

THE PREVALENCE OF HELICOBACTER PYLORI INFECTION AND ITS ASSOCIATED RISK FACTORS IN VILLAGES SURROUNDING SUNDAR ESTATE INDUSTRIAL AREA

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ABSTRACT

Background:

Helicobacter pylori has been one of the most prevalent chronic bacterial infections in the world and its infection is highly linked with gastritis, peptic ulcer disease and gastric cancer. In developing countries, substandard sanitation, drinking water and hygiene, overcrowding, and sanitation contribute to the high prevalence of infection. The aim of this study was to find out the prevalence of *H. pylori* and associated risk factors in villages of Lahore in and around Sundar industrial estate.

Objective:

To determine the prevalence of *H. pylori* infection and its associated risk factors in villages surrounding Sundar Estate industrial area.

Methodology:

A cross-sectional study was conducted at Punjab Social Security Hospital, Lahore for four months. Convenience sampling was used to obtain a total of 194 subjects with gastrointestinal complaints. A structured questionnaire was used to gather data, which included demographic, environmental and lifestyle risk factors. Detection of infection was done using stool *H. pylori* Antigen ICT testing. The IBM SPSS Statistics software was used for data analysis.

Results:

The overall prevalence was 55.2% *H. pylori* infection. The highest prevalence (60%) was seen in the 31-40 age group. There was a slightly higher prevalence in males (58%) than in females (52.1%). The prevalence was significantly higher among participants who consumed unfiltered drinking water (65.8%) as compared to those who consumed filtered drinking water (40%). Poor sanitation (63.7%), poor personal hygiene (67%) and smoking (64.1%) were also very strongly associated with infection.

Conclusion:

The study has found that the prevalence of *H. pylori* infection in the study population was high, and that it was strongly associated with modifiable environmental and lifestyle factors. Reducing the burden

of infection may be achieved through improved sanitation, access to safe drinking water, awareness of personal hygiene and through early screening programs.

Keywords: *Helicobacter pylori infection, prevalence, risk factors*

INTRODUCTION

Helicobacter pylori is a spiral-shaped, Gram-negative bacterium that colonizes the gastric mucosa and survives in the highly acidic environment of the human stomach through adaptive mechanisms such as urease production. It is one of the most common chronic bacterial infections worldwide and is strongly associated with chronic gastritis, peptic ulcer disease, and gastric malignancies. Since its discovery by Marshall and Warren in 1982, it has transformed the understanding of gastrointestinal pathology, shifting the paradigm from lifestyle-based causes to infectious etiology. The organism's ability to persist for decades in the host makes it clinically significant in long-term gastric morbidity.¹

Globally, *H. pylori* infection affects nearly half of the population, with higher prevalence in developing regions due to poor sanitation, overcrowding, and unsafe water supply. South Asia and Africa report infection rates exceeding 60–80%, reflecting socioeconomic disparities in health infrastructure. Transmission primarily occurs via oral-oral and fecal-oral routes, especially within households and among children. Although many infected individuals remain asymptomatic, a substantial proportion develop dyspepsia, epigastric pain, bloating, nausea, and appetite loss. Chronic infection may progress to peptic ulcer disease, gastrointestinal bleeding, atrophic gastritis, and even gastric cancer or MALT lymphoma, highlighting its carcinogenic potential.²

The pathogenesis of *H. pylori* involves multiple virulence factors including CagA and VacA, which disrupt epithelial integrity and induce chronic inflammatory responses within the gastric mucosa. Continuous inflammation leads to cellular injury, ulceration, and in some cases malignant transformation. Host genetic susceptibility, particularly cytokine gene polymorphisms, further influences disease severity and progression. Diagnosis is achieved through invasive methods such as endoscopic biopsy and non-invasive tests

including urea breath tests and stool antigen assays. Antibiotic resistance, especially to clarithromycin and metronidazole, has increasingly complicated eradication therapy, necessitating updated treatment strategies and antimicrobial stewardship programs.³

Despite extensive global research, there remains limited localized data regarding *H. pylori* prevalence and associated risk factors in rural communities surrounding industrial zones such as Sundar Industrial Estate. Environmental contamination, inadequate sanitation, and restricted access to clean water may increase infection risk in these populations. Previous studies have largely focused on urban or hospital-based samples, leaving a significant epidemiological gap in semi-industrial rural settings. Therefore, localized investigations are essential to determine infection burden, identify specific environmental and lifestyle risk factors, and guide targeted public health interventions. Such evidence is critical for improving prevention strategies and reducing *H. pylori*-related gastrointestinal disease burden in vulnerable populations.⁴

Literature Review

Tibasima et al. (2025) conducted a pediatric study in an African region to evaluate environmental determinants of *H. pylori* infection and found a strong association between infection and poor sanitation, unsafe drinking water, and undernutrition. Children living in overcrowded households with inadequate hygiene facilities were at significantly higher risk of acquiring infection. The study also highlighted that malnutrition weakens immune defenses, thereby increasing susceptibility to chronic colonization. The authors emphasized that *H. pylori* transmission is strongly influenced by environmental and socioeconomic conditions rather than biological factors alone. They recommended integrated public health interventions focusing on sanitation

improvement, safe water supply, and nutritional support. These findings reinforce the importance of addressing environmental determinants in reducing pediatric *H. pylori* burden in low-resource settings.

