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Afr. J. Biomed. Res. Vol. 28(2s) (February 2025); 688-695

Research Article

The Association Between Helicobacter Infection and Serum Vitamin D3 Deficiency in Adult Patients Attending Baghdad Teaching Hospital

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ABSTRACT

Gastrointestinal disorders, particularly dyspepsia and chronic gastritis, present significant health challenges globally, with developing countries like Iraq being particularly affected due to high rates of *Helicobacter pylori* infection. Vitamin D3 deficiency, crucial for immune health, may exacerbate these conditions. This study aims to evaluate the prevalence of *H. pylori* infection and vitamin D3 deficiency among adult patients at Baghdad Teaching Hospital, exploring their association with various demographic and clinical factors to guide targeted interventions. Conducted from December 2023 to July 2024, this cross-sectional study involved 200 adult patients with gastrointestinal complaints. Data on socio-demographic, environmental, and lifestyle factors, as well as gastrointestinal symptoms, were collected using a structured questionnaire. Blood samples were tested for vitamin D3 levels, and *H. pylori* infection was diagnosed through clinical history and tests. Rigorous ethical standards, including informed consent and data confidentiality, were maintained. Findings revealed that 62% of participants had *H. pylori* infection, and 47% had vitamin D3 deficiency. A notable association between vitamin D3 deficiency and *H. pylori* infection was observed, with higher infection rates in individuals with obesity and those who smoked or consumed fast food. In contrast, no significant links were found between *H. pylori* infection and alcohol consumption or clean water access. Gastrointestinal symptoms like pain, bloating, diarrhea, and halitosis were strongly associated with *H. pylori*, while symptoms such as nausea, heartburn, and vomiting were not. The study underscores the significant prevalence of both *H. pylori* infection and vitamin D3 deficiency, with a clear link between the two. Addressing vitamin D3 deficiency and lifestyle factors, along with implementing regular screening, is essential for effective prevention and management of these gastrointestinal issues.

Keywords: *H. pylori*, Vitamin D3 deficiency, Association, Adult patients, and Baghdad

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Received: 15/01/2025

Accepted: 27/01/2025

DOI: <https://doi.org/10.53555/AJBR.v28i2S.6414>

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INTRODUCTION:

Gastrointestinal (GI) disorders represent a major global health issue, affecting individuals across diverse demographics. These conditions include a wide range of symptoms, such as dyspepsia, peptic ulcers, and chronic gastritis, all of which significantly diminish patients' quality of life. ⁽¹⁾ Understanding the underlying causes of these disorders is crucial for developing effective treatment strategies.

Helicobacter pylori (*H. pylori*) are a bacterium widely recognized for its role in the development of several GI pathologies. As a gram-negative bacterium, *H. pylori* colonize the gastric mucosa and are implicated in chronic gastritis, peptic ulcer disease, and even gastric cancer. It is estimated that approximately half of the world's population harbors *H. pylori*, with infection rates particularly high in developing countries, including Iraq. ⁽²⁾ The pathogenicity of *H. pylori* is largely due to its production of urease, an enzyme that hydrolyzes urea into ammonia, creating an alkaline environment that promotes bacterial survival and disrupts the gastric epithelial barrier, leading to inflammation. ⁽³⁾

Vitamin D, particularly in its D3 form (cholecalciferol), is essential for maintaining calcium homeostasis and bone health. Beyond these functions, vitamin D has been increasingly recognized for its role in modulating immune responses. Deficiency in vitamin D has been linked to various chronic conditions, including autoimmune diseases, cardiovascular diseases, and certain types of cancer. ⁽⁴⁾ Recent studies have also highlighted the potential role of vitamin D in GI health, suggesting that deficiency may increase the risk of inflammatory bowel diseases and other GI disorders. ^(5, 6)

