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Original article

Helicobacter pylori Infection and Its Associated Factors in Tripoli, Libya: Realities and Challenges

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Abstract
Helicobacter pylori infection is the main cause of chronic stomach inflammation and the main factor causing stomach ulcers and stomach cancer, affecting approximately half of the world's population. To identify factors associated with H. pylori infection in patients attending various government Hospitals in Tripoli for diagnosis and treatment. A cross-sectional analytical study was conducted from April 2025 to August 2025. 72 patients were infected with Helicobacter pylori, 58% of whom were female and 42% male. H. pylori infection to be 19.4% in the 31-40 age group and lowest in the 81-90 age group at 1.3%. Forty-six percent of patients had a university degree. 68% of H. pylori infections were found in people who used a source of untreated drinking water in compared with 32% use bottled water, and people who regularly ate at public restaurants had a slightly higher infection rate 56% compared to those who mainly ate at home. 72% of those who drink stimulants are infected, 74% of patients are smokers and infected, 26% non-smokers and infected too, 60% of patients who use traditional toilets are infected, 25% of patients have undergone histopathology examination, and 24% have undergone stool antigen and testing for Helicobacter pylori infection. Health awareness and educating the public about the risk factors associated with H. pylori infection and taking the necessary measures for a safe life are important factors in reducing this risk to public health. Further studies should be conducted to identify risk factors and develop a comprehensive strategic plan to combat them.
Keywords. H. pylori Infection, Reality, Challenge, Libya.

Introduction

Helicobacter pylori is a gram-negative bacterium [1]. The genus Helicobacter is a member of the subdivision of the Proteobacteria, order Campylobacterales, family Heliobacteria [2], situated on the luminal surface of the gastric epithelium. It was first isolated by Warren and Marshall in 1983 [3]. It provokes a sequence of chronic inflammation in the gastric mucosal layer [1]. *H.* pylori is a transmissible disease, although the exact mode of transmission is still unknown. The most common route among people is either the fecal–oral, oral–oral, gastric–oral, anal–oral, or genital–oral route [4]. *H.* pylori has been shown to survive for many days in milk and tap water in its infectious bacillary form and several months in river water in its coccoid form [2]. Although humans appear to be the primary reservoir for Helicobacter pylori infection, *H.* pylori has also been isolated from nonhuman primates and domestic cats [2]. Additionally, the possibility of iatrogenic infection in patients following endoscopy is a potential risk factor not only for *H.* pylori but also for other infectious diseases such as hepatitis B, hepatitis C, tuberculosis, and possibly human immunodeficiency virus, due to difficulty in disinfecting the endoscope's complex structure [5].

Despite its relatively recent discovery, researchers suggest that it has lived with humans for 88,000–116,000 years [6] and is distributed throughout the world. *H.* pylori infection affects almost half of the world's population, but the prevalence among different regions is heterogeneous. The prevalence of *H.* pylori infection has been declining in highly industrialized countries, whereas the prevalence has stabilized at a high level in developing and newly industrialized countries [7- 9].

The 2007 national expert consensus report and the Maastricht–Florence recommendations have not been formally implemented in Italy. Rather, the healthcare system's payment policies for prescription drug orders have regulated the clinical practices of general practitioners (GPs) in Italy [10]. A 2020 study carried out in Riyadh, Saudi Arabia, found that the incidence of *H.* pylori infection was 34.7%. Furthermore, there are two types of procedures for identifying Helicobacter pylori infection: invasive and non-invasive [11,12].

A variety of techniques have been employed to identify Helicobacter pylori infection. Direct techniques, such as the rapid urease test (RUT), smear microscopy, culture isolation, histopathological evaluation, and molecular diagnosis using polymerase chain reaction, rely on endoscopic gastric biopsy specimens. Urea breath tests and serology for the detection of antigens and antibodies are examples of indirect approaches [13]. Through colonization in a very specific area of gastric lactation and the secretion of urease, which converts urea found in the medium to ammonia and has the effect of the stomach lining being acidic, this bacterium has developed resistance to stomach acid. If antibiotics are not administered, this resistance allows the bacteria to remain in the human stomach for life [14].

