



Prevalence study of *Helicobacter pylori* infection in Zaltan City, Libya

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Abstract

High incidence of *H. pylori* infection in Libya is alarming. Thus, intensive epidemiological studies on *H. pylori* prevalence are crucial. There are few epidemiological and prevalence studies on *H. pylori* from large cities of Libya. Moreover, there are lack of studies in small Libyan towns. Therefore, the aim of this study was to determine the prevalence of *H. pylori* and its associated risk factors in the North-west city of Libya, Zaltan and its surrounding areas. Our study was conducted on symptomatic and asymptomatic participant patients. Socioeconomic, lifestyle, and gastrointestinal characteristics of patients were collected through a prepared questionnaire alongside with stool samples analysis. A total of 69 participants were included in this study and were tested for *H. pylori* using the stool antigen test (SAT). The result showed that 45% was *H. pylori* SAT positive with a significant relation between *H. pylori* infection and age ($p < 0.05$). The infection was higher among female 46 (66.6 %) and most positive result was among 10-11 years old 16 (23.18%). Food and drinking water hygiene has correlation with transmission of infection ($p < 0.05$). Significantly, 87% of positive *H. pylori* SAT patients suffered from chronic gastrointestinal symptoms. Among other chronic illness anemia was significantly related to the infection incidence ($p < 0.05$) while cardiovascular and diabetes mellitus were not significantly related. Lifestyle and financial status significantly influenced the infection incidence trend with more important of personal and food hygiene ($p < 0.05$). Based on the outcomes the study, we suggest that people and public health authorities should consider to apply worthy preventive measures food hygiene in particular against *H. pylori* infection transmission.

Key words: *H. pylori*, risk factors, stool antigen test, personal and food hygiene, gastrointestinal inflammation, *H. pylori* infection.

المخلص

إن ارتفاع معدلات الإصابة بالبكتيريا الحلزونية في ليبيا أمر مثير للقلق. وبالتالي، فإن الدراسات الوبائية المكثفة حول انتشار الملوية البوابية تعتبر حاسمة. هناك عدد قليل من الدراسات الوبائية ودراسات انتشار الملوية البوابية في المدن الكبرى في ليبيا. علاوة على ذلك، هناك نقص في الدراسات في المدن الليبية الصغيرة. لذلك، كان الهدف من هذه الدراسة هو تحديد مدى انتشار بكتيريا الملوية البوابية وعوامل الخطر المرتبطة بها في مدينة زلطن الواقعة شمال غرب ليبيا والمناطق المحيطة بها. أجريت دراستنا على مرضى المشاركين الذين يعانون من أعراض أو الذين لا تظهر عليهم الأعراض. تم جمع الخصائص الاجتماعية والاقتصادية ونمط الحياة وظهور أعراض الجهاز الهضمي للمرضى من خلال استبيان مُعد جيداً بالإضافة إلى تحليل عينات البراز. الدراسة تشمل ما مجموعه 69 مشاركاً وقد تم اختبارهم للكشف عن الملوية البوابية باستخدام اختبار مستضد البراز (SAT). أظهرت النتيجة أن 45% كانت نتيجة SAT إيجابية مع وجود علاقة معنوية بين الإصابة بالبكتيريا والعمر ($P < 0.05$). وكانت الإصابة أعلى بين الإناث 46 (66.6%) وكانت النتيجة الأكثر إيجابية بين 10-11 سنة 16 (23.18%). ترتبط نظافة الغذاء ومياه الشرب بانتقال العدوى ($P < 0.05$). بشكل ملحوظ، 87% من المرضى الإيجابيين لإختبار SAT عانوا من أعراض الجهاز الهضمي المزمنة. ومن بين الأمراض المزمنة الأخرى، كان فقر الدم مرتبطاً بشكل كبير بحدوث العدوى ($P < 0.05$) في حين لم يكن هناك ارتباط كبير بين أمراض القلب والأوعية الدموية والسكري. أثر نمط الحياة والوضع المالي بشكل كبير على اتجاه الإصابة بالعدوى مع أهمية النظافة الشخصية والغذائية ($P < 0.05$). بناءً على نتائج الدراسة، نقترح أن يأخذ الأشخاص وسلطات الصحة العامة في الاعتبار تطبيق تدابير وقائية جديرة بالاهتمام تتعلق بالنظافة الشخصية وصحة الأغذية لمنع انتشار وانتقال العدوى.

