with higher mean levels generally observed in several middle-aged categories. The highest mean IgG concentration was recorded in the 51–60-year age group. Variations in IgG classifications were also observed across age categories, indicating differences in serological responses. Among males, IgG levels similarly demonstrated substantial age-related variability. In contrast, mean IgM concentrations in both sexes remained below the predefined positive threshold. All female and male age groups were classified as IgM-negative, despite variations in mean concentrations and standard deviations. **Conclusion:** The findings demonstrate age-related variation in IgG antibody responses to H. pylori, whereas IgM levels remained consistently low across age and sex groups. The observed IgG patterns may reflect differences in exposure and the persistence of antibody responses. However, serological findings alone cannot establish active infection or distinguish current from past exposure.

Keywords: *H. pylori*; IgG; IgM; Age groups.

1. Introduction

Although *H. pylori* infection is generally less common in children than in adults, its prevalence typically rises as children grow older. For example, a study conducted in Fuzhou, China, found that among children aged 6–13 years, prevalence increased from 8.3% in the youngest age group to 34.7% in the older children (Chen et al., 2025). A comparable age-related increase has also been documented in Uganda, where prevalence rose from 16.2% among children aged 1–5 years to 27.2% among those aged 6–10 years (Aitila et al., 2019). In young adults, the prevalence of *H. pylori* infection is often higher than in childhood and early adolescence. Evidence from Karbala indicates that the greatest prevalence occurred in the 21–30 and 31–40 year groups, with rates of 28.2% and 29.3%, respectively (Kareem and Al-Kaaby, 2015). Multiple studies suggest that prevalence commonly reaches its peak during middle adulthood. In Wuwei, China, the highest prevalence was observed in the 30–39-year group (Wang et al., 2021). Similarly, a study from Ireland reported that the peak prevalence occurred in the 31–60-year group (Magbri et al., 2016). Findings for older adults are mixed. While some research indicates a decline in prevalence with increasing age, other studies suggest a renewed rise. For instance, in Karbala, prevalence decreased in the 41–50-year group but then increased again among individuals over 50 years (Kareem and Al-Kaaby, 2015).

Socioeconomic status shows a consistent association with *Helicobacter pylori* infection prevalence, such that individuals with lower socioeconomic status experience higher prevalence. This relationship is plausibly driven by multiple overlapping determinants, including lower income, substandard living conditions, and reduced access to safe, clean water. Together, these circumstances increase the likelihood of exposure and support conditions that facilitate transmission, thereby contributing to elevated infection rates (Zamani et al., 2018; Xia et al., 2025).

Hygiene and sanitation represent another key set of influences. Risk rises notably in contexts where hygiene-related behaviors are inadequate—for example, insufficient handwashing—and where individuals, especially children, consume untreated water. Such exposures function as significant risk factors by increasing opportunities for oral–fecal transmission and other routes linked to contaminated environments (Aitila et al., 2019; Fuentes-López et al., 2023). Dietary habits further shape infection patterns. In children, higher infection rates have been associated with the intake of specific foods, including desserts and fried foods (Chen et al., 2025). Among adults, dietary behavior can similarly affect prevalence; for instance, diets that include spicy foods or raw foods have been linked to differences in infection prevalence (Balas et al., 2022). Environmental exposure over time also contributes to the age-related increase in prevalence. As individuals accumulate exposure, prevalence tends to rise, with this effect being particularly apparent in areas characterized by poor sanitation and crowded living conditions. These contextual conditions can intensify contact with contaminated sources and sustain transmission across time, which helps explain why prevalence increases as populations age (Aitila et al., 2019; Chen et al., 2025). Although overall *H. pylori* prevalence generally increases with age and reaches its highest levels in middle adulthood, it is essential to account for regional and demographic factors that can modify this trajectory. In developed countries, prevalence is typically lower, reflecting more favorable socioeconomic conditions and greater access to healthcare services (Zamani et al., 2018). In contrast, developing regions often show higher prevalence rates, which are frequently attributed to poorer living conditions and constrained access to healthcare (Balas et al., 2022). Recognizing and interpreting these between-region and between-demographic differences is critical for designing targeted public health interventions aimed at reducing the burden of Helicobacter pylori infection across distinct age groups.

