Original Article

A study of prevalence and risk factors for *Helicobacter pylori* infection among adults in Duhok Province, Kurdistan Region, Iraq

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ABSTRACT

Helicobacter pylori is known to increase the risk of developing gastritis, peptic ulcer disease, gastric adenocarcinoma, and gastric lymphoma in adults across the globe. The present study aimed to determine the prevalence of *H. pylori* infection and its associated risk factors. This cross-sectional study was conducted among the adult population in Duhok Province, Kurdistan Region, Iraq. A total of 259 subjects over the age of 18 who visited the hospitals were included in the study from 2018 to 2020. An enzyme-linked immunosorbent assay was utilized to determine *H. pylori* seropositivity. A standardized questionnaire was administered to all study participants through face-to-face interviews. The *H. pylori* immunoglobulin G (IgG) antibody data were analyzed using the Chi-square test. The prevalence of anti-*H. pylori* IgG antibody was present in 40.02% of adults. Among the studied variables, the following risk factors were significantly associated with the presence of anti-*H. pylori* IgG antibodies: male gender ($P<0.043$), level of education ($P<0.025$), history of gastrointestinal diseases ($P<0.001$), smoking status ($P<0.001$), and more siblings ($P<0.001$). This study supports the hypothesis that *H. pylori* infection in adults is highly related to poor hygiene and smoking status, low level of education, and crowded conditions. Therefore, in order to reduce the prevalence of *H. pylori* infection among adults, it is crucial to implement effective strategies aimed at enhancing fundamental sanitary conditions, as well as improving educational and socioeconomic status.

Keywords: Adult, Duhok, *H. pylori* infection, IgG antibody, Iraq, Risk factors, Seroprevalence

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1. Introduction

Helicobacter pylori has gained global recognition as a significant issue, with an estimated infection rate of approximately 50% around the world. *Helicobacter pylori* plays a critical role in the occurrence of gastritis, peptic ulcer disease, and gastric cancer (1-3). This infection is also a crucial factor in the development of gastric adenocarcinoma and primary gastric lymphoma among adults (4). According to a previously conducted study on seroprevalence, approximately 50% and 90% of adults in developed and developing countries have tested positive for *H. pylori* infection, respectively (5). Another study has highlighted that person-to-person transmission, particularly within families, is a significant mode of transmission for *H. pylori* infection, as indicated by both epidemiological and microbiological investigations performed in both developed and developing countries (6). In Iraq, the prevalence of *H. pylori* among the Iraqi population was extensively studied (7-10). It was reported that more than 70% of the adult population in Iraq was infected with *H. pylori* infection (11). Previous research has demonstrated that the prevalence of *H. pylori* infection increases significantly with age. This rise can be primarily attributed to a birth cohort effect rather than a later acquisition of the infection (11). *H. pylori* infection can be acquired during early childhood, and adults may harbor the same bacterial strain for several consecutive decades (12). Several studies have identified notable variations in the prevalence of *H. pylori* infection both between and within countries (13,14). These differences can be ascribed to variances in ethnicity and geographical locations among different populations (13,14). In addition, a related study linked *H.* pylori infection with low socioeconomic characteristics, low educational level, poor quality of drinking water, crowded or poor living conditions, and inadequate sanitation practices (15). Conducting seroepidemiological studies and determining the potential risk factors linked with *H. pylori* infection among adults are vital in implementing successful health strategies to prevent *H. pylori*-associated diseases in the population. Further knowledge about the method of transmission could provide invaluable insight into the effective prevention of *H. pylori* infection in this particular population. Considering the aforementioned issues, the present study aimed to assess the seroprevalence of *H. pylori* infection and identify potential associated risk factors among adults residing in Duhok province, Iraq.

2. Materials and Methods

2.1 Study design

This cross-sectional study was performed at Shekhan and Azadi hospitals in Duhok province, Kurdistan Region, Iraq, between 2018 and 2020. After obtaining the consent form, a sample of 259 individuals above the age of 18 was collected to assess specific immunoglobulin G (IgG) antibodies against *H. pylori*. Various sociodemographic variables, such as age, gender, residency, level of education, sources of drinking water, smoking status, number of family members, family income, history of gastrointestinal diseases, and frequency of consuming fast food and chips, were obtained from each participant through a questionnaire. All subjects answered the questions regarding risk factors associated with *H. pylori* infection (10).