The potential interaction between *H. pylori* infection and vitamin D deficiency has garnered growing interest in the medical community. Several studies have suggested a negative correlation between *H. pylori* infection and serum vitamin D levels, indicating that individuals infected with *H. pylori* may have lower levels of vitamin D compared to uninfected individuals. ^(7, 8) This relationship is hypothesized to be bidirectional: while vitamin D may enhance the body's ability to mount an immune response against *H. pylori*, the infection itself may impair the absorption or metabolism of vitamin D, thereby exacerbating deficiency. ⁽⁹⁾ However, the evidence remains inconsistent, with some studies failing to establish a definitive link between these factors, highlighting the need for further research, particularly in specific populations and geographical regions. ⁽¹⁰⁾

This investigation is particularly relevant in Iraq, where both *H. pylori* infection and vitamin D deficiency are highly prevalent. Iraq's socio-economic conditions, including overcrowding, limited access to clean water, and inadequate healthcare infrastructure, contribute to

the widespread occurrence of *H. pylori*. ⁽¹¹⁾ Concurrently, vitamin D deficiency is a significant public health concern in the region, driven by factors such as limited sun exposure, dietary habits, and cultural practices related to clothing. ⁽¹²⁾ The high prevalence of both conditions in the Iraqi population makes it an ideal setting to explore the potential association between *H. pylori* infection and vitamin D deficiency.

The study's outcomes may significantly impact clinical practice and public health in Iraq by potentially establishing a strong link between *H. pylori* infection and vitamin D deficiency. This association could prompt the development of targeted interventions for vitamin D deficiency within the broader management of *H. pylori*-related gastrointestinal disorders. Furthermore, the findings could guide public health strategies to reduce vitamin D deficiency prevalence, improving overall health outcomes and lessening the burden of chronic diseases. Ultimately, this research will enhance understanding of the intricate relationship between infection, nutrition, and gastrointestinal health, paving the way for future studies and interventions.

Objectives of the Study

1. To determine the prevalence of *H. pylori* infection and serum vitamin D3 deficiency in adult patients attending the GIT clinic at Baghdad Teaching Hospital.
2. To investigate the association between *H. pylori* infection and Serum Vitamin D3 Deficiency, alongside any demographic or clinical factors influencing this relationship.

METHODOLOGY:

Study Design: Cross-sectional study was conducted to assess the prevalence of exposures (*H. pylori* infection) and outcomes (vitamin D3 deficiency) within a defined population at a specific time.

Study Setting and Timing: This study was carried out at the GI clinic of Baghdad Teaching Hospital, Iraq. Data collection was conducted over a period extending from December 15, 2023, to July 15, 2024. The GI clinic, being a prominent referral center, provided a relevant setting for evaluating the prevalence of *H. pylori* infection and serum vitamin D3 deficiency among adult patients presenting with GI complaints.

Sample Population, Size, and Technique: This cross-sectional study was conducted at Baghdad Teaching Hospital, targeting adult patients with GI complaints. A total of 200 participants, both male and female, were recruited using convenience sampling from those attending the GI Clinic. Eligible participants were required to be between 18 and 75 years old, have GI complaints, and provide informed consent. The study excluded individuals with a history of *Helicobacter pylori* eradication therapy, those who were pregnant or lactating, patients with major systemic diseases,

conditions that could affect serum vitamin D levels, and those currently using vitamin D supplements.

Data Collection Tools: To comprehensively evaluate the factors influencing the association between *H. pylori* infection and vitamin D3 deficiency, this study implements a detailed data collection strategy utilizing a carefully crafted structured questionnaire divided into three principal domains. The first domain, Sociodemographic Information, encompasses vital details such as age, gender, residency, education, occupation, marital status, and history of smoking and alcohol use. The second domain, Environmental and Lifestyle Factors, collects data on participants' sources of drinking water, dietary intake of vitamin D, sun exposure, consumption of fast food, and use of vitamin D supplements. The third domain, GI Symptoms, documents symptoms related to *H. pylori* infection, including epigastric pain, nausea, heartburn, vomiting, bloating, diarrhea, and halitosis. Anthropometric measurements, including weight, height, and BMI, are also recorded. To diagnose serum vitamin D3 deficiency, blood samples are analyzed to determine serum concentrations of 25-hydroxyvitamin D (25(OH) D), with levels below 20 ng/mL indicating deficiency. The diagnosis of *H. pylori* infection is based on participants' clinical history: newly diagnosed individuals are subjected to blood sample serological testing, while those with a previous diagnosis are evaluated through stool antigen tests or urea breath tests to determine current infection status.

