Infection and Drug Resistance

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Knowledge, Attitudes, and Practices Related to *Helicobacter pylori* and Gastric Disease in Jordan: Implications for Early Detection and Eradication

Shatha M Al Omari[1], Anas H Khalifeh[2], Raja Moman[3], Hana M Sawan[1]

[1]Faculty of Pharmacy, Zarqa University, Zarqa, Jordan; [2]Faculty of Nursing, Zarqa University, Zarqa, Jordan; [3]Faculty of Pharmacy, University of Tripoli, Tripoli, Libya

Correspondence: Shatha M Al Omari, Email somari@zu.edu.jo

Background: Gastric cancer and ulcers are responsible for almost 1 million deaths globally each year, disproportionately affecting low- and middle-income populations. *Helicobacter pylori* (*H. pylori*) infection is a major risk factor for both gastric cancer and peptic ulcers, with infection rates surpassing 70% in developing countries and reaching 88% in Jordan. Despite strong evidence linking *H. pylori* infection to gastric cancer, particularly with CagA-positive strains, public awareness of *H. pylori* infection, its transmission routes, and associated health risks remains insufficient.

Methods: This study aimed to assess the knowledge, attitudes, and practices (KAP) related to *H. pylori*-induced stomach ulcers and cancer in a Jordanian population, focusing on early detection and eradication efforts. A survey was administered to 398 participants to evaluate their understanding of *H. pylori* and its role in gastric disease.

Results: The findings revealed that 64.3% of respondents were aware of *H. pylori*, with 75.9% recognizing its association with gastric ulcers. However, awareness of the transmission routes and potential complications is limited. The frequent use of antacids for symptom relief also highlights the need for better awareness of appropriate treatments.

Conclusion: Public health education targeting these knowledge gaps could help reduce the incidence of *H. pylori*-related complications, including gastric cancer, especially in high-prevalence areas such as Jordan. Addressing these deficits and promoting preventive strategies, such as improved hygiene and regular medical check-ups, could facilitate early detection and improve health outcomes for individuals at risk of *H. pylori*-induced infection.

Keywords: *Helicobacter pylori*, *H. pylori*, gastric cancer, peptic ulcers

Key Messages

- Main findings: This study has revealed a moderate level of knowledge regarding *H. pylori* infection among the Jordanian population. Although 40–60% of participants showed a high level of awareness of *H. pylori* and its connection to stomach ulcers and cancer, there were notable gaps in their understanding of the relationship between *H. pylori* infection and lifestyle factors.
- Added knowledge: This study adds new knowledge by identifying gaps in awareness of *H. pylori* infection within the Jordanian population, especially among individuals with different employment statuses, highlighting the need to educate vulnerable groups, such as young adults and non-medical professionals, regarding *H. pylori* infection risk and prevention.
- Global health impact in terms of policy and action: The study findings highlight the necessity of enhanced public health strategies to control *H. pylori* infection, particularly in areas with restricted healthcare resources. Integrating awareness programs into public health policies could significantly reduce the incidence of serious gastrointestinal diseases associated with chronic *H. pylori* infection.

Received: 24 November 2024
Accepted: 25 February 2025
Published: 19 March 2025

Introduction

Globally, gastric cancer and ulcers are responsible for 1 million deaths annually, particularly among low- and middle-income individuals. Gastric cancer is the third leading cause of cancer-related deaths and the fifth most commonly diagnosed malignancy,[1] ranking seventh among Jordanian males and tenth among Jordanian females.[2] *Helicobacter pylori* (*H. pylori*) infection, a Gram-negative, flagellated, microaerophilic bacterial pathogen that selectively colonizes the stomach epithelium, causes long-lasting chronic inflammation and significantly increases the risk of developing gastric cancer, particularly with CagA-positive strains.[3,4] The majority of *H. pylori* infections are asymptomatic, with only a subset progressing to gastric cancer. Clinical outcomes are influenced by a complex interplay of host susceptibility, environmental factors, and bacterial strain characteristics. Genetic diversity among *H. pylori* isolates contributes to variations in pathogenicity, with key virulence factors such as the cag pathogenicity island (cag PAI) and VacA playing significant roles. Strains possessing a functional cag PAI and the CagA protein are associated with a higher risk of gastric cancer compared to cag-negative strains due to the oncogenic effects of CagA.[3] Epidemiological studies suggest that 2–3% of individuals with *H. pylori* infection develop gastric cancer, while around 10% develop peptic ulcer disease.[5]