1. Introduction

Helicobacter pylori (*H. pylori*) is a gram-negative microaerophilic bacterium that colonizes gastric mucosa of human and resist gastric acidity by its powerful urease, which acts on the urea passing through the gastric mucosa to generate ammonia, and this may neutralize the acidity around the bacteria [Greenwood *et al.* 2012].

It has reported that, more than 50% world's population is infected. The infection rate is variable based on socioeconomic factor, as the infection is higher in developing countries [Bakir W., 2012]. Generally, *H. pylori* infection is acquired during childhood and persists life-long due to negligence of treatment with proper antibiotics; most of the infected individuals remain asymptomatic for a long period. As a result, long-term colonization of *H. pylori* can damage the gastric mucosa causing various diseases of the upper gastrointestinal tract such as chronic gastritis, peptic ulcer, and gastric malignancies, particularly gastric cancer and gastric lymphoma [Pacifico L, *et. al.*, 2010]. Furthermore, *H. pylori* infection has been linked with several non-digestive conditions such as iron-deficiency anemia [Haile K, *et. al.*, 2021].

H. pylori has been documented as one of the strongest known risk factors for gastric malignant tumors [Kumar, S, *et. al.*, 2020]. Thus, eradication of *H. pylori* infection may reduce cancer cases [Lee, Y, *et. al.*, 2013] and many other gastric diseases such as peptic ulcer and gastritis; therefore, implementation of screening and eradication program is cost-effect strategy to overcome *H. pylori* related diseases and cancers [Wu JY., *et. al.*, 2019]. Successful strategies to implement an eradication plan involves up-to-date information regarding the epidemiology and prevalence of *H. pylori* and its diagnosis, prevention and proper treatments. Firstly, it is impotent to determine sources of the infection and probable routes of transmission of *H. pylori* within the community. Then, determine proper, accurate reliable laboratory diagnosis test followed by effective treatment and preventive measures. However, all this information have been well documented in literature it is important to study each socio-economical status and lifestyle for each community. For example, it well known that *H. pylori* infection transmission is fecal–oral route, or oro-oral, which more likely to happen intra-familial [Dominici P, *et. al.*, 1999]. Consequently, interpretation the risk factors for *H. pylori* infection closely associated with personal and food hygiene within the family and community. Other known risk factors associated to *H. pylori* infection include age, socioeconomic status, number of siblings, household crowding, ethnicity, migration from high prevalence areas, infection status of family members, and sanitary facilities [Borka Balas R, *et. al.*, 2022; Mhaskar RS, *et. al.*, 2013]. Which are variable amongst communities even within the same country.

Nowadays, diagnosis of *H. pylori* is including invasive, such as urease breathe test, histopathology, and polymerase chain reaction; and non-invasive methods; serological tests and stool antigen test (SAT). The invasive tests require endoscopic examination for obtaining the diagnostic sample and therefore they are difficult to use in epidemiological and prevalence studies. The *H. pylori* STA has improved in the recent years and has gained an interest to be used in *H. pylori* antigen detection [Talebi B, 2018]. Several studies have demonstrated that SAT is reliable, accurate and sensitive for detection of *H. pylori* infection and therefore facilitate robust clinical and epidemiological studies, particularly in children and toddlers [Omar E., 2023].

Globally, the epidemiology of *H. pylori* infection has changed with improvements in sanitation and methods of eradication. However, the prevalence of *H. pylori* is still high. In developing countries, the prevalence remains the highest, and this is related to socioeconomic status and levels of hygiene [Borka Balas R, *et. al.*, 2022].

In Libya, *H. pylori* prevalence has not been excessively studied, one study has been reported that the overall prevalence was 57% of asymptomatic population and 37% among the dyspeptic patients population in Sabha city, while in Tripoli city the results were 85.1% and 83.2% in asymptomatic and symptomatic population respectively [Nami, A, *et. al.*, 2019]. An earlier study reported that the infection was very high 94% in elder age residents [Bakka AS, *et.al.*, 2002]. Recently, a study on blood donors reported the incidence of *H. pylori* was at 85% among healthy individuals whereas another recent study showed that the prevalence of *H. pylori* infection was 53.84% of tested participants [Omar E., 2023].

The novelty of our study resides in being the first study to estimate the prevalence of *H. pylori* and its associated factors in Zaltan city taking into consideration the population existing in each region of Libya. Understanding the prevalence pattern of *H. pylori* in western Libya and its associated factors will aid in prioritizing and customizing public health efforts to better managing the problem of *H. pylori* infection and its associated diseases. To our knowledge, Libya lacks of *H. pylori* prevalence studies, and the few available ones indicates that *H. pylori* infection is highly fluctuating. Thus, we designed this study to investigate prevalence of infection in the Zaltan city.