Data Management and Analysis: To gain a comprehensive understanding of the relationships between *Helicobacter pylori* infection, vitamin D3 deficiency, and associated demographic and lifestyle factors, statistical analyses were conducted using SPSS software version 26. Descriptive statistics were employed to provide a detailed summary of demographic characteristics, as well as environmental and lifestyle factors related to *H. pylori* infection, which were presented in tables and figures. The associations between different categorical variables were assessed using chi-square tests. Furthermore, logistic regression analysis was performed to identify independent factors influencing *H. pylori* infection, while controlling for potential confounders.

Official and Ethical Approvals: Official approval (Reference No. 1919) was obtained from the Arab

Board Scientific and Ethical Committee, the Iraqi Ministry of Health on September 2, 2023. Additionally, written informed consent was acquired from all participants. Communication with the Baghdad City Directorate ensured permission for conducting the study in the Baghdad Teaching Hospital. To protect participant confidentiality, anonymization procedures were implemented on the data.

RESULTS

Table 1 provides an overview of the socio-demographic characteristics and *H. pylori* infection rates among 200 participants, who were predominantly female (75.5%). Age distribution showed that 42.0% were 18-30 years old, 37.5% were 31-45, 13.0% were 46-60, and 7.5% were over 60. Marital status included 56.0% married, 40.5% unmarried, and 3.5% divorced or widowed. Educational levels varied, with 55.0% holding graduate or postgraduate degrees and 22.5% having secondary education. Most participants (95.0%) resided in urban areas, and 38.0% were not employed or were housewives; employment status showed 17.5% were governmental employees, 18.0% self-employed, and 26.5% in other roles. Economically, 54.0% reported sufficient income, 44.0% insufficient, and 2.0% no income. Among the participants, 124 (62.0%) tested positive for *H. pylori*, with a higher prevalence among females (64.9%) than males (53.1%), though this difference was not statistically significant ($p=0.138$). Infection rates were highest in the 18-30 age group (66.7%) and lowest among those aged 46-60 (46.2%), without significant differences ($p=0.296$). Marital status showed higher infection rates among unmarried participants (69.1%) compared to married (57.1%) and divorced/widowed individuals (57.1%) ($p=0.230$). Although infection rates decreased with higher education levels, from 80.0% among the illiterate to lower rates in more educated groups, this trend was not statistically significant ($p=0.182$). Residency did not significantly affect infection rates, with urban residents at 62.1% and rural residents at 60.0% ($p=0.894$). Occupational status revealed that students had the highest infection rate (66.0%), though differences among other occupations were insignificant ($p=0.479$). Economic status was significantly associated with infection rates ($p=0.032$), as those with no income (75.0%) and insufficient income (71.6%) exhibited higher infection rates compared to participants with sufficient income (53.7%).