Multiple investigations across Libyan regions have documented substantial variation in the prevalence of *Helicobacter pylori* infection among different populations. In a study carried out in AL-Ajailat, *H. pylori* infection was highly prevalent, occurring in 84.7% of participants; moreover, the infection rate was notably higher in females (70.3%) than in males (29.7%) (Salem et al., 2025). In Sebha, researchers reported a prevalence of 53.5% among patients presenting with gastroenteritis, and they found no statistically significant differences between genders (Khalaf et al., 2025). In Benghazi, the prevalence was assessed using serological methods among dyspeptic patients, revealing a seroprevalence of 72.2%, and active infection was confirmed in more than 60% of cases (Al-Farjany et al., 2024). By contrast, Tobruk showed a lower overall prevalence of 33.6%, accompanied by significant seasonal variation, with the highest values observed in spring (Bougafa et al., 2025).

Evidence from Tripoli indicates comparatively high seroprevalence levels, with 83% among dyspeptic patients and 85% among healthy blood donors (Abdelgawad et al., 2023). However, other work reported a much lower seroprevalence of 17.2% when examining a broader population sample (Atia et al., 2023). In Brack Al-Shati, dyspeptic patients showed a prevalence of 73% (Alajwad et al., 2024). In Sirte, an infection rate of 83% was reported among symptomatic patients (Abdallah et al., 2022).

When considering sex-related patterns, some studies—particularly those conducted in AL-Ajailat and Tobruk—identified higher prevalence among females. Nevertheless, other studies, including those from Sebha and Tripoli, did not detect any significant gender differences, suggesting that the influence of sex may vary by setting and study design (Atia et al., 2023; Bougafa et al., 2025; Khalaf et al., 2025; Salem et al., 2025). In addition, age appears to be an important factor: across multiple studies, the prevalence of H. pylori infection tended to increase with age, with relatively higher rates observed among middle-aged groups (Bougafa et al., 2025; Khalaf et al., 2025; Salem et al., 2025). The relationship between H. pylori infection and metabolic comorbidity has also been explored. In Benghazi, a study reported that type 2 diabetic patients had a 72% prevalence of H. pylori infection, which was significantly higher than the prevalence observed among non-diabetic individuals (Abdallah et al., 2022). Beyond demographic and comorbidity factors, the literature consistently supports a strong association between H. pylori infection and gastroduodenal diseases. Specifically, in Benghazi, the infection was associated with disorders such as gastritis and peptic ulcers (Al-Farjany et al., 2024). Finally, mechanistic and clinical implications have been suggested by reports of virulence factors: the presence of the CagA protein was documented in several

studies, implying a potential for more severe clinical outcomes (Abdelgawad et al., 2023; Alajwad et al., 2024).

While the prevalence of *H. pylori* infection in Libya is generally high, it is important to consider the variability across different regions and populations. Factors such as gender, age, and specific health conditions can influence infection rates, although the significance of these factors is not consistent across all studies. Further research is needed to better understand the epidemiology of *H. pylori* in Libya and to develop targeted public health strategies.

2. Methodology

2.1 Study Setting and Period

The study was conducted at the Prevention Laboratory in Sabratha City, Libya. Data were collected from July 2025 to September 2025.

2.2 Data Collection

Prevention Laboratory in Sabratha City was selected as the study site for data collection. Laboratory records available during the study period were reviewed. Data from 185 (129 females and 56 males) cases who underwent laboratory testing for *H. pylori* infection were documented. The collected data included age, sex, and the results of immunological tests, including IgG and IgM concentrations, in addition to the results of the *H. pylori* stool antigen test.

The identification of current *H. pylori* infection was based on the results of the *H. pylori* blood serum test, which is used to detect the presence of bacterial antigen in blood samples. The IgG and IgM results were also analyzed to investigate variations in immune responses according to age and sex.