2.2 Inclusion and exclusion criteria

The inclusion criteria entailed subjects attending Shekhan and Azadi hospitals, being over 18 years old, and being willing to be recruited in the study. On the other hand, individuals who declined to participate in the study were excluded from the analysis. Moreover, those who self-reported a history of *H. pylori* positivity or other gastric disorders were excluded from the study.

2.3 Blood samples and assessment of *anti-H. pylori* IgG

Under sterile conditions, a 5-mL blood sample was collected from each subject. The blood samples were then subjected to centrifugation at 1500 rpm for 10 min to separate the serum, which was subsequently frozen and stored at -20°C until further analysis. The detection of anti-*H. pylori* IgG positivity was carried out using a commercially available kit (Bioactiva Diagnostica, Germany), following the instructions provided by the manufacturer. The cut-off value was determined based on an index value obtained by calculating the absorbance ratio of the sample to that of a cut-off calibrator. An *H. pylori* IgG index greater than 1.00 was considered positive, while an index below 0.90 was regarded as negative.

2.4 Ethics

The study procedure was approved by the Ethics Committee of the College of Medicine, University of Zakho, Iraq. Informed written consent was obtained from all participants.

2.5 Statistical analysis

In order to investigate the potential risk factors associated with *H. pylori* seropositivity and identify influential factors, the Chi-square test was employed. The statistical analysis was performed using SPSS

software (SPSS, Inc., Cary, NC, USA). A p-value of ≤ 0.05 was considered statistically significant in this study.

3. Results

The sociodemographic characteristics and risk factors associated with the prevalence of *H. pylori* infection among adults older than 18 are presented in **table 1**. In general, 259 subjects (137 male and 122 female) were assessed for the detection of *H. pylori*-specific IgG. The prevalence of *H. pylori* IgG-specific antibody was 104/259 (40.02%). The prevalence of such infection varied across different age groups, with higher rates observed in older individuals. Nonetheless, these differences were not statistically significant (*P*=0.32), as displayed in table 1. There was a significant association between *H. pylori* seropositivity and gender, with a higher seropositivity rate observed in males than in females (46.0% vs 33.6%) (*P*<0.043). Regarding educational level, high school attendees had the highest seropositivity rate (54.3%), while university students had the lowest rate (23.3%), and these differences were statistically significant (*P*<0.025). A significant relationship was also detected between *H. pylori* seropositivity and a history of gastrointestinal diseases (*P*<0.001). It was also found that there was a significant association between the number of siblings and the prevalence of *H. pylori* infection (*P*<0.001), with larger families having a higher prevalence rate (64.4%). Moreover, the prevalence rate of the anti-*H. pylori* IgG antibody was significantly higher among smokers than in non-smokers (*P*<0.001). Nevertheless, no statistically significant differences were observed in the rates of *H. pylori* infection based on residency (*P*=0.99), source of drinking water (*P*=0.21), frequency of fast-food consumption (*P*=0.79), consumption of chips and cakes (*P*=0.56), regular hand washing before meals (*P*=0.29), tooth decay (*P*=0.98), and family income (*P*=0.22) (**Table1)**.

4. Discussion

In this study, the seropositivity rate of *H. pylori* was determined to be 40.02% among individuals over the age of 18. It is worth noting that the prevalence rate of *H. pylori* infection differs across geographic regions globally, with seropositivity rates exceeding 70% in developing countries, such as Bangladesh and India, but less than 20% in developed countries, such as the Netherlands and Australia (16). It has been previously reported that inadequate sanitation practices, crowded or high-density living conditions, history of gastrointestinal diseases, smoking status, and low social status seem to be related to a higher prevalence of *H. pylori* infection (10). The findings of the current research were in line with those of a community-based study conducted in Sulaimani province, Iraq, which reported an infection rate of 32.3% (17). Another study performed in Duhok province, Iraq, found a seropositivity rate of 28% among the recruited subjects, marginally lower than that observed in our study (18). Variations in *H. pylori* infection rates among studies can be attributed to differences in the sample size, age groups, and diagnostic methods. On the contrary, infection prevalence in our study was significantly lower than that reported in several studies conducted in Iran, where *H. pylori* infection rates ranged from 47% to 64% (19) and 72.8% (20). The results of the current research also differed from studies conducted in Egypt, Saudi Arabia, and Turkey, where the prevalence rates of infection were reported to be 60%, 75%, and 77.5%, respectively (21,22). These discrepancies in the results may be due to differences in the studied geographic regions, sample sizes, age groups, and employed diagnostic methods. The relatively low prevalence rate of infection observed in our study could also be attributed to the frequent use of proton pump inhibitors or antibiotics and the gradual improvements in sanitation and socioeconomic status over the past few decades. These factors have likely contributed to the increased clearance of *H. pylori*, leading to a reduced prevalence of infection. Research conducted in developed countries revealed a greater seropositivity rate for *H. pylori* among males than in females (23). Nonetheless, in developing countries, seropositivity rates in males and females seem to be similar (10). The present study also found a higher infection rate in males than in females, with statistically significant differences (*P*=0.04). *H. pylori* seropositivity rates based on gender can differ depending on the level of development and geographical location of the country. When considering age groups, the prevalence of *H. pylori* infection ranged from 39.8% to 55.6%. Although there were no significant differences in seroprevalence rates among different age groups, the older age group (above 36 years) exhibited a higher prevalence rate of *H. pylori* IgG antibodies. These findings were in agreement with those of a previous study conducted in Iraq, reporting variations in the prevalence of infection based on age groups (11). The current study identified various risk factors associated with *H. pylori* infection among adults. Our findings revealed a significant association between *H. pylori* seropositivity and socio-demographic variables, including the level of education, history of