Table 1: Association between socio-demographic variables and H. pylori infection in study participants				
Variables	H. Pyloric Infection			P- value
	Yes 124 (62.0)	No 76 (38.0)	Total 200 (100.0)	
Gender				
Male	26 (53.1)	23 (46.9)	49 (24.5)	0.138
Female	98 (64.9)	53 (35.1)	151 (75.5)	
Age group (years)				
18- 30	56 (66.7)	28 (33.3)	84 (42.0)	0.296
31- 45	46 (61.3)	29 (38.7)	75 (37.5)	
46- 60	12 (46.2)	14 (53.8)	26 (13.0)	
+ 60	10 (66.7)	5 (33.3)	15 (7.5)	
Marital state				
Unmarried	56 (69.1)	25 (30.9)	81 (40.5)	0.230
Married	64 (57.1)	48 (42.9)	112 (56.0)	
Divorce & widowed	4 (57.1)	3 (42.9)	7 (3.5)	
Education level				
Illiterate	4 (80.0)	1 (20.0)	5 (2.5)	0.182
Primary	11 (55.0)	9 (45.0)	20 (10.0)	
Intermediate	16 (80.0)	4 (20.0)	20 (10.0)	
Secondary	31 (68.9)	14 (31.1)	45 (22.5)	
Graduate & postgraduate	62 (56.4)	48 (43.6)	110 (55.0)	
Residency				
Urban	118 (62.1)	72 (37.9)	190 (95.0)	0894
Rural	6 (60.0)	4 (40.0)	10 (5.0)	
Occupation				
Not work/House wife	50 (65.8)	26 (34.2)	76 (38.0)	0.479
Governmental employee	20 (57.1)	15 (41.9)	35 (17.5)	
Self-employee	19 (52.8)	17 (47.2)	36 (18.0)	
Others (student)	35 (66.0)	18 (34.0)	53 (26.5)	
Economic status				
No income	3 (75.0)	1 (25.0)	4 (2.0)	0.032
Not enough income	63 (71.6)	25 (28.4)	88 (44.0)	
Enough income	58 (53.7)	50 (46.3)	108 (54.0)	

Table 2 presents significant findings regarding H. pylori infection and vitamin D3 deficiency among 200 participants. A high prevalence of H. pylori infection was observed, with 62.0% (n=124) testing positive and 38.0% (n=76) uninfected. Nearly half of the participants (47.0%, n=94) had vitamin D3 deficiency, while 53.0% (n=106) maintained sufficient levels. Regarding BMI, most individuals were of normal weight (48.0%, n=96), with others classified as overweight (35.5%, n=71) or obese (14.5%, n=29), and only a small percentage underweight (2.0%, n=4). Among those deficient in vitamin D3, 70.2% (n=66) were positive for H. pylori, compared to 29.8% (n=28) who were not, revealing a significant association

(p=0.024). Conversely, in participants without vitamin D3 deficiency, 54.7% (n=58) were H. pylori positive, while 45.3% (n=48) were not. Examining BMI categories, H. pylori prevalence was notably higher in obese individuals (79.3%) than in underweight (25.0%), normal weight (59.4%), and overweight (60.6%) groups, with statistically significant differences (p=0.011). Specifically, 1 (25.0%) of the underweight group, 57 (59.4%) of the normal weight group, 43 (60.6%) of the overweight group, and 23 (79.3%) of the obese group were H. pylori positive, indicating a strong association between H. pylori infection and both vitamin D3 deficiency and BMI categories.

Table 2: Association between H. pylori infection with vitamin D3 deficiency and the BMI Categories among study participants

Variables	H. Pyloric Infection			P- value
	Yes 124 (62.0)	No 76 (38.0)	Total 200 (100.0)	
Vitamin D3 Deficiency				
Yes	66 (70.2)	28 (29.8)	94 (47.0)	0.024
No	58 (54.7)	48 (45.3)	106 (53.0)	
BMI categories				
Under weight	1 (25.0)	3 (75.0)	4 (2.0)	0.011
Normal weight	57 (59.4)	39 (40.6)	96 (48.0)	
Over weight	43 (60.6)	28 (39.4)	71 (35.5)	
Obesity	23 (79.3)	6 (20.7)	29 (14.5)	