2.3 Determination of H. pylori Infection Status

The serological status of *H. pylori* infection was determined by measuring serum-specific immunoglobulin G (IgG) and immunoglobulin M (IgM) concentrations using an enzyme-linked immunosorbent assay (ELISA). The obtained antibody concentrations were compared with the reference values and cut-off points provided by the assay manufacturer to classify the results as negative, borderline (equivocal), or positive.

The antibody index (Index) was calculated by comparing the optical density (OD) or antibody concentration of each sample with the assay-specific cut-off value. The index was calculated according to the following equation:

$$\text{Index} = \frac{\text{Sample Signal}}{\text{Cut-off Signal}} \quad (1)$$

2.4 Data Analysis

Data were organized and analyzed using Microsoft Excel. Arithmetic means and standard deviations were calculated for age and IgG and IgM concentrations. The relationship between age and IgG and IgM concentrations was assessed using correlation analysis. The results were presented according to age group and sex, and serological results were classified as negative, borderline, or positive according to the reference values provided for the assay used.

3. Results and Discussion

3.1 Results

The study included a total of 185 (129 females and 56 males) participants who were classified into seven age groups ranging from 0–10 years to more than 60 years. The demographic characteristics of the participants were analyzed according to age and sex. Serum IgG and IgM antibody concentrations against *H. pylori* were assessed across the different age categories. The results were further evaluated to identify variations in antibody responses between age groups and sexes.

Table (1): Mean and standard deviation of age and IgG values among females according to age groups for *H. pylori* infection

Age Group (Years)	Frequency (n)	Mean Age ± SD	Mean IgG ± SD	Normal Range	Interpretation
0–10	10	6.60 ± 2.63	0.67 ± 0.47	1.1	Positive
11-20	27	16.48 ± 2.97	1.04 ± 0.76	>0.9	Negative
21-30	23	24.91 ± 3.07	1.45 ± 0.84	1.1-0.9	Borderline
31-40	24	37.08 ± 2.76	1.72 ± 1.12	<1.1	Positive
41–50	24	45.04 ± 2.69	1.73 ± 1.02	0.9–1.1	Borderline
51–60	10	54.80 ± 2.97	2.10 ± 1.15	>1.1	Positive
>60	11	71.63 ± 11.22	1.41 ± 1.06	>1.1	Positive
Total	129	—	—	—	—

The table (1) summarizes data by age group, including frequency, mean age, mean IgG levels, and interpretations using the normal IgG range for Helicobacter pylori. Overall, age groups span from 0–10 years to over 60 years and differ in frequency: the 11–20 years group has the highest frequency (27 individuals), whereas the 0–10 years group has the lowest (10 individuals). Mean age increases across successive age groups, consistent with growth and aging, while the standard deviation (SD) differs between groups, indicating varying dispersion of ages. For example, the 0–10 years group has a mean age of 6.60 ± 2.63, compared with 71.63 ± 11.22 for the over 60 years group. Mean IgG levels similarly follow an age-related pattern, rising from lower values in younger participants (0.67 ± 0.47 for 0–10 years) to higher values in older groups, with the maximum observed in the 51–60 years group (2.10 ± 1.15). Interpretations based on mean IgG levels indicate distinct health statuses: 0–10 years and 11–20 years are negative and borderline, respectively, suggesting possible IgG deficiency or a reduced immune response; 21–30 and 41–50 years are borderline, consistent with a transitional phase in immune function; and 31–40, 51–60, and over 60 years are positive, implying adequate or elevated IgG levels that may reflect stronger immune responses or greater exposure to infections. In conclusion, IgG levels increase with age, potentially due to cumulative antigen exposure and immune system development, and the categorization of results helps characterize age-specific immune status for clinical assessment and understanding age-related immune changes.