Sherpa et al. (2025) conducted a cross-sectional study in Thimphu, Bhutan, and reported an *H. pylori* prevalence of 19.5% among children, with significantly higher rates in those exposed to poor sanitation and inadequate hygiene practices. The study also identified environmental pollution, particularly proximity to industrial areas, as an additional risk factor contributing to infection. Children living near industrial zones demonstrated increased vulnerability due to contaminated surroundings and limited protective infrastructure. The authors concluded that both environmental exposure and hygiene behavior play crucial roles in transmission dynamics. They recommended strengthening sanitation systems, promoting hygiene education, and implementing environmental protection policies. The study highlights the growing importance of industrial and environmental contamination in pediatric infection patterns.

Emmanuel B et al. (2024) performed a continent-wide review across Africa and reported that *H. pylori* prevalence exceeds 70% in many regions, particularly in low-resource and overcrowded communities. The review identified unsafe drinking water, poor sanitation, and limited healthcare access as major drivers sustaining transmission. It also emphasized that environmental contamination and inadequate hygiene practices significantly contribute to persistent infection cycles. The authors noted that antibiotic resistance and weak healthcare infrastructure further complicate eradication efforts. They recommended strengthening water safety systems, improving sanitation infrastructure, and increasing public awareness to reduce infection burden. The study underscores the multifactorial nature of *H. pylori* epidemiology in African populations.

Ibrahim BM et al. (2024) conducted a five-year retrospective hospital-based study in Karachi and reported a high prevalence of *H. pylori* among patients with dyspeptic symptoms undergoing

gastric biopsy. The study identified contaminated water, poor sanitation, air pollution, and low socioeconomic status as major contributing risk factors. It further highlighted that populations residing near industrial and urban zones were more exposed to environmental hazards associated with infection. The authors emphasized that environmental and behavioral determinants collectively increase susceptibility in high-risk groups. They recommended targeted public health interventions, including awareness campaigns and improved access to clean water. The findings support the strong link between environmental exposure and *H. pylori* infection in urban-industrial settings.

Chen et al. (2024) conducted a global meta-analysis and found that *H. pylori* infection remains significantly higher in low- and middle-income countries compared to developed regions. The study identified poor sanitation, unsafe drinking water, and low socioeconomic conditions as primary determinants of infection distribution worldwide. It also emphasized that infection is commonly acquired in childhood and persists throughout life if untreated. Environmental contamination was highlighted as a major transmission pathway contributing to global disease burden. The authors recommended improving sanitation infrastructure, access to clean water, and public health education to reduce disparities in infection prevalence. The study concludes that socioeconomic and environmental interventions are essential for global control of *H. pylori* infection.

Methodology

The present study employed a cross-sectional research design to determine the prevalence of *Helicobacter pylori* infection and its associated risk factors among residents of villages surrounding Sundar Estate Industrial Area, Lahore. The study was conducted at Punjab Social Security Hospital, Manga Raiwind Road, Lahore over a period of four months following approval of the synopsis. A total sample size of 194 participants was calculated using a standard prevalence-based formula and selected through convenience sampling. Both male and female participants aged 20–55 years

presenting with gastrointestinal symptoms and willing to provide informed consent were included, while individuals with prior *H. pylori* eradication therapy, recent antibiotic or proton pump inhibitor use, or history of gastric surgery were excluded to avoid confounding effects.

Data collection was carried out using a structured questionnaire and clinical history review to obtain detailed demographic, environmental, and behavioral information including age, gender, residence, drinking water source, sanitation status, hygiene practices, smoking habits, dietary patterns, and gastrointestinal symptoms. Additional medical history was documented to ensure eligibility and accuracy of classification. Stool samples were collected under strict aseptic conditions in clean, dry, and labeled containers to prevent contamination. Participants were instructed on proper sample collection techniques, and all samples were transported to the laboratory on the same day for immediate processing, ensuring reliability and minimizing degradation of antigens.

