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Environmental Risk Factors of *Helicobacter pylori* Infection Among Dyspeptic Patients at Rivers State University Teaching Hospital (RSUTH): A Cross-Sectional Study

Kingsley Okpara[1ab]*, Edwin Isotu Edeh[1b] and Theresa Thompson

[1a] Institute of Geosciences and Environmental Management, Rivers State University, Port Harcourt, Nigeria
[1b] Nigerian Environmental Summit Group, Abuja, Nigeria.
School of Medical Laboratory Science, Rivers State College of Health Science Management, Port Harcourt, Nigeria.

Corresponding author's email address: kingsley.okpara@ust.edu.ng

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Abstract

Helicobacter pylori (*H. pylori*) is a significant global health concern, linked to chronic gastritis, peptic ulcers, and gastric cancer. This study aimed to determine the prevalence of *H. pylori* infection and identify factors associated infection rate among dyspeptic patients at Rivers State University Teaching Hospital (RSUTH), Nigeria. A cross-sectional design was employed, involving 1,106 consenting patients with ulcer symptoms who provided stool samples for *H. pylori* antigen testing. The prevalence rate was calculated using descriptive statistics and chi-square test was used to determine the association. Results revealed a 65.6% overall prevalence of *H. pylori* infection. Contaminated water and poor sanitary practices were identified as the primary risk factors, contributing to 50% and 30% of the cases, respectively. There was no significant association between *H. pylori* prevalence and variables such as gender, age, marital status, occupation, religion, or year of diagnosis ($p>0.05$). The study has shown that patient's sociodemographics such as gender, merital status, age, occupation and year do not affcet the distribution of *H. pylori* infection among dyspepetic patients attending RSUTH. These findings highlight the urgent need for improved water quality and environmental sanitation to mitigate the spread of *H. pylori* in this population. Regular screening and public health interventions are recommended to manage and prevent further transmission of this infection.

Keywords: *Dyspepsia, Helicobacter pylori, Prevalence, Risk factors.*

INTRODUCTION

The prevalence of *Helicobacter pylori* (*H. pylori*) infection varies significantly worldwide, with rates ranging from 85% to 95% in developing countries and 30% to 50% in developed nations [1]. Despite advancements in sanitation and eradication methods, H. pylori remains prevalent, affecting 50% to 70% of the global population. It is the most common chronic bacterial infection, impacting approximately 4.4 billion individuals globally [2]. This prevalence is closely tied to socio-economic status and hygiene levels, with the highest rates observed in Africa (70.1%) and the lowest in Switzerland (18.9%). In South Asia. Pakistan and India have high prevalence rates of 81% and 63.5%, respectively, while in Western Asia, Turkey's rate is 77.2%. In Nigeria, H. pylori prevalence varies across regions. Community-based studies indicate a prevalence of 26% in the Northern region and 45% in the Middle Belt, with 20-30% of individuals in the Southern region reporting chronic or recurrent dyspeptic symptoms. Despite consistent diagnostic criteria, prevalence rates fluctuate widely. The highest reported prevalence in Nigeria is 87.7%, with rates of 58%, 69%, and 91% in children under one year, between 7-10 years, and between 10-19 years, respectively [3]. Among dyspeptic individuals, H. pylori seroprevalence is 94.5% in the Western region [4], 81.5% on histology in the Northwest, and 91% via rapid urease testing in the North Central zone [5]. H. pylori is a gram-negative, microaerophilic bacterium that colonizes the gastric mucosa, affecting over half of the world's population with significant geographic variability [2]. It primarily colonizes the stomach and duodenum, leading to ulcers and certain types of stomach cancer. The infection, typically acquired during childhood, persists lifelong without antibiotic treatment and is often asymptomatic for extended periods. In developing countries like Nigeria, the infection rate is high in children, but recent research suggests that adults, especially those of advanced age, now exhibit the highest prevalence, ranging from less than 10% to over 80%. Prolonged colonization can damage the gastric mucosa, resulting in chronic gastritis, peptic ulcers, and gastric mucosa-associated lymphoid tissue (MALT) lymphoma [6]. H. pylori is classified as a class 1 carcinogen by the International Agency for Research on Cancer, being one of the strongest risk factors for gastric malignancies, with about 89% of all gastric cancers attributed to H. pylori infection [7]. Eradicating this infection has been shown to reduce gastric cancer incidence. Globally, gastric cancer ranks sixth in incidence and second in mortality among all cancers [8]. In the United Arab Emirates, it was ranked seventh among the top ten cancers in 2011 [9]. Although the incidence and mortality rates of gastric cancer have decreased over the past two decades, controlling H. pylori infection remains critical to further reducing this burden [10]. Screening and eradication of H. pylori are cost-effective strategies for reducing gastric cancer and peptic ulcers in high-prevalence populations. Additionally, H. pylori has been linked to extra-digestive diseases like iron deficiency anemia and idiopathic thrombocytopenic purpura [11]. The routes of H. pylori infection are closely associated with food and personal hygiene. Risk factors include age, socio-economic status, number of siblings, household crowding, ethnicity, migration from high-prevalence regions, family infection status, and sanitation facilities. In Nigeria, studies show wide variation in H. pylori prevalence among children, ranging from 11% to 92% across regions. These studies primarily used serological tests, which do not distinguish between past and current infections [12]. However,