gastrointestinal diseases, smoking status, and number of family members. In this study, attending school was identified as a significant risk factor for *H. pylori* infection compared to non-attendance. This suggests that poor hygiene conditions in schools could contribute to an increased likelihood of *H. pylori* infection. In addition, the density of individuals in schools may facilitate person-to-person transmission of the bacteria (10). It is worth noting that people-to-people transmission can also occur within households if an infected individual resides there for a few months (24). The obtained results contradict a previous study conducted in Duhok province among children which did not find a significant association between different levels of education and *H. pylori* infection (18). This disparity may be partly attributed to the difference in the sample sizes recruited for each study. Further investigations with larger sample sizes are necessary to explore this aspect. In our study, the seroprevalence of *H. pylori* was 73.5% among individuals with a history of gastrointestinal diseases, demonstrating a significant difference (P<0.001). This positive correlation between *H. pylori* infection and a history of gastrointestinal disease

Table 1: Association between seroprevalence of *H. pylori* and risk factors among adult

	H. pylori Result (No. [%])				
Demographic and Risk factors	**Positive**	**Negative**	**Total**	***Chi-Square test***	***P value***
	N= 104 (40.2%)	**N=155 (59.8%)**	**N=259**		
Age (Year)					
18-25	74 (39.8%)	112 (60.2%)	186		
26-35	20 (36.4%)	35 (63.6%)	55	2.11	0.32
≥ 36	10 (55.6%)	8 (44.4%)	18		
Gender					
Male	63 (46.0%)	74 (54.0%)	137	4.11	0.043
Female	41 (33.6%)	81 (66.4%)	122		
Residency					
City	(%٤٠,١) ٥٥	82 (59.9%)	137	0.001	0.99
Country side	49 (40.2%)	73 (59.8%)	122		
Level of education					
Illiterate	17 (51.5%)	16 (48.5%)	33	11.18	0.025
Primary School	33 (33.0%)	67 (67.0%)	100		
Secondary School	28 (45.9%)	33 (54.1%)	61		
High School	19 (54.3%)	16 (45.7%)	35		
University	7 (23.3%)	23 (76.7%)	30		
Source of drinking water					
Tape water	89 (42.0%)	123 (58.0%)	212	1.62	0.21
Mineral water	15 (31.9%)	32 (68.1%)	47		
Fast Food					
Daily	71 (39.4%)	109 (60.6%)	180	1	0.79
Weekly	14 (37.8%)	23 (62.2%)	37		
Monthly	11 (50.0%)	11 (50.0%)	22		
Occasionally	8 (40.0%)	12 (60.0%)	20		
Chips and cakes					
Daily	(%٣٧,٧) ٦٣	104 (62.3%)	167	2.04	0.56
Weekly	30 (44.1%)	38 (55.9%)	68		
Monthly	10 (50.0%)	10 (50.0%)	20		