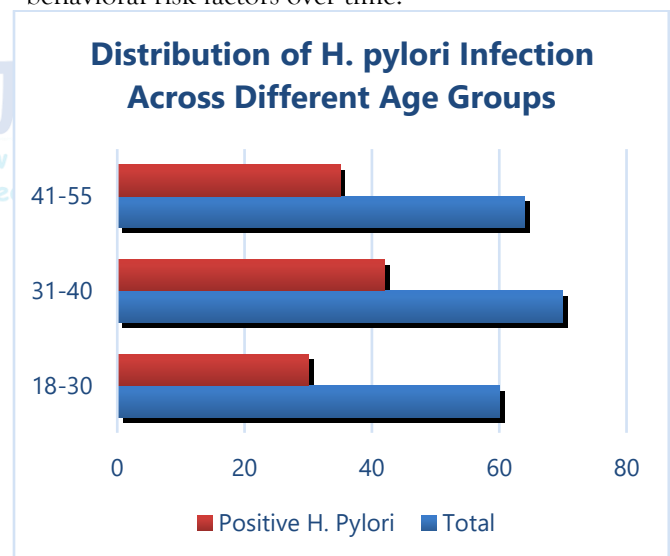
Laboratory analysis was performed using the Stool *H. pylori* Antigen Immunochromatographic Test (ICT), which detects bacterial antigens through antigen-antibody binding on a test strip. Stool samples were mixed with extraction buffer and processed according to the manufacturer's protocol, after which 2-3 drops were added to the test cassette. Results were interpreted within 10-15 minutes, with two visible lines indicating a positive result, one control line indicating a negative result, and absence of a control line considered invalid and repeated for confirmation. Standard biosafety measures and personal protective equipment were used throughout the procedure to ensure safety and accuracy.

Data analysis was performed using IBM SPSS Statistics software. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize demographic characteristics and prevalence of infection. Inferential analysis was conducted using Chi-square test or Fisher's exact test to determine the association between *H. pylori* infection and various risk factors including sanitation, water source, hygiene practices, and lifestyle variables. A p-value

of less than 0.05 was considered statistically significant, and results were presented in tables and graphs to facilitate clear interpretation and comparison of findings.

Results

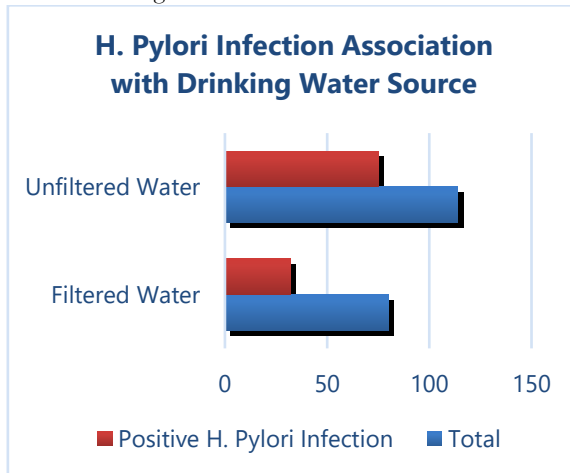
A total of 194 patients presenting with gastrointestinal complaints were included in this cross-sectional study to assess the prevalence of *Helicobacter pylori* infection and its associated risk factors in the study population. The overall prevalence was found to be 55.2%, indicating that more than half of the participants were infected. Age-wise distribution showed the highest infection rate in the 31-40 years group (60%), followed by 41-55 years (54.7%) and 18-30 years (50%). These findings suggest that middle-aged individuals are more frequently affected, possibly due to prolonged exposure to environmental and behavioral risk factors over time.



Distribution of *H. pylori* infection Across Different Age Groups

Gender-wise distribution revealed that males had a slightly higher prevalence of infection (58%) compared to females (52.1%), although the difference was not markedly large. This may reflect lifestyle differences such as smoking, occupational exposure, or variations in hygiene practices between genders. Overall, both males and females

showed a substantial burden of infection, indicating that *H. pylori* is widely prevalent across the population without strong gender exclusivity. The data suggests that infection is more closely linked to environmental and behavioral factors rather than biological sex differences alone.

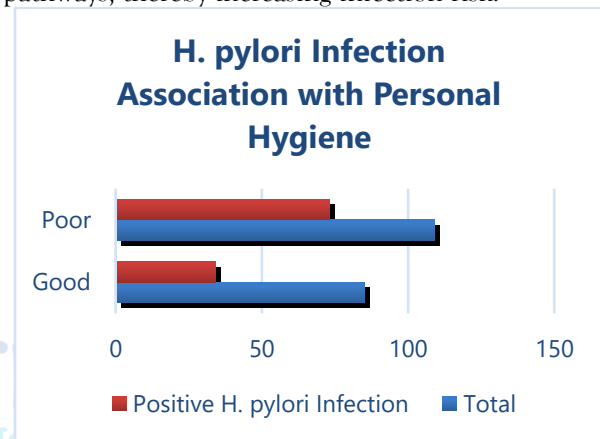


H. pylori Infection Association with Drinking Water Source

This chart shows the relationship between drinking water source and infection. Individuals using unfiltered water had a much higher prevalence (65.8%) compared to those using filtered water (40%). This indicates a strong association between unsafe water and infection. Contaminated water may be a major source of transmission. Improving water quality can reduce infection rates.