Table 3 summarizes the lifestyle and dietary factors among the study population. Of the participants, 19.5% are smokers, 80.5% are non-smokers, and alcohol consumption is low at 2.0%. Nearly all participants (99.0%) have access to clean water, while sunlight exposure is adequate for only 27.5% and insufficient for 72.5%. Regarding dietary vitamin D intake, 35.5% consume adequate amounts, while 64.5% do not. Fast food is consumed by 39.0% of participants, with 61.0% avoiding it. Among the 200 participants, 62.0% tested positive for H. pylori, and 38.0% were negative. A significant association with H. pylori infection was observed among smokers, with 79.5% testing positive

(p=0.012). In contrast, alcohol consumption, clean water access, and sunlight exposure did not show significant associations with H. pylori infection (p=0.617, p=0.069, and p=0.312, respectively). However, there was a significant link between H. pylori infection and dietary vitamin D intake, with 67.4% of those not consuming vitamin D testing positive (p=0.033). Fast food consumption was also significantly associated, with 70.5% of fast food consumers testing positive for H. pylori (p=0.047). These findings highlight significant associations between H. pylori infection and smoking, fast food consumption, and low dietary vitamin D intake.

Table 3: Association of H. pylori infection with lifestyle and dietary factors among study participants

Variables	H. Pyloric Infection			P- value
	Yes 124 (62.0)	No 76 (38.0)	Total 200 (100.0)	
Smoker				
Yes	31 (79.5)	8 (20.5)	39 (19.5)	0.012
No	93 (57.7)	68 (42.3)	161 (80.5)	
Consume alcoholic				
Yes	2 (50.0)	2 (50.0)	4 (2.0)	0.617
No	122 (62.2)	74 (37.8)	196 (98.0)	
Access to clean water				
Yes	124 (62.6)	74 (37.4)	198 (99.0)	0.069
No	0 (0.0)	2 (100.0)	2 (1.0)	
Exposed Sunlight				
Yes	31 (56.4)	24 (43.6)	55 (27.5)	0.312
No	93 (64.1)	52 (35.9)	145 (72.5)	
Dietary intake of Vitamin D				
Yes	37 (52.1)	34 (47.9)	71 (35.5)	0.033
No	87 (67.4)	42 (32.6)	129 (64.5)	
Fast food consumption				
Yes	55 (70.5)	23 (29.5)	78 (39.0)	0.047
No	69 (56.6)	53 (43.4)	122 (61.0)	

Table 4 presents the prevalence of gastrointestinal symptoms among 200 study participants, revealing significant variability in symptom occurrence. Pain was the most common, reported by 158 participants (79.0%), while 42 (21.0%) experienced no pain. Nausea affected 119 participants (59.5%), while 81 (40.5%) did not report it. Heartburn was the least common symptom, affecting only 17 participants

(8.5%), with 183 (91.5%) not experiencing it. Vomiting was reported by 90 participants (45.0%), while 110 (55.0%) did not experience it. Bloating affected half the participants (100, 50.0%), while diarrhea and halitosis affected 33 (16.5%) and 47 (23.5%) participants, respectively. Among these 200 participants, 124 (62.0%) tested positive for H. pylori infection, showing statistically significant associations

with certain symptoms. Pain was significantly associated with H. pylori, as 102 of 158 participants with pain (64.5%) tested positive, compared to 22 of 42 without pain (52.4%; $p = 0.011$). Bloating, diarrhea, and halitosis were similarly linked with H. pylori, with 70 of 100 participants with bloating (70.0%), 28 of 33 with diarrhea (84.8%), and 35 of 47 with halitosis (74.5%) testing positive, with p -values of 0.020, 0.003,

and 0.044, respectively. However, symptoms such as nausea, heartburn, and vomiting did not show significant associations (p -values 0.086, 0.810, and 0.349, respectively). These findings suggest that while symptoms like pain, bloating, diarrhea, and halitosis may be strongly linked to H. pylori infection, others may not be as predictive.