the stool monoclonal antigen test, which has high sensitivity and specificity, is now the standard of care for diagnosing H. pylori infection in children [12]. This non-invasive method is employed in this study to determine the prevalence of H. pylori among dyspeptic patients.

Helicobacter pylori infection is a major global health concern, linked to chronic gastritis, peptic ulcer disease, and gastric cancer. In Nigeria, *H. pylori* prevalence is notably high, with many infected individuals remaining asymptomatic until adulthood. Prolonged infection can damage the gastric mucosa, leading to severe upper gastrointestinal diseases and increasing the risk of gastric cancer. This study aims to determine the prevalence of *H. pylori* and associated risk factors among dyspeptic patients at Rivers State University Teaching Hospital (RSUTH) in Nigeria. The general Objective is to determine the prevalence of *H. pylori* infection and identify the most affected age and sex groups, as well as associated risk factors, among patients with gastritis and peptic ulcers at RSUTH while the specific objectives are, to determine the prevalence of *H. pylori* in patients with peptic ulcers, gastritis, or gastric ulcers attending RSUTH, to assess *H. pylori* infection prevalence across different age groups, sexes, marital statuses, occupations, and religious groups among patients at RSUTH and to identify risk factors associated with *H. pylori* infection in patients with ulcers at RSUTH. This study seeks to answer several key research questions: What is the prevalence of *Helicobacter pylori* infection among patients with symptoms of peptic ulcers, gastritis, or gastric ulcers at Rivers State University Teaching Hospital (RSUTH)? Additionally, what are the patterns of infection across different age and sex groups within this patient population? Finally, what are the predisposing risk factors linked to *H. pylori* infection among these patients?, This study will determine the prevalence of *H. pylori* based on age, sex, occupation, religion, and marital status among infected individuals. It will also identify the risk factors contributing to the increased prevalence of the infection. The rising number of positive cases, along with the associated morbidity and mortality rates, highlights the urgency of addressing *H. pylori* infection, which is exacerbated by poor living conditions and unhygienic environments.

METHODOLOGY

Research Design

This study utilized a cross-sectional design.

Study Area

The research was conducted at Rivers State University Teaching Hospital (RSUTH), formerly known as Braithwaite Memorial Specialist Hospital (BMSH), located in Old GRA, Port Harcourt, Rivers State. Established in March 1925, RSUTH is a government-owned facility initially serving senior civil servants before becoming a general hospital and later a specialist institution. In 2018, it was renamed RSUTH to serve as the teaching hospital for the state-owned university's College of Medical Sciences. RSUTH is officially recognized by the Federal Ministry of Health and is one of the largest hospitals in the Niger Delta, with 375 licensed beds and 731 medical staff. The hospital is accredited by several medical councils and has departments including Medicine, Pediatrics, Radiology, Surgery, and more.

Ethical Considerations

The ethical clearance to conduct this study was obtained from the Ethics Committee, Rivers State University Teaching Hospital. This clearance pave the way for the commencement of the study at the hospital. In addition, written consent was obtained directly from adult participants while the parents or legal guardian of participating children and those below age 18 provided written consents on their behalf.

Study Population

The study involved 1,106 patients, both male and female, aged one year and above, who presented with ulcer symptoms during the study period.

Sampling Technique

A purposive sampling technique was employed to recruit participants. Patients who presented with symptoms indicative of ulcers or gastritis at the outpatient department were approached about the study.

Questionnaires

Participants completed questionnaires providing key information such as age and gender. The data collected was used to categorize participants into different age groups to assess the prevalence of *H. pylori* infection and to evaluate associated risk factors among patients with gastritis and ulcers. The questionnaires were completed voluntarily and the responses were analyzed accordingly.