The prevalence of *H. pylori* infection varies significantly across regions, with higher rates observed in developing nations than in developed nations, reaching more than 70% in developing countries.[6–8] For example, in Jordan it has been estimated that approximately 88% of the Jordanian population tests positive for *H. pylori*.[9] The primary mode of transmission is believed to be through oral–oral or fecal–oral contact during childhood, and the infection persists throughout life in the absence of antibiotic treatment. Therefore, risk factors for *H. pylori* infection are closely associated with food and personal hygiene.[5,10]

The connection between *H. pylori* infection and an increased risk of developing stomach cancer is well-established, leading the World Health Organization to classify it as a class I carcinogen.[11] Notably, a study by Uemura et al found that none of the *H. pylori*-uninfected patients developed gastric cancer, whereas 3% of the *H. pylori*-infected patients did. Eradicating *H. pylori*, especially in individuals infected with cagA-positive strains, has been shown to significantly lower the risk of developing precancerous lesions and gastric cancer.[12]

The development of gastric cancer is a complex and gradual process that can take decades to progress from *H. pylori* infection, starting with the transition from normal mucosa to non-atrophic gastritis, followed by atrophic gastritis, intestinal dysplasia, and, eventually, adenocarcinoma.[13,14] This latency period offers an opportunity for early detection and elimination of *H. pylori* before complications occur.

Prospective studies by Mera et al have shown that successful antibiotic-mediated eradication of *H. pylori* significantly reduces the incidence of precancerous lesions, emphasizing the role of *H. pylori* in initiating a multistep cascade that leads to these lesions.[15] Currently, *H. pylori* infection is considered the most significant and controllable risk factor for preventing gastric cancer.[8]

Despite the importance of knowledge and awareness regarding *H. pylori* infection and its potential complications, there is general consensus that the public lacks understanding in this regard. However, a previous study indicated that knowledge of the association between *H. pylori* infection and gastric cancer is likely to prompt individuals to undergo screening and receive treatment for *H. pylori* infection,[16,17] as knowledge correlates with positive attitudes and good practices.[18] For instance, a survey conducted in the United Arab Emirates to assess the knowledge, attitudes, and practices (KAP) of the adult population regarding *H. pylori*-induced stomach ulcers and gastric cancer revealed that only 24.6% of adults had heard of *H. pylori*, with 33% willing to seek medical help if they experienced *H. pylori* infection symptoms. The majority of participants (approximately 61%) were unaware of the connection between *H. pylori* and gastric cancer.[17]

The purpose of this study was to evaluate current KAP levels among the Jordanian population regarding *H. pylori*-induced stomach ulcers. It aimed to promote early identification and eradication of *H. pylori* infection and raise awareness about the consequences of untreated *H. pylori* infection.

Materials and Methods

Development of the Survey

The survey used in this study was created by Malek et al[17] and adapted for the general population in Jordan. Initially, a group of gastroenterologists and microbiologists reviewed and validated each item in the original survey and selected relevant items for this study. To ensure clarity and suitability for the general population, a pilot study was conducted using a random sample of 20 individuals. Following pilot testing, linguistic and grammatical modifications were made to enhance question comprehensibility. The internal consistency of the survey was evaluated and Cronbach's alpha coefficient for knowledge was calculated to be 0.83. The data collected during the pilot phase were not included in the final results of this study. The well-designed and comprehensive survey was then distributed to the study population. Data collection took place from December 2023 to April 2024.

The survey of the Jordanian population regarding *H. pylori* infection encompassed four sections: demographics (eight items), knowledge (six items), attitudes (two items), and practices (two items). The demographic section gathered information on participants' gender, age, nationality, educational level, and occupation. Participants were also asked about their current symptoms and previous health conditions. Knowledge was assessed through multiple-choice questions that aimed to gauge the participants' understanding of gastric ulcers in general and *H. pylori* specifically. Attitudes toward the prevention of gastric ulcers and avoidance of *H. pylori* infection were also evaluated using multiple-choice questions. The practice section consisted of multiple-choice questions about the participants' regular habits.

Calculation of Sample Size

The sample size was determined using the Kish formula for sample size estimation, considering a 95% significance level and a 5% margin of error. The estimated sample size was 384. A total of 408 undergraduate students were recruited for the current study.

Ethical Approval

This study was approved by the Ethics Committee of Zarqa University (approval #2023/7/5259/36).

Outcome Measures

This study was designed to evaluate the knowledge, attitudes, and practices (KAP) of the Jordanian population concerning the relationship between *H. pylori* infection, gastric ulcers, and cancer.