Table 4: Association of gastrointestinal symptoms with H. pylori infection among study participants				
Variables	H. Pyloric Infection			P- value
	Yes 124 (62.0)	No 76 (38.0)	Total 200 (100.0)	
Pain				
Yes	102 (64.5)	56 (35.5)	158 (79.0)	0.011
No	22 (52.4)	20 (47.6)	42 (21.0)	
Nausea				
Yes	68 (57.1)	51 (42.9)	119 (59.5)	0.086
No	56 (69.1)	25 (30.9)	81 (40.5)	
Heart burn				
Yes	11(64.7)	6 (35.3)	17 (8.5)	0.810
No	113 (61.7)	70 (38.3)	183 (91.5)	
Vomiting				
Yes	59 (65.6)	31 (34.4)	90 (45.0)	0.349
No	65 (59.1)	45 (40.9)	110 (55.0)	
Bloating				
Yes	70 (70.0)	30 (30.0)	100 (50.0)	0.020
No	54 (54.0)	45 (46.0)	100 (50.0)	
Diarrhea				
Yes	28 (84.8)	5 (15.2)	33 (16.5)	0.003
No	96 (57.5)	71 (42.5)	167 (83.5)	
Halitosis				
Yes	35 (74.5)	12 (25.5)	47 (23.5)	0.044
No	89 (58.2)	64 (41.8)	153 (76.5)	

DISCUSSION:

The present study aimed to investigate the association between H. pylori infection, serum vitamin D3 deficiency, and various socio-demographic, lifestyle, and dietary factors among a population of 200 participants. The findings offer valuable insights into the prevalence of H. pylori infection, vitamin D3 deficiency and its potential correlates, shedding light on significant public health concerns.

The study population was predominantly female (75.5%), with the majority aged between 18-30 years (42.0%). A significant portion of the participants had graduate or postgraduate education (55.0%), and most resided in urban areas (95.0%). These socio-demographic characteristics are reflective of similar studies conducted in various regions, highlighting the diverse yet predominantly urban and educated nature of the sample. For instance, a study in Jordan reported a higher prevalence of H. pylori infection among females, which aligns with the findings of this study; although the exact reasons for this gender disparity remain unclear. (13)

The analysis revealed no statistically significant association between gender, age, marital status, or

residency and H. pylori infection, which is consistent with findings from studies in neighboring countries, such as Iran and Saudi Arabia, where socio-demographic factors were not strongly associated with H. pylori prevalence. (14, 15) However, the significant association between economic status and H. pylori infection in this study, particularly among those with no income or insufficient income, underscores the role of socio-economic factors in the spread of the infection. This finding aligns with global research indicating that lower socio-economic status is often associated with higher rates of H. pylori infection due to factors like overcrowding, poor sanitation, and limited access to healthcare. (16)

The study found a significant association between vitamin D3 deficiency and H. pylori infection, with 70.2% of individuals with vitamin D3 deficiency testing positive for H. pylori. This association is noteworthy as it supports the growing body of evidence suggesting that vitamin D3 plays a crucial role in immune function and may influence susceptibility to infections, including H. pylori. (17) A similar study conducted in Turkey found that patients with H. pylori infection had significantly lower levels of vitamin D3

compared to uninfected individuals, suggesting a potential protective role of adequate vitamin D3 levels against *H. pylori* infection. ⁽¹⁸⁾

Globally, studies have reported varying levels of vitamin D3 deficiency among different populations, with high prevalence rates in the Middle East and North Africa (MENA) region due to factors such as limited sun exposure and dietary habits. ⁽¹⁹⁾ The significant association observed in this study aligns with regional data, reinforcing the need for public health interventions to address vitamin D3 deficiency, particularly in populations at higher risk for *H. pylori* infection. ⁽²⁰⁾

The study revealed a significant association between BMI categories and *H. pylori* infection, with the highest prevalence observed among obese individuals (79.3%). This finding is consistent with research indicating a potential link between obesity and *H. pylori* infection. ⁽²¹⁾ For example, a study conducted in China found that obese individuals had a higher risk of *H. pylori* infection compared to those with normal weight, suggesting that obesity-related changes in the gastrointestinal environment may favor *H. pylori* colonization. ⁽²²⁾