2. Materials and Methods

2. 1. Specimen collection and *H. pylori* antigen detection.

The present study was carried out in the Department of Medical Laboratory at Zaltan institute of science and technology, Permission and approval of samples collection and analyses were obtained from the department of Medical Laboratory, during September 2022 to December 2022. Total of 69 stool samples were randomly collected from patients of different ages based upon requesting of physician for doing *H. pylori* antigen detection. The feces specimens were collected in clean, dry, waterproof containers, which free of detergents, preservatives or transport media. To obtain maximum antigens, 1-2 ml or 1-2 g of specimen were tested for antigens detection within 6 hours according to the manufacture instructions (ACON Laboratories, Incorporated. USA, 2018). Collected specimens may be stored for 3 days at 2-8°C if not tested. For long-term storage, specimens were kept below -20°C until analyze.

2.2 Questionnaire of the subjected patients to qualitative detection of *H. pylori* antigen.

A questionnaire was carefully prepared and build-up to determine the correlation between the incidences of *H. pylori* in subjected patients whom has positive result of *H. pylori* antigen test. Moreover, to determine the risk factors such as personal and food hygiene that related to prevalence of *H. pylori* infection.

2.3 Statistical analysis

Chi-Square was used to analyze the obtained data and if p value is less than 0.05 ($p < 0.05$) the result is considered statistically significant difference.

3. Results and discussion

Qualitative detection of *H. pylori* antigen in the stool samples [Figure1.]; indicated that 44.9% were infected with *H. pylori* this was similar to prevalence percentage in developed countries and it is lower than previous studies in Libya [Bakka AS, *et.al.*, 2002; Nami, A, *et. al.*, 2019] and closer to the results reported recently by Omar E., 2023. Fluctuating of *H. pylori* incidence may related to heavily misuse of antibiotic by some of patients, misuse of antibiotic has been reported as a big concern in Libya [Hosien, B *et. al.*, 2022]. However. This may have some benefits but it significantly adverse affects on the *H. pylori* strains antibiotics susceptibility

which may lead to spread of super strains which could not be treated with ordinary antibiotics [Argueta EA *et. al.*, 2022]. Moreover, the low incidence of *H. pylori* in our study population comparing to other studies may related to demographic reason as crowded population in Tripoli comparing to Zaltan and surrounding areas, and also dining out is more common in Tripoli comparing to our study population.

However, *H. pylori* infection can occur at any age, but it has been reported that the *H. pylori* infection is most likely occurred during childhood and teenage [Park JS. *et.al.*, 2021]. Similarly, our results show most of positive antigen test was among 11-20 years old [Table.1]. *H. pylori* infection acquired during childhood and teenage is important in terms of its effect in development of gastric cancer [Cam S., 2014], chronic gastritis, gastric atrophy, ulceration of the gastric mucosa and other gut diseases which act as predispose factors for other illness such as enteritis, diarrhea and iron deficiency anemia [Adeniyi OF., *et. al.*, 2019]. Thus, it is vital to eradicate the *H. pylori* in children infection to prevent the possibility of subsequent development these illness. Furthermore, symptomatic *H. pylori* is crucial in childhood if not treated properly may affects general child health and leads to growth retardation. In our results, antibiotics exposure or different protective immunity may explain the differences of observed results between young and older patients [de Martel C, and Parsonnet J., 2006].

The role of gender differences as a risk factor of *H. pylori* infection has been reviewed in many literatures indicating that males are more susceptible than females [Ibrahim A *et. al.*, 2017]. In this study, the result reveled that female gender was more infected than male, [Table. 1] that may due to females get the infection from their children whom acquired the infection from school or contacting other children. However, children are normally acquired the infection from their parents, but they can pass the infection to their mothers as they are considered as a dining out people when they have their lunch from canteens [Hu J. *et. al.*, 2020] also by inappropriate hygiene when using school toilets.

H. pylori infection could be symptomatic or asymptomatic based on many factors [Mungazi G. *et. al.*, 2018, Oztürk H. *et. al.*, 1996]. Significantly, in our study, most of positive SAT patients were suffering from digestive system symptoms [Figure 2]; this may because most of them attending clinics only when they are feeling unwell. Moreover, *H. pylori* infection is the most common cause of chronic gastritis and associated with peptic ulcer disease, dyspepsia, idiopathic thrombocytopenic purpura, iron deficiency anemia and gastric adenocarcinoma thus trigger any symptom of these conditions in considered as a symptomatic *H. pylori* infection.