Data Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 26). Descriptive statistics (mean, standard deviation, and frequency) were used to describe the sample and knowledge, attitudes, and practice levels. A series of independent-sample *t*-tests and analysis of variance (ANOVA) were then used to identify differences in knowledge scores based on demographics. Results were considered statistically significant at a significance level of less than 0.05.

Results

Participant Characteristics

Table 1 presents the sociodemographic characteristics of the 398 participants. The majority (70.4%) were aged between 18 and 29 years and most were female (n=289, 72.6%). Additionally, 71.6% held a bachelor's degree and 54.8% were employed in non-medical fields.

Table 2 presents the clinical characteristics of the participants; most of the sample (n=350, 87.9%) did not currently have *H. pylori* infection. The participants' most frequent health issues were acid reflux disease (heartburn) and constipation or diarrhea (47.7 and 34.4%, respectively). Loss of appetite and heartburn were the most frequent symptoms participants were currently experiencing or had previously experienced. Participants with a *H. pylori* infection most commonly reported experiencing constipation or diarrhea (66.7%), recurring pain or burning in the upper abdominal area

Table 1 Sociodemographic Characteristics of Participants (N=398)

Variables	Number	%
Age		
18–29	280	70.4
30–39	66	16.6
40–60	44	11.1
>60	8	2.0
Gender		
Male	109	27.4
Female	289	72.6
Educational level		
Elementary school	8	2.0
High school	59	14.8
Bachelor	285	71.6
Masters	33	8.3
Ph.D	13	3.3
Employment status		
Medical	180	45.2
Non-medical	218	54.8

Table 2 Clinical Characteristics of Participants

Do you have a Helicobacter pylori infection?	Number	%
Yes	15	3.8
No	350	87.9
Maybe	33	8.3
Do you suffer from the following health issues?		
Acid reflux disease (heartburn)	190	47.7
Constipation or diarrhea	137	34.4
Recurring pain or burning in the upper abdominal area	111	27.9
Peptic ulcer disease (ulcers in the stomach or intestines)	52	13.1
Esophageal problems	40	10.1
What symptoms do you experience?		
Loss of appetite	122	30.7
Heartburn	121	30.4

(*Continued*)

Table 2 (Continued).

Dull aching pain resembling the feeling of hunger	110	27.6
None of these	106	26.6
Feeling of indigestion	101	25.4
Nausea	100	25.1
Weight loss	78	19.6
Repeated episodes of stomach bleeding	2	0.5

(60%), and peptic ulcer disease (60%). The most prevalent symptoms reported were heartburn (53.3%) and a dull, aching pain similar to hunger (46.7%), as shown in Table 3.

Knowledge Regarding H. pylori

In terms of knowledge of *H. pylori*, Table 4 shows that more than half of the participants (n=256, 64.3%) had heard of it previously. For approximately one-third of participants (39.1%), the source of information was their place of study, followed by family members or friends (20.3%). The most commonly recognized causes of stomach ulcers were bacterial infections (58.5%), stress and depression (55.3%), and smoking, alcohol consumption, and drug abuse (55.0%). Additionally, 75.9% of patients reported that *H. pylori* infection was frequently associated with gastric ulcers. Regarding remedies, 45.7% indicated that they would use or recommend antacids to relieve ulcer symptoms, followed by drinking milk (40.2%). Regarding transmission, 60.6% of participants frequently mentioned that *H. pylori* was transmitted through contaminated food and water. Regarding knowledge of foods that are allowed or prohibited for individuals with stomach ulcers, Figure 1 illustrates that the majority of participants identified allowed foods such as

Table 3 Clinical Characteristics of Participants with a *H. pylori* Infection

Health issues exerienced by participants		**%**
Constipation or diarrhea	10	66.7
Recurring pain or burning in the upper abdominal area	9	60.0
Peptic ulcer disease (ulcers in the stomach or intestines)	9	60.0
Esophageal problems	4	26.7
Acid reflux disease (heartburn)	1	6.7
Symptoms		
Heartburn	8	53.3
Dull aching pain resembling the feeling of hunger	7	46.7
Nausea	5	33.3
Feeling of indigestion	4	26.7
Weight loss	2	13.3
Loss of appetite	2	13.3
None of the above	3	20.0