To effectively manage *H.* pylori infection, it is necessary to follow the latest scientific guidelines on diagnosis and treatment, as well as to provide physicians with up-to-date scientific information and train them to implement it accurately. Antibiotic resistance caused by *H.* pylori infection is one of the biggest global problems at present. Patients are often treated by primary care physicians who lack experience in supervising treatment and applying *H.* pylori treatment recommendations. It is essential to bridge the knowledge gap between effective professional practice and *H.* pylori treatment because implementing these

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recommendations can take a long time. The main objective of this study is to identify factors associated with an increased risk of *H.* pylori infection among the population of Tripoli, Libya, to develop a national strategy that will effectively contribute to reducing its prevalence among the population and promoting public health in the community.

Methods

Study design and setting:

The study was a cross-sectional study with an analytical approach between April and August 2025. The total number of subjects participating in this study was 72 individuals affected by *H.* pylori infection. All patients participating in the study were outpatients at various government hospitals in the city of Tripoli. The ethical approval was obtained from the College of Health Sciences, Al-Jafara University (HSC:25-167).

Data collection procedure

Data collected by using a pre-prepared data form written in English, with a set of questions directed by the treating physician and research team toward the patient, was used. The study focused on several important factors that researchers believe are related to the increased incidence of stomach bacteria, including demographic factors such as gender, age, and social status; level of education, type and sources of water used for drinking; consumption of tea, coffee, or both; smoking; places where daily meals are eaten, at home or in public restaurants; methods of human waste disposal, as well as clinical information on the methodologies used in the diagnosis of gastrointestinal diseases, specifically patients infected with stomach bacteria. All collected data were documented and analyzed using simple statistical analysis software, based on which the data were assessed and the study results interpreted.

Results

The study was carried out in different government Hospitals in Tripoli. The socio-demographic information of the survey participants was studied. A total of 72 participants took part in this study, and information was correctly collected from them through their responses. This was supported by the results of the medical examinations conducted on them; the results will be presented in the form of the following tables and graphs.

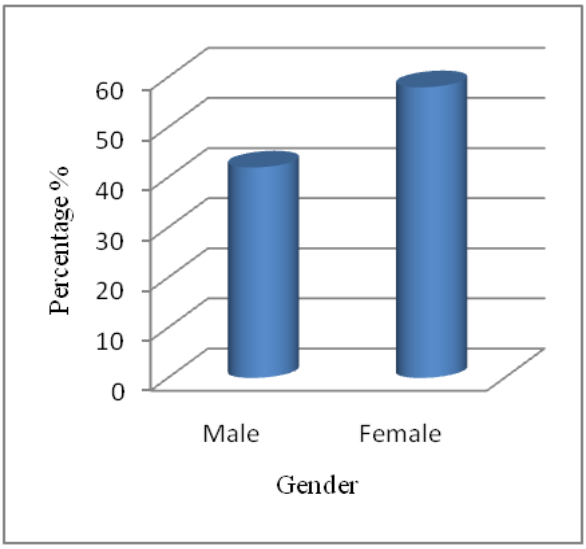

Figure 1. Infection rate of *H.* pylori according to gender

The data presented in (Figure 1) indicate that there is a marked gender difference in the prevalence of *H.* pylori infection in the study sample. Males accounted for 42% of all positive cases, and females represented approximately 58%. Such distribution and variance indicate that *H.* pylori infection is more prevalent in females than in their male counterparts. This difference could be attributed to biological, behavioral, and environmental factors that directly influence these variations in daily activities revolving in the home, childcare, personal hygiene, and food habits. A deeper understanding of the underlying causes of this difference will help to address this gap, promoting health literacy and knowledge among women, which contributes to reducing transmission and improving the health of families and society in general.