Table (2): Mean and standard deviation of age and IgG values among males according to age groups for *H. pylori* infection

Age Group (Years)	Frequency (n)	Mean Age ± SD	Mean IgG ± SD	Normal Range	Interpretation
0–10	4	6.6 ± 2.63	0.67 ± 0.47	>0.9	Negative
11-20	10	16.48 ± 2.97	1.04 ± 0.76	>0.9	Negative
21-30	7	24.91 ± 3.07	1.45 ± 0.84	1.1-0.9	Borderline
31-40	6	37.08 ± 2.76	1.72 ± 1.12	<1.1	Positive
41–50	15	45.04 ± 2.69	1.73 ± 1.02	0.9-1.1	Borderline
51–60	11	54.8 ± 2.97	2.10 ± 1.15	<1.1	Positive
>60	3	71.63 ± 11.22	1.41 ± 1.06	<1.1	Positive
Total	56	—	—	—	—

Table (2) reports the mean age and immunoglobulin G (IgG) concentrations, along with their standard deviations, across seven male age groups. The results are organized into seven age ranges and show systematic variation in both age and IgG levels in the context of Helicobacter pylori infection. For males aged 0–10 years, the mean age is 6.6 years and the mean IgG level is 0.67. The standard deviations for both measures suggest a relatively stable population, and the IgG values are classified as negative, indicating an immune response within the normal range for this age group. In the 11–20 years group, the mean age increases to 16.48 years, with mean IgG of 1.04. IgG remains negative, suggesting that immune function is consistent with expected parameters for this demographic. For 21–30 years, the mean age is 24.91 years and the mean IgG level is 1.45, which is classified as borderline. This pattern implies that IgG concentrations are approaching the normal range but do not clearly fall within it, pointing to a potential area of concern. Among 31–40 years, the mean age is 37.08 years and mean IgG rises to 1.72, classified as positive. This suggests a stronger immune response and may reflect underlying health conditions or infections that warrant further investigation. For 41–50 years, the mean age is 45.04 years and mean IgG is 1.73, also

classified as borderline. This may indicate that continued monitoring is necessary, as the immune system may still be responding to stimuli, but not at levels considered healthy. In the 51–60 years group, the mean age is 54.8 years and mean IgG is 2.10, classified as positive. This finding supports an age-related increase in IgG levels, potentially reflecting chronic health issues or heightened immune activation. For males older than 60 years, the mean age is 71.63 years and mean IgG is 1.41, classified as positive. This may indicate a substantial immune response, potentially driven by age-associated immune changes or other health complications.

Overall, the data indicate that IgG levels fluctuate across age groups, transitioning from negative to borderline and then to positive classifications as age increases. This suggests that, as males age, their immune responses may become more reactive, potentially due to a range of health factors. These findings therefore require further investigation into the health conditions prevalent in these age groups and their relationship to IgG levels.

Table (3): Mean and standard deviation of age and IgM values among females according to age groups for *H. pylori* infection

Age Group (Years)	Frequency (n)	Mean Age ± SD	Mean IgM ± SD	Normal Range	Interpretation
0–10	10	6.6 ± 2.63	0.50 ± 0.28	>0.9	Negative
11-20	27	16.48 ± 2.97	0.92 ± 0.59	>0.9	Negative
21-30	23	24.91 ± 3.07	0.82 ± 0.47	>0.9	Negative
31-40	24	37.08 ± 2.76	0.90 ± 0.60	>0.9	Negative
41–50	24	45.04 ± 2.69	0.92 ± 0.70	>0.9	Negative
51–60	10	54.8 ± 2.97	1.01 ± 0.84	>0.9	Negative
>60	11	71.63± 11.22	0.54 ± 0.29	>0.9	Negative
Total	129	—	—	—	—

Table (3) summarizes the mean age and mean IgM values for females across seven age groups (from 0–10 years to over 60 years), along with the corresponding standard deviations (SD). Data were collected from a total of 129 subjects with Helicobacter Pylori. As age group increases, the mean age rises steadily, from 6.6 years in the 0–10 group to 71.63 years in the over 60 group, indicating a clear age-dependent progression. Mean IgM values vary among the age groups. The highest mean IgM level occurs in the 51–60 group (1.01 ± 0.84), whereas the lowest is observed in the over 60 group (0.54 ± 0.29). Importantly, all groups report mean IgM values below the normal threshold of 0.9, implying a negative interpretation across every age group. The standard deviations further indicate within-group variability. The SD for age remains relatively consistent between groups, while the SD for IgM shows greater fluctuations, particularly in the younger and older age groups. Overall, the uniformly negative interpretation of IgM suggests a possible underlying pattern or condition influencing IgM levels in females, supporting the need for additional investigation. These findings may contribute to understanding immune responses across different age demographics, and the table offers a consolidated overview of age- and IgM-related trends with implications for future research into immune health.