The relationship between obesity and *H. pylori* infection is complex and may involve multiple factors, including altered gastric acid secretion, changes in gut microbiota, and inflammatory responses associated with obesity. While some studies have suggested that *H. pylori* infection may contribute to weight gain and obesity, the directionality of this relationship remains unclear and warrants further investigation. ⁽²³⁾

The study identified significant associations between *H. pylori* infection and certain lifestyle and dietary factors, particularly smoking, dietary vitamin D intake, and fast food consumption. Smoking was significantly associated with *H. pylori* infection, with smokers showing a higher prevalence of infection (79.5%) compared to non-smokers. This finding is consistent with global research, including a meta-analysis that demonstrated a positive association between smoking and *H. pylori* infection, possibly due to the adverse effects of smoking on gastric mucosal immunity and defense mechanisms. ⁽²⁴⁾

Dietary intake of vitamin D also showed a significant association with *H. pylori* infection, where individuals with inadequate vitamin D intake had a higher prevalence of infection. This aligns with the observed association between vitamin D3 deficiency and *H. pylori* infection, further emphasizing the importance of adequate vitamin D intake in potentially reducing the risk of infection. ⁽²⁵⁾

Fast food consumption was another significant factor, with higher infection rates observed among those who consumed fast food. This finding resonates with studies linking poor dietary habits, such as high fast food consumption, with increased risk of gastrointestinal infections, including *H. pylori*. ⁽²⁶⁾ The high-fat, low-nutrient content of fast foods may contribute to a favorable environment for *H. pylori* colonization and persistence. ⁽²⁷⁾

The study also explored the association between *H. pylori* infection and various gastrointestinal symptoms, finding significant associations with pain, nausea, vomiting, and bloating. These symptoms are commonly reported in individuals with *H. pylori* infection and are consistent with the clinical presentation of the infection in other studies conducted both regionally and globally. ⁽²⁸⁾ Pain, notably, showed a significant association with *H. pylori* infection, consistent with the established role of *H. pylori* in causing gastritis and peptic ulcer disease, which often result in abdominal pain. ⁽²⁹⁾ The significant correlation between pain and bloating with *H. pylori* infection further underscores the pathogen's involvement in upper gastrointestinal discomfort, emphasizing the importance of considering *H. pylori* testing in patients presenting with dyspeptic symptoms. ⁽³⁰⁾

CONCLUSION:

The study highlights a significant prevalence of *H. pylori* infection (62.0%) and vitamin D3 deficiency (47.0%), revealing a strong association between the two. Individuals with vitamin D3 deficiency were found to be at a higher risk for *H. pylori* infection, suggesting that low vitamin D3 levels may increase susceptibility to the infection. Additionally, *H. pylori* was more common in individuals with obesity, indicating a link between higher body mass and infection rates. Lifestyle factors like smoking and fast food consumption were also significantly associated with *H. pylori* infection. Gastrointestinal symptoms such as pain, bloating and diarrhea showed a strong correlation with the infection, whereas nausea and vomiting were less relevant. These findings underscore the importance of addressing vitamin D3 deficiency and lifestyle factors as part of preventive strategies and suggest that regular screening for *H. pylori* in at-risk populations could enhance early diagnosis and management.

Acknowledgments: The researcher expresses deep gratitude to Assistant Prof. Dr. Waleed Ibraheem Ali for his vital guidance and supervision throughout the study. Thanks are also extended to Dr. Ihab Saeed Ahmed, Consultant Gastroenterologist at Baghdad Teaching Hospital, for his assistance in diagnosing cases and supporting data collection. Appreciation is given to the Arab Board of Health Specializations for their approval and commitment to ethical standards, as well as to the study participants for their essential cooperation and data contributions.

Conflict of Interest: All contributing authors declare no conflict of interest with regards to the publication of this article.

Financial support: This study was entirely self-funded by the researcher and did not receive any financial support from any institution or organization.

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