https://doi.org/10.2147/IDR.S508330

Table 4 Knowledge of *H. pylori*-Induced Gastric Ulcers and Cancers

Knowledge Item	Number	%
Sources of Knowledge		
Place of study	100	39.1
Family member/friend	52	20.3
Social media	35	13.7
Healthcare professionals	32	12.5
Personal reading	26	10.2
News, radio, and television	11	4.3
Causes		
Bacterial infection	233	58.5
Stress and depression	220	55.3
Smoking, drinking alcohol, and drugs	219	55.0
Poor diet and lifestyle	203	51.0
Medications (such as aspirin, Voltaren)	168	42.2
Malabsorption of nutrients from the gastrointestinal tract	106	26.6
Food allergies	105	26.4
Bile reflux	76	19.1
Viral or fungal infection	66	16.6
Autoimmune diseases	64	16.1
Umbilical hernia	22	5.5
Skin burns or bleeding	18	4.5
Diseases		
Gastric ulcers	302	75.9
Peptic ulcers	188	47.2
Stomach cancer	153	38.4
Dyspepsia (reflux)	134	33.7
Appendicitis	50	12.6
Psoriasis	26	6.5
Kidney failure	21	5.3
Remedies		
Using an antacid	182	45.7
Drinking milk	160	40.2
Seeking medical help	153	38.4
Drinking water	152	38.2

(*Continued*)

Table 4 (Continued).

Herbal drinks such as chamomile and cumin	136	34.2
Fasting	83	20.9
Drinking 7 Up	54	13.6
Ignoring the problem; it will heal without intervention	42	10.6
Sleeping on the abdomen	27	6.8
Eating to relieve pain	27	6.8
Routes of Transmission		
Contaminated food and water	241	60.6
Poor self-hygiene	155	38.9
Sharing utensils, toothbrushes, towels, and bedsheets	145	36.4
Contaminated hospital equipment	120	30.2
I do not know	90	22.6
Through a needle prick or blood	65	16.3
From household animals	64	16.1
Low socioeconomic level and overcrowding	61	15.3
Genetic (hereditary)	54	13.6
From mother to child (during pregnancy, childbirth, breastfeeding)	45	11.3

meat (eg, beef, chicken, and fish) and dairy products (58.3 and 68.8%, respectively). On the other hand, prohibited foods included citrus fruits (eg, orange and pineapple), beverages (eg, coffee, including decaffeinated coffee, soft drinks, and black tea), and certain fruit and vegetables (eg, lemons and spicy peppers) (56.8, 75.4, and 68.6%, respectively).

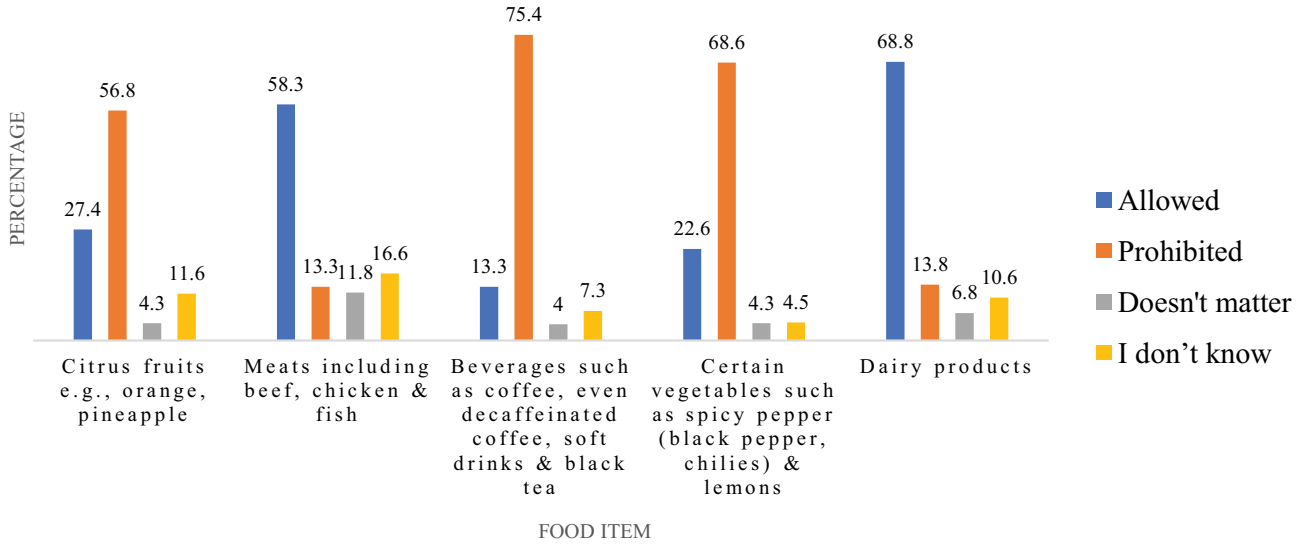

Figure 1 Knowledge that certain foods should be allowed or prohibited in cases of stomach ulcer.