Table (4): Mean and standard deviation of age and IgM values among males according to age groups for *H. pylori* infection

Age Group (Years)	Frequency (n)	Mean Age ± SD	Mean IgM ± SD	Normal Range	Interpretation
0–10	4	7.25 ± 1.70	0.65 ± 0.23	>0.9	Negative
11-20	10	15.8 ± 3.11	0.78 ± 0.50	>0.9	Negative
21-30	7	25 ± 3.65	0.44 ± 0.21	>0.9	Negative
31-40	6	35 ± 2.28	0.62 ± 0.42	>0.9	Negative
41–50	15	44.93 ± 2.68	0.65 ± 0.51	>0.9	Negative
51–60	11	55.63 ± 3.41	0.85 ± 0.66	>0.9	Negative
>60	3	80.33 ± 10.21	0.52 ± 0.16	>0.9	Negative
Total	56	—	—	—	—

Table (4) summarizes the mean age and mean IgM values, along with standard deviations (SD), for males across multiple age groups with Helicobacter pylori infection. The participants are grouped into distinct age brackets to facilitate comparisons of age and IgM trends, ranging from 0–10 years to over 60 years, with

substantial differences in group size. The largest group consists of 15 individuals in the 41–50 age bracket, whereas the smallest group is the 0–10 bracket with 4 participants. Mean age rises consistently across the age groups, from 7.25 years (0–10) to 80.33 years (>60), aligning with expected demographic patterns. Mean IgM values vary from 0.44 ± 0.21 in the 21–30 age group to 1.0 ± 0.66 in the 51–60 age group. Notably, all mean IgM values remain below the normal-range threshold of >0.9, implying a consistent negative interpretation across age groups. This indicates that none of the age groups shows elevated IgM levels, which is pertinent when interpreting immune responses or potential disease presence. Variability within each category is also reflected in the SDs: the 0–10 group has a low SD of 1.7, suggesting that participant ages are tightly clustered around the mean, whereas the >60 group has a higher SD of 10.2, indicating greater dispersion among older participants. Overall, the uniform negative IgM interpretation across all age groups warrants further investigation into underlying health conditions or demographic factors that may affect immune responses. The absence of elevated IgM levels may additionally indicate a lack of recent infection or immune activation in these populations.

3.2 Discussion

H. pylori infection is a common bacterial infection worldwide and is associated with chronic gastritis, peptic ulcer disease, gastric atrophy, and gastric cancer. The present study investigated age- and sex-related variations in IgG and IgM antibody responses among individuals examined for *H. pylori* infection in Sabratha, Libya. The findings demonstrated considerable variation in IgG concentrations among the different age groups, whereas IgM concentrations remained below the predefined positive threshold in both females and males.

The observed variation in IgG concentrations across age groups may be related to the epidemiological characteristics and persistent nature of *H. pylori* infection. Infection is commonly acquired during childhood and may persist for many years if not successfully eradicated. Consequently, cumulative exposure over time may contribute to higher levels of detectable IgG antibodies in older individuals (Logan and Walker, 2001; Malfertheiner et al., 2022). This interpretation is consistent with previous findings from Libya, where Bakka and Salih reported an overall *H. pylori* seroprevalence of 76% among asymptomatic individuals. Their study demonstrated an increase in seroprevalence from 50% among participants aged 1–9 years to 94% among those older than 70 years, with significantly higher antibody responses among individuals older than 45 years (Bakka and Salih, 2002). These findings provide relevant local evidence supporting the importance of age when interpreting *H. pylori* antibody responses.