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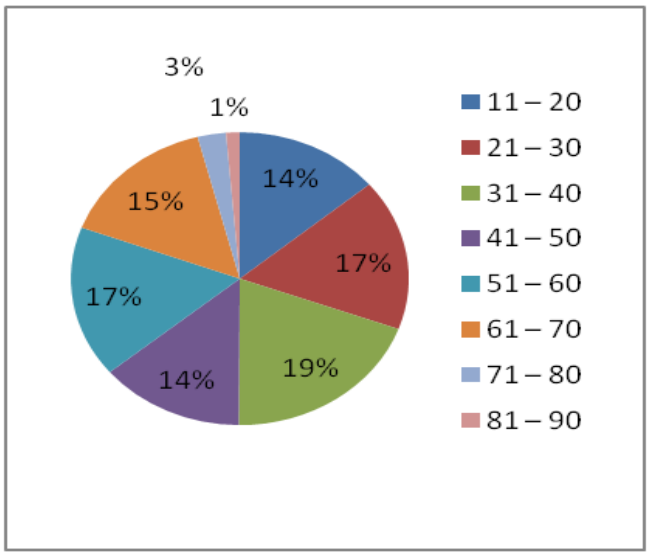

Figure 2. Infection rate of H. pylori by age group.

The results in (Figure 2) show a significant variation in rates of *H.* pylori infection between the age groups. Among those with the highest infection rates is the 31-40 age group, with 19.4% of the population infected. This suggests that individuals in this age group may be more susceptible to infection with *H.* pylori. On the contrary, the 81-90 age group has the lowest infection rate of 1.3%. This decline in prevalence among the elderly might be due to varied reasons, such as the good healthcare being provided, attention to their diet, as well as the quality and methods of food preparation in their families.

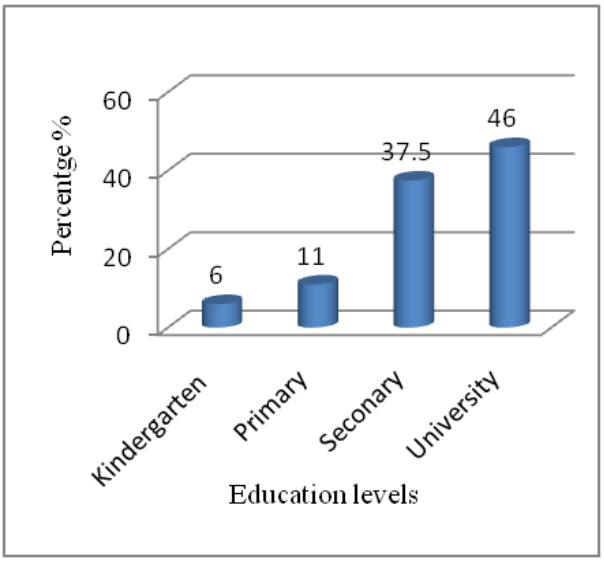

Figure 3. Infection rate of H. pylori by education level.

Based on (Figure 3) it is evident that the prevalence of *H.* pylori infection varies significantly across different educational levels. The findings indicate that individuals with a university education constitute the largest affected group among the four educational categories examined. The data suggest that individuals who have attained higher levels of education, particularly those with university degrees, exhibit the highest percentage of *H.* pylori infection rates in comparison to other groups. This observation raises several questions regarding the potential socio-economic, lifestyle, and health-related factors that might contribute to increased *H.* pylori infection rate. Efforts are necessary to understand this public health concern and to formulate evidence-based recommendations for reducing the burden of *H.* pylori infection across all educational demographics.