https://doi.org/10.2147/IDR.S508330

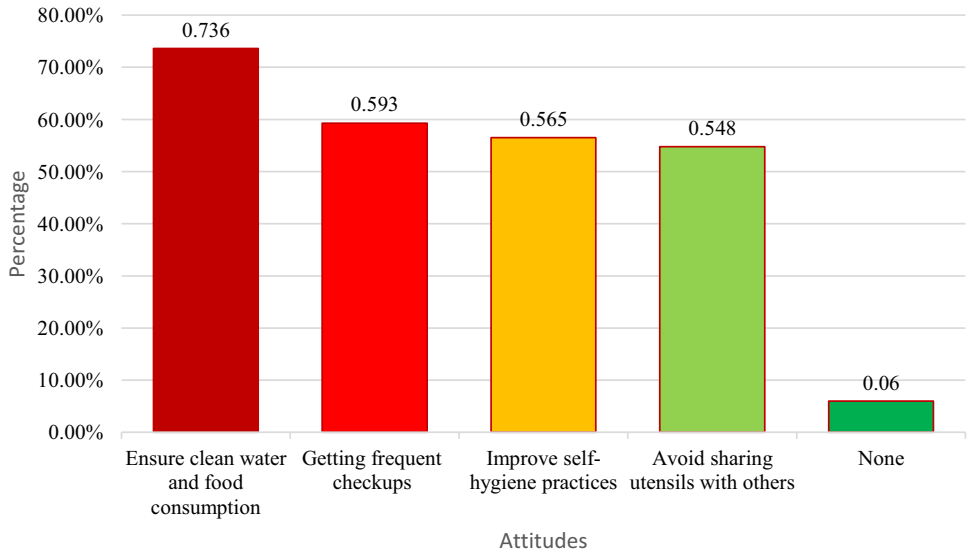

Figure 2 General attitudes of participants regarding prevention of *H. pylori* infection.

Attitudes Toward H. pylori

Figure 2 highlights the participants' general attitudes toward the prevention of *H. pylori* infection. The most commonly recommended preventive measure was the consumption of clean water and food, with 73.6% of participants advocating for it. Over half of the participants (59.3%) recognized the importance of regular medical checkups for early detection and management of *H. pylori* infection. Additionally, 56.5% of respondents acknowledged the significance of improving self-hygiene practices, such as maintaining personal sanitation and proper handwashing, to reduce the risk of infection. A portion of participants (54.8%) also emphasized the role of avoiding the sharing of utensils as a preventive measure, recognizing the potential for oral–oral transmission Notably, a small percentage of participants (6.0%) reported not following any of the preventive measures mentioned.

Practices and Daily Habits

The most frequent practices that the participants engaged in regularly were drinking coffee (36.4%), eating spicy food (32.2%), drinking soft drinks (20.9%), other forms of smoking (hookah/electronic cigarettes, etc) (17.1%), smoking cigarettes (16.3%), and use of anti-inflammatory drugs (15.1%), as presented in Table 5.

Table 5 Practices in which the Population Engages on a Regular Basis

Practices	Number	%
Drinking coffee (more than one cup a day)	145	36.4
Eating spicy food	128	32.2
Neither of the above	111	27.9
Drinking soft drinks	83	20.9
Other forms of smoking (hookah/electronic cigarette, etc)	68	17.1
Smoking cigarettes	65	16.3
Taking anti-inflammatory drugs (Aspirin, Celebrex)	60	15.1

Table 6 Differences in Knowledge Regarding *H. pylori* Based on Participants' Demographic Characteristics

Variable	Mean (SD)	t or F	*p*-value
Age[b]		0.346	0.792
18–29	4.28 (1.6)		
30–39	4.47 (1.7)		
40–60	4.32 (1.7)		
>60	4.00(2.1)		
Gender[a]		0.916	0.360
Male	4.43 (1.6)		
Female	4.27 (1.6)		
Educational Level[b]		1.017	0.398
Elementary school	3.50 (1.8)		
High school	4.08 (1.8)		
Bachelor	4.35 (1.5)		
Masters	4.48 (1.7)		
Ph.D	4.54 (1.7)		
Employment Status[a]		2.725	0.007**
Medical	4.55 (1.5)		
Non-medical	4.11 (1.6)		

Notes: [a]independent *t*-test; [b]ANOVA test; **Significant at the 0.01 level.
Abbreviation: SD, Standard deviation.