H. pylori infection has been correlated to chronic diseases other than gastrointestinal (GIT) diseases; a study reported that the infection is more prevalent in type 2 diabetic patients than non-diabetic patients or healthy people [Hosseinasab Nodoushan A. and Nabavi A., 2019]. Another study highlighted that *H. pylori* contributes to the genesis, progression, and severity of cardiovascular disease and considered as a risk factor of cardiovascular diseases [Torres, A.M. and Gaensly, M.M., 2002]. In our study, there is no significant relation between the infection and cardiovascular disease or diabetes militias ($p > 0.05$) [Table. 2]. Whereas we have found significant relation between the infection and anemia ($p < 0.05$), similar correlation has been reported elsewhere as *H. pylori* considered as a risk factor of anemia via different pathogenesis [Haile K, *et. al.*, 2021; Xu, M.Y., *et., al.*, 2017].

H. pylori infection is usually acquired in childhood and school age acquisition of the infection is associated with poor personal and household hygiene in particular among children and youths. Significant risk factors for *H. pylori* infection are mostly related to living conditions, for instance: living in high-density and poor sanitary homes, crowded schools, poor personal hygienic practices and direct contact with infected people.

Recently, *H. pylori* is an emergent foodborne pathogen of concern. It is entering the food chain through the contamination of fresh or semi processed food, and infected food handlers particularly whom are asymptomatic [Pina-Pérez, M.C., *et.al*, 2018]. *H. pylori* has been detected in drinking water, vegetables and animal origin foods. It survives in complex foodstuffs such as milk, vegetables and ready-to-eat foods [Quaglia NC, and Dambrosio A. 2018]. Foods that incriminated for *H. pylori* contamination are raw food including fresh fruits and vegetables, fresh dairy product and meat [Quaglia NC, and Dambrosio A., 2018; Atapoor S, *et. al.*, 2018]. The use of irrigation water and soils contaminated with faecal or sewage is the main factor that possibly leads to contamination of fruits and vegetables with pathogens (Atapoor *et al.*, 2014, Nutt *et al.*, 2003). The contamination of vegetables with *H. pylori* and the subsequent introduction of these minimally – processed vegetables into the food chain is being suggested as one of the contributing factors to the transmission of the pathogen to humans, increasing the prevalence of the infection (Atapoor *et al.*, 2014, Yahaghi *et al.*, 2014). Moreover, increasingly using public desalination water, which distributed almost at Mosques may increase the possibility of pathogen contamination to drinking water. In this study most of interviewed patients said that their drinking water sources were from small public desalinization water units ($p < 0.05$) [Table. 3] which may be a possible source of contamination if it is improperly sanitized.

Poor hygienic and low quality livings condition are considered as main predisposing factor of *H. pylori* this reflects significant differences of the infection prevalence between developing and developed countries, economic factor is another factor considered as a risk factor. Significant relation between income and *H. pylori* provenances, which, significantly increases in association with low income [Bakka AS, Salih BA., 2002]. This is expected as most other risk factors are associated with low income such as education level and nutritional quality. In our study, the relation was insignificant ($p > 0.05$) [Table. 3]. Which may due to the most of the questionnaired patients were at the middle-income category.

Conclusion

This study shows high prevalence of *H. pylori* within the community with a significant relation between the infection and socioeconomic status particularly food hygiene and drinking water, gastrointestinal symptoms and financial status. More studies are required to understand about spreading of infection via food and water also to determine way of transmission among schools children. Based on the outcomes current study, we suggest that people and public health authorities should consider strong worthy preventive measures against *H. pylori* infection particularly personal and food hygiene transmission.