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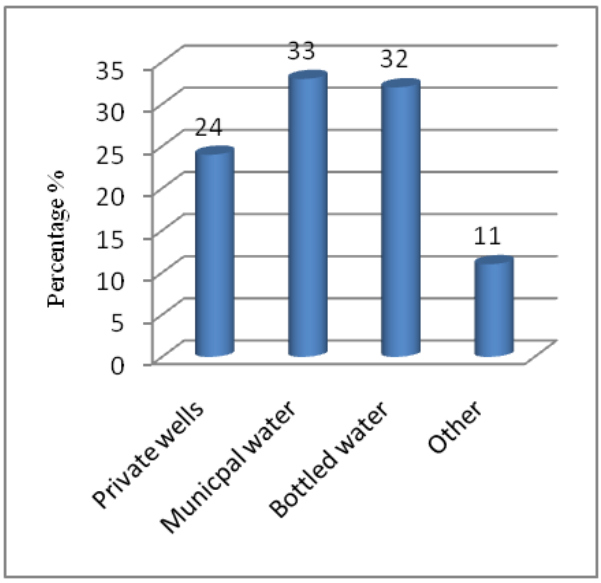

Figure 4. Infection rate of H. pylori by source of drinking water.

Based on (Figure 4) there is a correlation of *H.* pylori infection with various sources of drinking water. Infection rates among persons drinking water from public supplies (municipal water) were particularly high at 33%. However, those who did not rely on this source had infection rates of 11%, 24%, and 31% among bottled water drinkers.

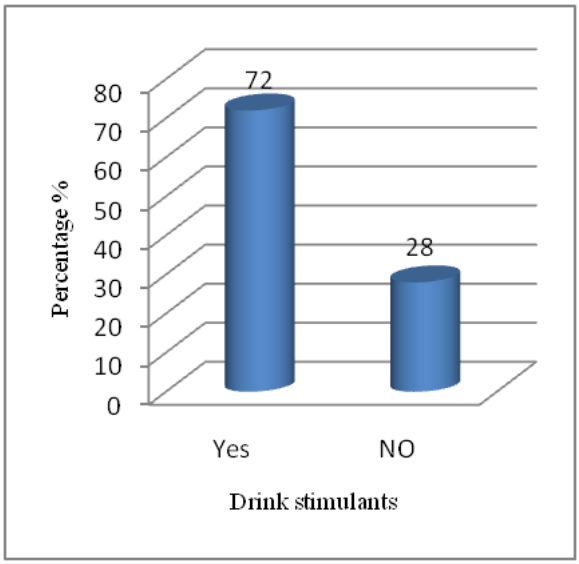

Figure 5. Infection rate of H. pylori according to drinking stimulants Coffee and Tea or both.

Based on examining the data in (Figure 5) we can establish a strong relationship of about 72% between the infection rate and the consumption of stimulant beverages such as coffee and tea; that is, most patients consuming these beverages may have a higher infection rate. Next, the data show that about 28% of patients do not drink coffee or tea, which means this group might have different health outcomes in terms of infection rates and might have been exposed to other factors that cause infection.

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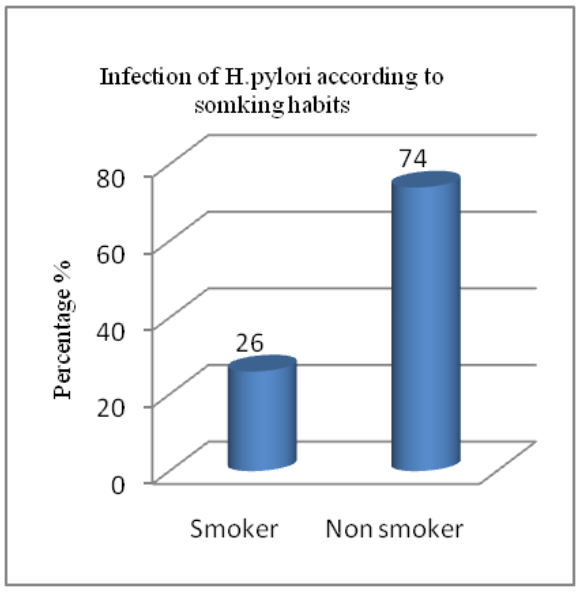

Figure 6. Infection rate of *H.* pylori according to smoking habits.