Differences Between Knowledge Regarding H. pylori and Demographic Characteristics

As presented in Table 6, an independent-sample *t*-test and ANOVA were conducted to compare knowledge regarding *H. pylori* and demographic characteristics (gender, employment status, age, and educational level). The results showed significant differences in knowledge regarding *H. pylori* infection (t [396]=2.725, p <0.01) based on employment status.

Discussion

Helicobacter pylori infection can lead to chronic gastritis, gastro-duodenal diseases such as gastric cancer, gastric mucosa-associated lymphoid tissue lymphoma, and peptic ulcers. Usually acquired during childhood, *H. pylori* can last for a lifetime if left untreated. Approximately 50% of people worldwide are infected by *H. pylori*, and its prevalence varies according to geography and sanitary conditions. On the other hand, chronic *H. pylori carriage* dramatically increases the chance of acquiring site-specific illnesses. Approximately 10% of infected individuals develop peptic ulcer disease, 1–3% develop gastric adenocarcinoma, and fewer than 0.1% develop mucosa-associated lymphoid tissue (MALT) lymphoma.[19]

In most individuals, *H. pylori* colonization does not cause symptoms. Furthermore, *because* of its unique abilities, *H. pylori* can colonize the stomach epithelium in an acidic environment. The intricate virulence mechanisms of *H. pylori* bacteria, along with its interactions with the host immune system and environmental factors, govern the pathophysiology of the infection.[20] This leads to varied gastritis phenotypes, which in turn dictate the possibility of progression to a range of gastroduodenal diseases.

Research on *H. pylori* awareness among the general population in Jordan remains limited. This study aimed to evaluate Jordanians' knowledge, attitudes, and practices regarding *H. pylori* infection, highlighting the crucial role of public awareness in infection control. The level of knowledge within a population directly influences preventive behaviors, such as adopting healthier lifestyles and seeking timely medical care.[18] A well-informed community is more likely to take proactive measures to reduce *H. pylori* transmission, ultimately lowering infection rates and the risk of associated conditions like peptic ulcers and stomach cancer. Since increased awareness is strongly linked to

positive attitudes and improved health behaviors, targeted education and awareness programs can serve as effective strategies to curb the spread of the infection.

Participants who met the inclusion criteria were asked to complete a questionnaire through interview. The questionnaire was divided into three sections: sociodemographic data (including gender, age, educational level, and occupation), information about any current symptoms or previous health conditions, and an evaluation of participants' attitudes toward preventing gastric ulcers and avoiding *H. pylori* infection using multiple-choice questions. Additionally, daily practices that could affect *H. pylori* transmission were assessed.

Regarding *H. pylori* and gastrointestinal disorders, the sociodemographic details of the 398 participants provided crucial information on their knowledge, attitudes, and practices (KAP). The majority (70.4%) of participants were between the ages of 18 and 29 and likely to use contemporary health information platforms; however, they potentially lacked practical awareness of chronic gastric conditions. The predominance of female participants (72.6%) reflects common patterns in health-related research, that is, women are more likely to engage in health-seeking behaviors,[21] albeit this disparity may restrict the applicability of the findings to men. Furthermore, a reasonably educated sample with possibly higher baseline knowledge and receptiveness to health education was suggested by the fact that 71.6% of participants had a bachelor's degree. However, a substantial percentage of people (54.8%) work in non-medical sectors, which contrasts with findings from research in the UAE and Jordan[2,17] and suggests that there may be potential gaps in certain health-related knowledge, highlighting the need for easily accessible, focused educational activities. Notably, differences in knowledge about *H. pylori* infection were significant only in respect to employment status ($p=0.007$).

Overall, 87.9% of participants did not have a current *H. pylori* infection. Many patients reported experiencing acid reflux, constipation, or diarrhea (46.5 and 34.0%, respectively). Other symptoms included loss of appetite (30.7%) and heartburn (30.4%). Only 0.5% of the patients experienced recurrent episodes of stomach bleeding. This finding contrasts with other studies that suggest hemorrhage is the most common complication of ulcer disease, affecting an estimated 15–20% of ulcers.[22] Additionally, Popa et al reported that approximately 40% of patients with upper gastrointestinal bleeding had a hemorrhagic ulcer,[23] which was not reflected in our study (0.5%).