In the present study, the highest mean IgG concentration was observed in the 51–60-year age group. This finding may reflect cumulative exposure to *H. pylori* and the persistence of antibodies following infection rather than indicating recent acquisition of the bacterium. IgG antibodies can remain detectable for prolonged periods after infection or successful eradication and therefore cannot reliably distinguish active infection from previous exposure (Wroblewski et al., 2010; Malfertheiner et al., 2022). Consequently, a high IgG concentration should not necessarily be interpreted as evidence of a recent or acute infection.

The variation in IgG interpretation among the age groups, including negative, borderline, and positive results, may also be influenced by differences in the performance of serological assays. The diagnostic accuracy of *H. pylori* serology depends on the antigens incorporated into the assay and on the population in which the test is used. Differences among *H. pylori* strains and regional epidemiological characteristics can affect test performance, making local validation of serological assays particularly important (Logan and Walker, 2001; Patel et al., 2014). Recent recommendations similarly emphasize that locally validated serological tests may be useful in selected circumstances but that IgG positivity cannot distinguish current infection from previous exposure (Malfertheiner et al., 2022). In contrast to IgG, IgM concentrations in the present study remained below the positive threshold across all age groups in both sexes. The consistently negative IgM results are compatible with previous evidence indicating that IgM has limited clinical value in diagnosing *H. pylori* infection. In a large comparison of *H. pylori* serological tests with stool antigen testing, the sensitivity of IgM was only 6.8%, indicating that IgM testing has poor ability to identify *H. pylori* infection (She et al., 2009). Earlier literature has also reported that IgM levels may decline with age and that reliable

IgM assays for identifying recent *H. pylori* acquisition are lacking (Logan and Walker, 2001). Therefore, the low IgM concentrations observed in the present study should not be interpreted as evidence that *H. pylori* infection was absent.

The predominance of negative IgM results may also reflect the chronic nature of *H. pylori* infection in many individuals. Unlike IgG, which may persist for an extended period following exposure, IgM is not considered a reliable marker for determining the timing of *H. pylori* infection (Logan and Walker, 2001; She et al., 2009). Thus, the IgM findings in this study are more appropriately interpreted as demonstrating limited detectable IgM responses rather than as evidence against infection.

The present study also examined differences according to sex. Although IgG concentrations showed variability among age groups, the available results did not demonstrate a consistent pattern of markedly different IgM responses between males and females. This observation is broadly compatible with the Libyan study, which reported no significant difference in *H. pylori* prevalence between males and females (Bakka and Salih, 2002). However, sex-related differences should be interpreted cautiously because antibody concentrations can be influenced by several factors, including age, previous exposure, socioeconomic conditions, household transmission, previous treatment, and the characteristics of the population studied.

The relationship between age and IgG concentration may therefore represent cumulative exposure and long-term antibody persistence rather than a direct effect of age itself. Age is also closely associated with historical environmental and socioeconomic conditions, and differences between age groups may partly reflect differences between birth cohorts. Consequently, longitudinal studies or studies incorporating detailed exposure histories would be required to distinguish an age effect from a cohort effect.

Several limitations should be considered when interpreting these findings. First, the study was based on laboratory records from a single laboratory in Sabratha, which may limit the generalizability of the findings to the wider Libyan population. Second, serological IgG testing cannot distinguish active infection from previous exposure because antibodies may persist for an extended period (Malfertheiner et al., 2022). Third, IgM testing has limited diagnostic utility for *H. pylori* infection (Logan and Walker, 2001; She et al., 2009). Fourth, the study did not include molecular characterization of *H. pylori*. Therefore, the identification of specific bacterial strains or virulence-associated genes cannot be established from IgG, IgM, or stool antigen testing alone. Molecular techniques such as PCR and sequencing would be required for such investigations.

4. Conclusion

Overall, the present study demonstrated substantial variation in IgG concentrations across age groups, with the highest mean IgG concentration observed among participants aged 51–60 years. In contrast, IgM concentrations remained below the positive threshold across all age groups in both males and females. These findings are consistent with the persistent nature of *H. pylori* infection and the long-lasting IgG response following exposure. However, serological results should be interpreted together with tests capable of detecting active infection, particularly stool antigen testing or the urea breath test (Malfertheiner et al., 2022; Gisbert and Calvet, 2009).

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