The results show that there is a significant difference in the prevalence of *H.* pylori infection between smokers and non-smokers. Specifically, only 26% of smokers were infected with *H.* pylori, while 74% of non-smokers were infected. This contradicts the previous assumption that smoking may be a risk factor for *H.* pylori infection, as some common beliefs suggest that tobacco use may contribute to infection. This discrepancy suggests that smoking may not be a risk factor for *H.* pylori infection. Overall, the data suggest that smoking and the presence of *H.* pylori are not factors influencing bacterial infection in the population, as shown in figure (6) above.

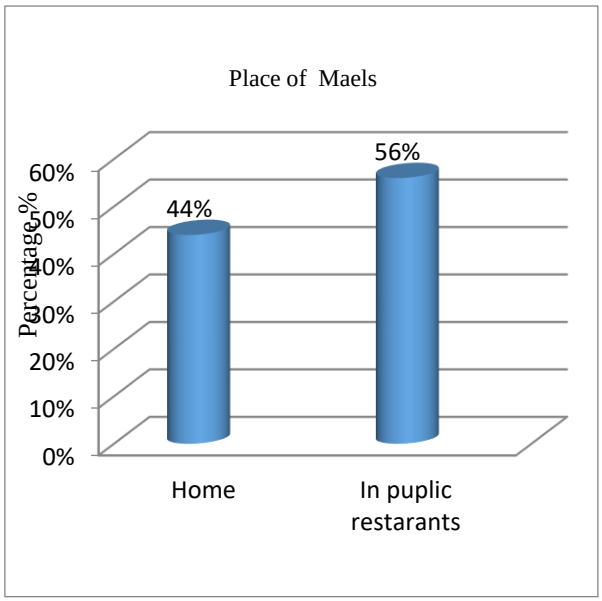

Figure 7. Infection rate of H. pylori according to the places where participants take their meals.

The results illustrated in (Figure 7) identify an interesting correlation with respect to infection rates and the eating places of the participants. The data specifically reveal that roughly 56% of the participants said they ate at public restaurants, while the other 44% preferred not to eat in such establishments. The very high infection rates among the patrons of public eating establishments suggest several public health implications. These results, therefore, raise questions about the settings available in public restaurants that may be contributing to the infection risk, and obtaining an understanding of these may be useful for government and health authorities dealing with rebuttal measures against public dining-related infection risks.

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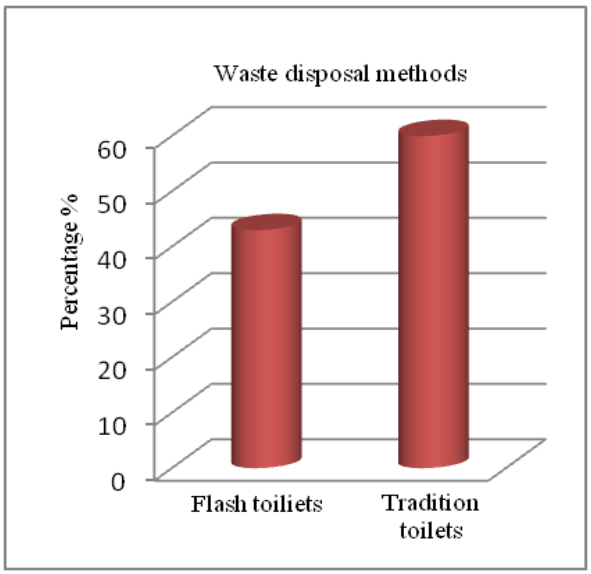

Figure 8. Waste disposal and occurrence of *H.* pylori.

From the results shown in (Figure 8) a very strong relationship exists between the infection rates of *H.* pylori and waste disposal methods used by the specific sample population being studied. For example, infection with *H.* pylori was found to occur mostly among users of traditional toilets who had an infection rate approximating 58%, while the infection rate for flash-toilet users was extremely lower at about 40%. The very same means of waste disposal, therefore, is indicative of the transmissibility of *H.* pylori. The lower infection rate with flash toilets may be attributed to better sanitation and reduced exposure to fecal pathogens, emphasizing the importance of modern public health sanitation facilities regarding waste disposal.