Regarding general knowledge about *H. pylori*, gastric ulcers and their link to cancer, 40–60% of participants demonstrated good knowledge on this subject, consistent with the results of another study.[24] In terms of stress, depression, smoking, alcohol consumption, and drug use, the study found that approximately 55% of contributors associated these factors with gastric ulcers. In particular, smoking has been linked in many studies to the presence of approximately 69 carcinogenic chemicals, and is known to increase the rate of treatment failure in *H. pylori* infection.[25]

Additionally, nearly 50% believed that poor diet and lifestyle contributed to this illness. Other factors cited by participants included medications, such as acetylsalicylic acid and diclofenac sodium (42%), malabsorption and food allergies (26%), viral or fungal infections, and autoimmune diseases (16.6 and 16.1%, respectively). These findings align with published data indicating that non-steroidal anti-inflammatory drug (NSAID) users infected with *H. pylori* face almost double the risk of developing bleeding peptic ulcers compared to uninfected NSAID users, and low-dose aspirin tends to cause more gastric injury in *H. pylori*-infected individuals than in uninfected individuals.[24] Furthermore, approximately 5% of participants mentioned umbilical hernias, skin burns, or bleeding as associated factors.

Conclusions

This study provides valuable insights into the knowledge, attitudes, and practices (KAP) of Jordanians regarding *H. pylori* infection, emphasizing the crucial role of public awareness in infection prevention and management. While participants demonstrated a moderate understanding of *H. pylori*, significant gaps remain in understanding the transmission, prevention, and long-term health risks of *H. pylori* and highlight the need for targeted educational interventions. Sociodemographic factors, particularly employment status, significantly influenced knowledge levels, suggesting that specific groups may require tailored awareness efforts.

The relatively low reported prevalence of current *H. pylori* infection and inconsistencies in perceived complications underscore the importance of further epidemiological studies to validate and expand upon these findings. Strengthening

public health strategies, including broader access to screening programs and education campaigns focusing on hygiene, is essential to improving awareness, encouraging preventive behaviors, and reducing infection rates.

By addressing misconceptions and promoting proactive health measures, targeted interventions can contribute to better disease control and lower complication risks, and ultimately improve gastric health outcomes in Jordan. Future research should explore the long-term impact of educational initiatives and assess the effectiveness of public health strategies in reducing *H. pylori* transmission and related complications.

Ethics Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or ethics committee) of Zarqa University (approval #2023/7/5259/36). All participants provided informed consent.

Acknowledgment

We gratefully acknowledge the faculty and staff who facilitated the distribution of this study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work. All authors read and agreed to the published version of the manuscript.

Funding

This research is partially funded by Zarqa University.

Disclosure

The authors declare no conflicts of interest.

References

1. Díaz P, Valderrama MV, Bravo J, Quest AFG. *Helicobacter pylori* and gastric cancer: adaptive cellular mechanisms involved in disease progression. *Front Microbiol*. 2018;9(JAN):1–10. doi:10.3389/fmicb.2018.00005
2. Alaridah N, Jarrar RF, Joudeh RM, et al. Knowledge and information sources towards *Helicobacter pylori* in Jordan. *PLoS One*. 2023;18(3 March):1–11. doi:10.1371/journal.pone.0278078
3. Yong X, Tang B, Li BS, et al. *Helicobacter pylori* virulence factor CagA promotes tumorigenesis of gastric cancer via multiple signaling pathways. *Cell Commun Signal*. 2015;13(1):1–13. doi:10.1186/s12964-015-0111-0
4. Suerbaum S, Michetti P. *Helicobacter pylori* infection. *N Engl J Med*. 2002;347(15):1175–1186. doi:10.1056/NEJMra020542
5. Wroblewski LE, Peek RM, Wilson KT. *Helicobacter pylori* and gastric cancer: factors that modulate disease risk. *Clin Microbiol Rev*. 2010;23(4):713–739. doi:10.1128/CMR.00011-10
6. Bravo D, Hoare A, Soto C, Valenzuela MA, Quest AF. *Helicobacter pylori* in human health and disease: mechanisms for local gastric and systemic effects. *World J Gastroenterol*. 2018;24(28):3071–3089. doi:10.3748/wjg.v24.i28.3071
7. Hooi JKY, Lai WY, Ng WK, et al. Global prevalence of *Helicobacter pylori* infection: systematic review and meta-analysis. *Gastroenterology*. 2017;153(2):420–429. doi:10.1053/j.gastro.2017.04.022
8. Gao S, Tang Z, Miao H, et al. Awareness and attitudes regarding *Helicobacter pylori* infection among university students: a national cross-sectional survey. *Life Res*. 2022;5(2):11. doi:10.53388/2022-0116-101
9. Obaidat MM, Roess AA. First nationwide seroepidemiology and risk factors report of *Helicobater pylori* in Jordan. *Helicobacter*. 2019;24(3):e12572. doi:10.1111/hel.12572
10. Khoder G, Sualeh Muhammad J, Mahmoud I, Soliman SSM, Burucoa C. Prevalence of *Helicobacter pylori* and its associated factors among healthy asymptomatic residents in the United Arab Emirates. *Pathogens*. 2019;8(2):44. doi:10.3390/pathogens8020044
11. Ishaq S, Nunn L. *Helicobacter pylori* and gastric cancer: a state of the art review. *Gastroenterol Hepatol Bed Bench*. 2015;8(6):S6–S14.
12. Examination H. of gastric cancer. 2001.
13. Correa P. Human gastric carcinogenesis: a multistep and multifactorial process- first American Cancer Society award lecture on cancer epidemiology and prevention. *Cancer Res*. 1992;52(24):6735–6740.
14. Correa P, Houghton J. Carcinogenesis of *Helicobacter pylori*. *Gastroenterology*. 2007;133(2):659–672. doi:10.1053/j.gastro.2007.06.026
15. Mera R, Fontham ETH, Bravo LE, et al. Long term follow up of patients treated for *Helicobacter pylori* infection. *Gut*. 2005;54(11):1536–1540. doi:10.1136/gut.2005.072009