Sample Collection

Participants were given clean, dry, grease-free stool containers and instructed to provide stool samples for *H. pylori* testing without contaminating the specimen. The collected stool samples were immediately transported to the laboratory for analysis. All participants voluntarily provided stool samples for the detection of *H. pylori* antigens.

Laboratory Analysis for *H. pylori* Stool Antigen Test

The *H. pylori* stool antigen test was based on immunochromatography for the qualitative detection of *H. pylori* antigens (Bio tracers TM). Specific monoclonal antibodies coated on the test device membrane were used. A small stool sample (approximately 50 mg or 100 µl for liquid stools) was collected using a sample collection stick or pipette from multiple sites of the specimen. The sample was then mixed with phosphate buffer in a sample extraction tube, which was securely closed and thoroughly shaken to homogenize the stool with the buffer for analysis. The testing device (cassette) was then taken out of the foil pouch and placed on a clean and flat surface, preferably on a bench. Then the dispenser cap of the sample tube was twisted off and by holding the tube vertically, five (5) drops of the mixture of the stool sample and buffer were dispensed into the sample well of the cassette test device. The results were read after 15 minutes

Test outcome information

For a negative test, no H. pylori antigen was present, so no colored line appeared on the test window (T). For a positive test, the H. pylori antigen reacted with the antibody conjugate, resulting in a red line on the test window (T). An additional line appeared on the control window (C) in both cases, confirming test validity. Results were interpreted within 15 minutes. A red line on both the test (T) and control (C) windows indicated a positive result, while a line on the control (C) window only indicated a negative result.

Statistical Analysis

Data analysis was conducted using SPSS version 20. Descriptive statistics, including percentages, means, and frequencies, were used to summarize the data. Inferential statistics were performed using Pearson chi-square tests, with a significance level of alpha equal to 0.05. Results were presented in charts and frequency tables.

RESULTS

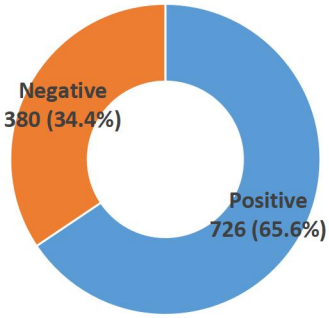

Figure 1: The prevalence of *H pylori* infection

The Figure 1 above showed the prevalence rate of H pylori among patients suspeccted to have gastric ulcer. The result showed that the prevalence of confirmed H pylori infection was 726 (66%).

Table 1: Gender Prevalence of *Helicobacter pylori*

Gender	Frequency	Percentage	Positive	Negative	Prevalence	X^2	Sig. (2-tailed)
Male	407	36.8%	263	144	64.61%	2.00	0.157
Female	699	63.2%	463	236	66.23%		
Total	**1,106**	**100%**	**726**	**380**	**65.64%**		

Table 1 above showed the association between gender and the rate of *H. pylori* infection. The result showed that there was no significant association (p= 0.157) between gender and H. pylori prevalence.

Table 2: Association between Marital status and *H pylori* Prevalence

Marital Status	Frequency	Percentage	Positive	Negative	Prevalence	X^2	Sig.
Married	650	63.3%	420	230	64.62%	10.176	0.062
Single	456	36.7%	306	150	67.11%		
Total	1,106	100%	726	380	65.64%		

Table 2 above showed the association between marital status and H pylori infection rate. The result showed that there was no significant association (p=0.062) between marital status and H pylori infection rate.

Table 3: Age Distribution Prevelence of *Helicobacter Pylori*

Age	Frequency	Percentage	Positive	Negative	Prevalence	X^2	Sig.(2-tailed)
01-10	40	3.6%	20	20	50%	31.000	0.154
11-30	80	7.2%	50	30	62.51%		
31-50	650	58.7%	450	200	69.23%		
51-60	170	15.4%	100	70	58.88%		
61-70	110	9.9%	70	40	63.63%		
71-90	56	5.1%	36	20	64.28%		
Total	1,106	100%	726	380	65.64%		

Table 3 presents the relationship between age and *H pylor*i prevalence. The result showed that there was no significant relationship (p=0.154) between age and *H pylori* prevalence.

Table 4: Relationship between Occupation and *H pylori* Prevalence

Occupation	Frequency	Percentage	Positive	Negative	Prevalence	X^2	sig
Business women/men	596	53.88%	436	160	73.15%	6.00	0.199
Civil servant	350	31.65%	200	150	57.14%		
Student	160	14.47%	90	70	56.25%		
Total	1,106	100%	726	380	65.64%		

Table 4 presents the relationship between occupation and *H pylor*i prevalence. The result showed that there was no significant relationship (p=0.199) between occupation and *H pylori* prevalence.