Environmental risk factors showed a strong association with *H. pylori* infection. Participants using unfiltered drinking water had a significantly higher prevalence (65.8%) compared to those using filtered water (40%). Similarly, poor sanitation conditions were associated with increased infection rates (63.7%) compared to good sanitation (40%). These findings clearly indicate that contaminated water and inadequate sanitation are major contributors to transmission in the study area. The results strongly support the hypothesis that environmental hygiene plays a critical role in the spread of *H. pylori* infection in community settings.

Personal hygiene practices also demonstrated a significant impact on infection rates. Participants with poor hygiene showed a markedly higher prevalence (67%) compared to those with good hygiene practices (40%). Smoking was another important contributing factor, with smokers exhibiting a higher infection rate (64.1%) than non-smokers (49.1%). These results suggest that modifiable lifestyle behaviors significantly influence susceptibility to infection. Poor hygiene and smoking likely impair gastric defenses and increase exposure to bacterial transmission pathways, thereby increasing infection risk.



H. pylori Infection Association with Personal Hygiene

Overall, the study highlights a high burden of *H. pylori* infection in the study population, with a prevalence of 55.2%. The findings consistently demonstrate that environmental factors such as unsafe drinking water, poor sanitation, and inadequate personal hygiene, along with behavioral factors like smoking, are strongly associated with infection. These results emphasize the need for targeted public health interventions focusing on improving water quality, sanitation infrastructure, hygiene awareness, and lifestyle modification. Addressing these modifiable risk factors can significantly reduce the prevalence of *H. pylori* infection in the community.

Discussion

The present study confirms that *Helicobacter pylori* infection is highly prevalent (55.2%) among patients presenting with gastrointestinal

complaints in villages surrounding Sundar Industrial Estate, Lahore. This indicates a substantial burden of infection in the studied population, where more than half of the participants were affected. The findings demonstrate strong associations between infection and modifiable environmental and lifestyle factors, particularly the use of unfiltered drinking water, poor sanitation, and inadequate personal hygiene practices. These factors collectively suggest fecal-oral transmission as the dominant route in this setting. Higher infection rates among males and middle-aged individuals further indicate possible behavioral and exposure-related influences, while smoking also emerged as an important contributing factor. Overall, the results highlight that *H. pylori* infection in this community is not only a clinical issue but also a significant public health concern driven largely by preventable determinants.

Environmental determinants were found to play a central role in the transmission and persistence of *H. pylori* infection in the study population. Individuals consuming unfiltered drinking water showed markedly higher infection rates, indicating that contaminated water is likely a major source of exposure. Similarly, poor sanitation conditions were strongly associated with increased prevalence, reflecting the role of unhygienic environments in facilitating bacterial spread. Personal hygiene practices were also significantly linked with infection status, as individuals with poor hygiene demonstrated substantially higher positivity rates compared to those maintaining good hygiene. These findings collectively suggest that inadequate water safety, sanitation infrastructure, and hygiene awareness are key drivers of infection in the studied rural-industrial communities. Therefore, control measures must prioritize environmental improvements alongside medical management to effectively reduce transmission and reinfection. Lifestyle-related factors, particularly smoking, were also identified as important contributors to *H. pylori* infection in this study. Smokers exhibited a higher prevalence compared to non-smokers, suggesting that smoking may compromise gastric mucosal integrity and immune defense mechanisms, thereby increasing susceptibility to

infection. The slightly higher prevalence observed among males may be related to greater exposure to smoking and environmental risk factors in occupational or outdoor settings. Additionally, the higher infection burden in middle-aged individuals likely reflects cumulative exposure to contaminated environments and long-standing unhealthy practices. These findings reinforce that *H. pylori* infection is multifactorial in nature, involving an interaction of behavioral, biological, and environmental determinants. Addressing these interconnected factors is essential for effective prevention and long-term control of infection in high-risk populations.

Conclusion

This study provides valuable local evidence regarding the burden and risk factors of *H. pylori* infection in villages surrounding Sundar Industrial Estate. The results clearly demonstrate that infection is strongly associated with preventable factors such as unsafe drinking water, poor sanitation, inadequate personal hygiene, and smoking habits. These findings emphasize the need for integrated public health interventions focusing on environmental sanitation, safe water supply, and community hygiene education. Early screening and timely diagnosis should be encouraged in symptomatic individuals to prevent complications, while health promotion programs can help reduce risky behaviors such as smoking. Strengthening healthcare access and awareness at the community level is also essential. Collectively, these measures can significantly reduce the prevalence of *H. pylori* infection and improve gastrointestinal health outcomes in similar underserved and high-risk populations.

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