Results

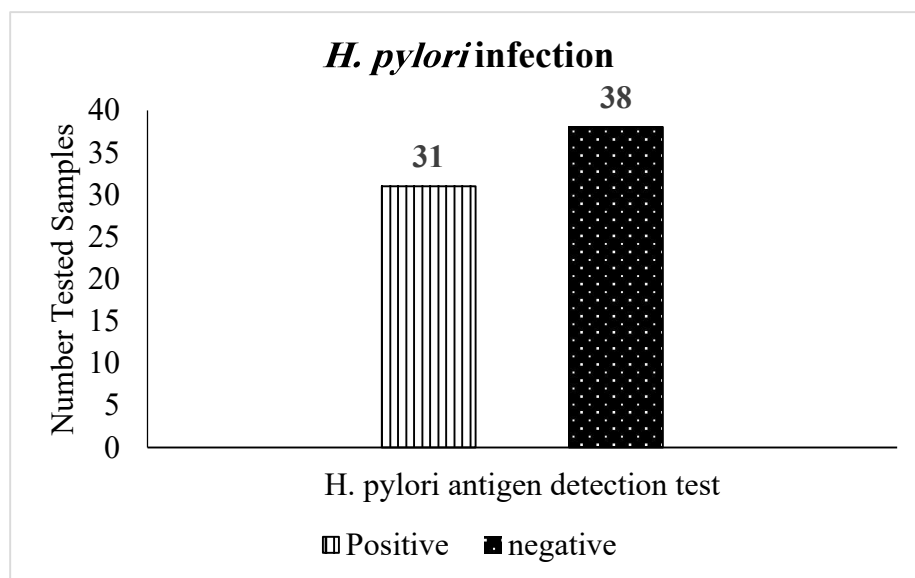


Figure 1. Results of *H. pylori* stool antigen test.

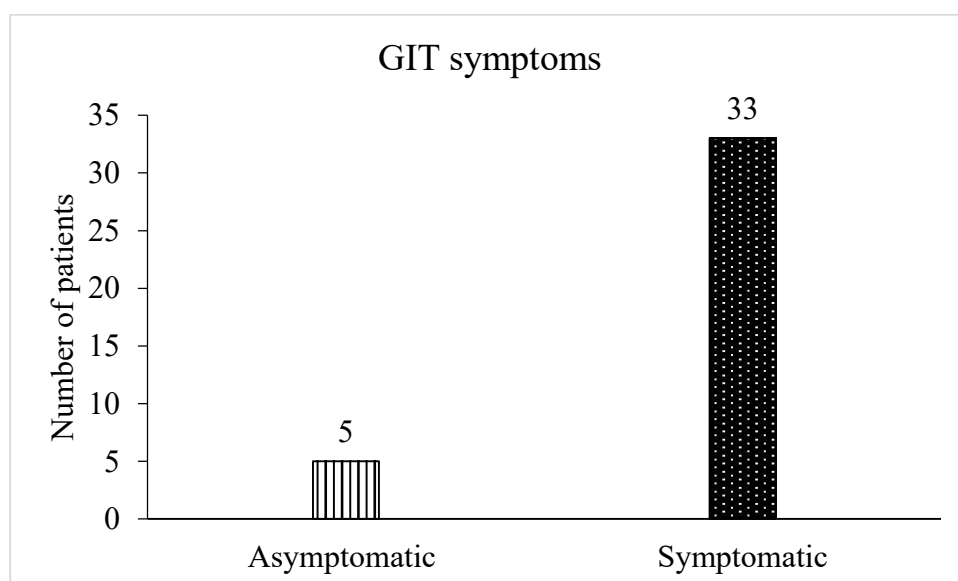


Figure 2. Gastrointestinal (GIT) symptoms; asymptomatic and symptomatic of patients.

Table 1. Relation between *H. pylori* and patient's age and gender.

Table 1: Relation between <i>H. pylori</i> and patient's age and gender.					
Questionnaire	Age (Years) and gender criteria	Distribution of patients based on age and gender	<i>H. pylori</i> antigen test		P-value
			Positive	Negative	
The age of patients (Years)					
	≥ 10	0	0	0	0.003
	11-20	15	4	11	
	21-30	21	16	5	
	31-40	14	3	11	
	41-50	11	6	5	
	< 50	08	2	6	

The gender				
	Male	23	7	16
	Female	46	24	22

Table 2. Relation between *H. pylori* infection and chronic illness.

Questionnaire	Infected patients		Non infected patients		P-value	Total
	Yes	No	Yes	No		
Diabetes mellitus	2	29	5	33	0.000	69
Cardiovascular diseases	3	28	01	37	0.213	69
Anemia	24	7	16	22	0.003	69

Table 3. Correlation between *H. pylori* infection and income, lifestyle and, personal and food hygiene.

Questionnaire	Number of Infected patient		Number of Non-Infected patient		P-value
	Yes	No	Yes	No	
Personal hygiene practice	5	26	20	18	0.002
Smoking	17	14	6	32	0.001
Fast food eating	11	20	11	27	0.003
Source of drinking water					
• Bottled water	5	26	8	30	0.001
• Desalination water	3	28	18	20	
• Well water	23	8	12	26	
Income and lifestyle					
• High	3	35	6	32	0.440
• Middle	24	14	30	39	
• Low	4	34	2	67	

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