16. Liu Q, Zeng X, Wang W, et al. Awareness of risk factors and warning symptoms and attitude towards gastric cancer screening among the general public in China: a cross-sectional study. *BMJ Open*. 2019;9(7):e029638. doi:10.1136/bmjopen-2019-029638
17. Malek AI, Abdelbagi M, Odeh L, Alotaibi AT, Alfardan MH, Barqawi HJ. Knowledge, attitudes and practices of adults in the United Arab Emirates regarding *Helicobacter pylori* induced gastric ulcers and cancers. *Asian Pacific J Cancer Prev*. 2021;22(5):1645–1652. doi:10.31557/APJCP.2021.22.5.1645
18. Amro FM, Rayan AH, Eshah NF, ALBashtawy MS. Knowledge, attitude, and practices concerning Covid-19 preventive measures among healthcare providers in Jordan. *SAGE Open Nurs*. 2022;8. doi:10.1177/23779608221106422
19. Peek RM, Crabtree JE. Helicobacter infection and gastric neoplasia. *J Pathol*. 2006;208(2):233–248. doi:10.1002/path.1868
20. Peek RM, Blaser MJ. *Helicobacter pylori* and gastrointestinal tract adenocarcinomas. *Nat Rev Cancer*. 2002;2(1):28–37. doi:10.1038/nrc703
21. Baumann E, Czerwinski F, Reifegerste D. Gender-specific determinants and patterns of online health information seeking: results from a representative German health survey. *J Med Internet Res*. 2017;19(4):e92. doi:10.2196/jmir.6668
22. Obleaga CV, Vere CC, Valcea ID, Ciorbagiu MC, Moraru E, Mirea CS. *Helicobacter pylori*: types of diseases, diagnosis, treatment and causes of therapeutic failure causes of therapeutic failure. *J Mind Med Sci*. 2016;3(2):150–161. doi:10.22543/2392-7674.1048
23. Hentschel E, Brandstätter G, Dragosics B, et al. Effect of ranitidine and amoxicillin plus metronidazole on the eradication of *Helicobacter pylori* and the recurrence of duodenal ulcer. *N Engl J Med*. 1993;328(5):308–312. doi:10.1056/nejm199302043280503
24. Ali A, Mohamed N, Garad Mohamed Y, Keleşoğlu S. Clinical presentation and surgical management of perforated peptic ulcer in a tertiary hospital in Mogadishu, Somalia: a 5-year retrospective study. *World J Emerg Surg*. 2022;17(1). doi:10.1186/s13017-022-00428-w
25. Wu J, Qian Z, Zhong D, Lin M. The impact of secondhand smoke on failure of *Helicobacter pylori* therapy is not inferior to that of smoking. *Clin Res Hepatol Gastroenterol*. 2024;48(6):102312. doi:10.1016/j.clinre.2024.102312