Table 1. *H.* pylori infection diagnostic methods.

Diagnostic Methods	Percentage %
Blood antibody test	20
Stool antigen test	24
Endoscope Examination	25
Histopathology Examination	25
Urea breath test	6

The data in (Table 1) illustrate the different diagnostic methods used to detect *H.* pylori infection. Among these methods, endoscopy combined with gastric histopathology biopsies was the most common, used in 25% of cases. This was followed by stool antigen tests 24%, and serological assessments, which were used in 20% of cases. In contrast, the urea breath test was the least common, being used in only 6% of diagnoses.

Discussion

The current study assessed the prevalence and risk factors associated with infection from *H.* pylori among patients visiting various hospitals across Tripoli, Libya for diagnosis and treatment. The findings eventually revealed that *H.* pylori infections still pose a serious public health challenge, consistent with the world data stating that almost half of the world's population is infected. The high infection rate persists in developing countries, including Libya, further emphasizing the continued challenges to this pathogen regarding prevention, diagnosis, and treatment.

The socio-demographic information of participants was studied. A total of seventy-two participants agreed to participate in this study, and the research team, with the participation of doctors, collected the data correctly according to the pre-prepared form. Gender and Age distribution Among females, the infection rates were 58% compared to their male counterparts, forming a significant finding in the study. This observation is similar to most reports from developing areas where females have been reported to have a slightly higher prevalence than males. Variations in exposure to domestic environments, dietary habits, and probably hormonal or immunological factors may account for the disparity.

Other studies would indicate that while some have reported no significant difference between the two genders, the association sometimes differs depending on the socio-cultural and environmental conditions of measurement. The study concludes that *H.* pylori has a greater tendency to infect females more than males, which leads to more chances of acquiring infections, especially among mothers and their children, leading to more infections in the family and community.

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Findings indicated that the age group with the highest prevalence of infection 20% belonged to the age group 31–40 years, while the least was found in the age group 81–90 years, 1.3%. This pattern could reflect the acquisition of cumulative exposure during the early years of life because most *H.* pylori infections are established in childhood and persist in adulthood. Reduced rates among older participants may be related to sample size restriction or selective survival bias, in which those who retained a long-term infection had already developed mostly severe complications earlier in their lives.

Among all the people studied, university graduates were among the highest incidence of infection by 46%. This was not an expected finding, considering that the higher level of education has always been associated with better hygiene practices and, ultimately, accessibility to available health services. Perhaps the relationship reflects the composition of the study sample or the peculiar habits and diets of educated individuals in urban areas. Educated individuals may not have been an exception to this. This says that education alone does not suffice as a protective factor without parallel improvements in environmental sanitation and food safety awareness.

Among all diseased subjects, municipal water was the next most popular source, with 33.3%, while bottled water was used among participants at 32%. As such, water was still found to probably play a role in transmitting *H.* pylori in Tripoli, perhaps now more than before, with growing reliance on bottled water. It has been postulated previously that sporadic water supply and inadequate treatment could promote the survival of microorganisms.

Tea and Coffee consumption were strongly associated with *H.* pylori infection, with 73% of infected individuals being regular consumers with a positive dose-response relation between coffee consumption and active infection [15]. Though these are not routes of infection transmission in themselves, intake of high doses of caffeine may worsen irritation caused by the gastric mucosa and subsequently aid in the establishment or presentation of symptoms. Furthermore, people who regularly dined in public restaurants 55.6% had a slightly higher incidence of infection compared with those who mainly ate from home. This supports the theory that food cooked healthily does not pose a risk factor. The results also showed that infection with *H.* pylori bacteria among participants was not statistically significantly associated with where meals were eaten. In other words, where meals were eaten had no significant effect and no impact on the spread of Helicobacter pylori infection. This explains why infections can occur among family members who eat food prepared at home, due to the spread of infection through the sharing of contaminated household items such as spoons or cups, or neglecting personal hygiene and the cleanliness of the place where food is prepared and eaten, or from sharing contaminated household items such as spoons or cups.