Occasionally	1 (25.0%)	3 (75.0%)	4		
History of gastrointestinal disease					
Yes	36(73.5%)	13(26.5%)	49	27.91	0.001
No	68(32.4%)	142(67.6%)	210		
Hand washing habit before eating					
Yes	115(61.8%)	71(38.2%)	186	1.07	0.29
No	40(54.8%)	33(45.2%)	73		
Status of Smoking =					
Yes	19(36.5%)	(%٦٣,٥)33	52	19.15	0.001
No	130(67.7%)	62 (32.3%)	192		
Not regularly	6(40.0%)	9 (60.0%)	15		
Teeth decay	35(40.2%)	52(59.8%)	87	0.002	0.98
Yes	69(40.1%)	103(59.9%)	172		
No					
Family income					
Very bad	4(80.0%)	1(20.0%)	5	5.71	0.22
Bad	11(52.4%)	10(47.6%)	21		
Middle	79(38.5%)	126(61.5%)	205		
Good	7(31.8%)	15(68.2%)	22		
Very good	3(50.0%)	3(50.0%)	6		
Number of family members					
2-4	(%١٨,٨)3	13 (81.2%)	16	26.26	0.001
5-7	19 (28.8%)	47 (71.2%)	66		
8-10	35 (33.7)	69 (66.3%)	١٠٤		
>10	(%٦٤,٤)47	26 (35.6%)	73		

The Chi-Square test (X2) was utilized to calculate the P values. P values less than 0.05 were considered statistically significant.

could be partially explained by the confounding effects of nutritional habits and lifestyles associated with this condition. Numerous studies have proposed a significant relationship between cigarette smoking and *H. pylori* seropositivity; nevertheless, the results were not yet definitive (25). Consistent with the findings of other studies, in the present research, we observed a higher prevalence of *H. pylori* seropositivity among smokers compared to individuals who had never smoked (25). When adjusting for lifestyle habits and disease status through multiple logistic regression analyses, the impact of cigarette smoking on *H. pylori* seropositivity displayed a slight change in effect size but did not completely disappear. The primary factor contributing to the growth in household size is the number of family members. Consequently, larger household sizes can potentially raise the likelihood of adult individuals contracting *H. pylori* infection. Our findings revealed a reduced rate of *H. pylori* infection among individuals residing in households with 2-4 members (18.8%), in contrast to 64.4% among those living in households with over 10 family members (P<0.001). This could be explained by the fact that overcrowding in households increases the chances of acquiring *H. pylori* infection among people (26). In large families, family members often share their bedrooms, which could significantly increase the risk of exposure to *H. pylori* infection (23). A study confirmed that the positivity rates of *H. pylori* infection were higher among adults residing in sizable households (13). In the present study, *H. pylori* infection did not reveal any significant correlation with age groups, place of residence, source of drinking water, consumption of fast food and chips, regular hand washing before meals, tooth decay, or family income. A study reported that the prevalence of *H. pylori* can vary among urban and rural populations within the same country (27). In addition, a subsequent investigation revealed a significant decrease in infection prevalence among families with a higher socioeconomic status (P<0.005) (26).

Another study demonstrated that the seroprevalence of *H. pylori* was more significant in individuals who relied on unprotected surface water compared to those who utilized piped tap water (28). The findings of a study were indicative of a significant difference in the seroprevalence of *H. pylori* infection between individuals who did not engage in regular hand washing and those who did (*P*=0.021) (29). As a result, our findings were inconsistent with those reported in previous studies (27, 28). These variations in prevalence might stem from differences in testing techniques, sample sizes, geographical locations, societal factors, and variations in the socioeconomic status of the participants under study. Further research is necessary to investigate potential risk factors associated with *H. pylori* infection. In conclusion, the prevalence rate of *H. pylori* positivity infection was quite similar to a previous study conducted in the Kurdistan Region, Iraq. Our result supports the hypothesis that *H. pylori* infection among adults is significantly associated with poor hygiene, smoking status, low level of education, history of gastrointestinal diseases, dense living conditions, and crowded conditions. To reduce and manage *H. pylori* infection in the region, it is essential to implement effective strategies that focus on enhancing fundamental sanitary conditions, as well as improving educational and socioeconomic conditions.

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Authors' Contribution

Study concept and design: A.A. Acquisition of data: I.N and A.A. Analysis and interpretation of data: I.N. Drafting of the manuscript: I. N and N.H. Revision of the manuscript: N. H. Statistical analysis: I. N and A.A.

Ethics

The study procedure, methods pf taking consent and format of informed consent were approved by the ethics committee of the College of Medicine, University of Zakho, Kurdistan Region of Iraq, based on the ethical principles of human research and experiment. University of Zakho. Consent was obtained from all participants before samples collection.

Conflict of Interest

The authors declare that they have no conflict of interest.

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