In respect to smoking factor, this study doesn't support a previous finding in the city of Ramadi, Iraq, 2015, there are six of nine published studies that have looked into the relation of smoking with *H.* pylori infection have found evidence consistent with a weak positive association [16-19], where smoking had a huge effect in that study and reached 86% of smokers among total cases, where the present study indicated that smoking is not very much significant by a rate of 26% of infected non-smokers and 74% were smokers. All infected males were smokers, while most females were non-smokers.

Not only does this reflect gender lifestyle patterns specific to Libyan society, but it also associates smoking with increased susceptibility to *H.* pylori infection and slower healing of gastric lesions due, probably, to a negative effect on mucus defense mechanisms of the stomach.

Many previous studies have documented the transmission of bacterial and viral diseases associated with the use of public toilets in the past [20-24]. This occurs mainly because of hands meeting surfaces contaminated with pathogens, followed by their transfer from the hands to the mouth and ingestion. Contamination of surfaces in public toilets also occurs in several ways, such as contaminated hands or splashes during flushing the toilet or using taps to wash hands [22-32]. Our results showed that the highest rates were among users of traditional toilets, 60%, supporting the fecal-oral route of transmission in poorly designed toilet environments, such as water tap handles, equipment, and door handles.

The detection methods of *H.* pylor*i* infection most used by doctors in this study were the stool antigen test and endoscopy, in 75% of cases each, considered to be reliable tests of active infection. The SAT is a useful method of diagnosis with an accuracy of over 90%. It is a quick test, useful both for diagnosis and for confirming the presence of bacteria after treatment. Compared to other methods, it is a low-cost method for the patient, and it is often preferred by clinicians and patients, regardless of the patient's age [33-36]. The current SAT guidelines recommend that the evaluation of eradicating the infection should be done at least 4 weeks after finishing the eradication therapy so that the clinician can avoid a false-positive result [37,33,34,35,36]. The simplicity of the method does not require the prior preparation of the patient, but a 2-week restriction of proton pump inhibitor (PPI) use, and a four-week restriction of antibiotics and bismuth compounds, before testing, is recommended [35,36]. The diagnosis and evaluation of the efficiency of the eradication therapy can be performed using SAT with monoclonal antibodies [37,35]. These tests can be used in patients with a history of gastric surgery and in children. Gastric neoplasia could be prevented if these tests were to be used in screening programs in the future [33-36]. Although the urea breath test is effective in detecting *H.* pylori infection and is highly accurate in diagnosis [38-40], it is the least used in diagnosis because this technology is not available in all hospitals that provide diagnostic and treatment services. The availability of this non-invasive and accurate diagnostic technique is essential for the efficient

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management of *H.* pylori infection.

Conclusion

The high rates of *H.* pylori infection in undeveloped countries and rural areas are mainly because the population in those areas are more vulnerable to the risk factors mentioned., the reason for this is the poor economic and social situation of the population, their lack of access to safe drinking water, and the poor infrastructure and services in these areas, where infection can be transmitted through contaminated water and food, posing a threat to the health of the community in general. The hygiene factor is greatly important and a prime factor in the prevention and reduction of *H.* pylori infection. Considering this, there is an urgent need to promote community health education on proper hand washing, food safety, water hygiene, and human waste disposal. Such measures could drastically decrease the possibility of transmission, and enhancing public health would correlate to reducing infection rates, especially in developing countries. Further studies should be carried out to determine the risk factors to the community and to put into action control and prevention plans so that the infection rate can be brought down among all age groups. Further studies should be conducted to identify risk factors and develop a comprehensive strategic plan to combat them.

Human Ethics

The ethical approval was obtained from the College of Health Sciences, Al-Jafara University (HSC:25-167).

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflicts of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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