Table 4: Relationship between Occupation and *H pylori* Prevalence

Occupation	Frequency	Percentage	Positive	Negative	Prevalence	X^2	sig
Business women/men	596	53.88%	436	160	73.15%	6.00	0.199
Civil servant	350	31.65%	200	150	57.14%		
Student	160	14.47%	90	70	56.25%		
Total	1,106	100%	726	380	65.64%		

Table 4 presents the relationship between occupation and *H pylor*i prevalence. The result showed that there was no significant relationship (p=0.199) between occupation and *H pylori* prevalence.

Table 5: Relationship between Religion and *H pylori* Prevalence

Religious	Frequency	Percentage	Positive	Negative	Prevalence	X^2	sig
Christianity	750	67.81%	500	250	66.66%	6.00	0.199
Islamic	260	23.51%	150	110	57.69%		
Pagan	96	8.68%	76	20	79.16%		
Total	1,106	100%	726	380	65.64%		

Table 5 presents the relationship between religion and *H pylor*i prevalence. The result showed that there was no significant relationship (p=0.199) between religion and *H pylori* prevalence.

Table 6: Association between Year *Helicobacter pylori* Infection Rate

YEAR	POSITIVE	NEGATIVE	TOTAL	PREVALENCE	P-RATE	X2	Sig
2017	60	35	95	0.631	63.15	**15.00**	**0.241**
2018	169	80	249	0.678	67.87		
2019	158	80	238	0.663	66.38		
2020	134	94	228	0.587	58.77		
2021	205	91	296	0.692	69.25		
Total	**726**	**380**	**1,106**	**0.656**	**65.64**		

Table 6 shows the prevalence of *H. Pylori* infection from the year 2017-2021. From the result above, the prevalence rate was highest in 2021 at 69.25% prevalence, followed by 2018 at 67.87%, 2019 with 66.38%, 2017 with 63.15% and the lowest in 2020 with 58.77% and there is no significant relationship between years and the prevalence H. Pylori (P=0.241).

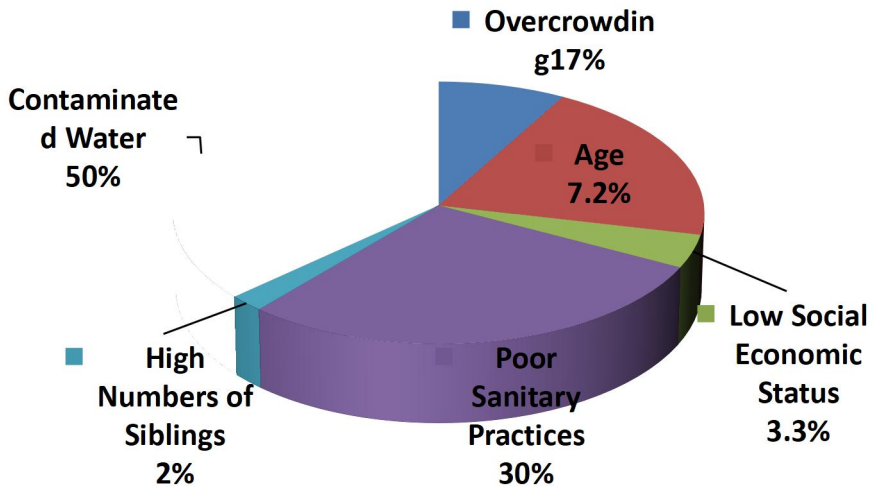

Figure 2: Prevalence of *Helicobacter pylori* and Its associated Risk Factors

From the chart above, the highest associated risk factor on the prevalence of *Helicobacter pylori* was caused by contaminated water with a prevalence rate of 50%, followed by poor sanitary practices (30%), age (7.2%), overcrowding (7%), low social economic status (3.3%), while the lowest risk factor was high number of siblings (2.5%).

Discussion

Generally, the study has shown that the prevalence of *H. pylori* infection among dyspeptic patients is 65.5%. This rate reflects the large proportion of patients with stomach disorder that is due to *H. pylori* infection. That is to say that H pylori is the major cause of dyspepsia in people living in Port Harcourt This rate is averagely consistent with global report, report from Africa and in Nigeria which had prevalence reports over 50% [1,3,4].

In determining the association between gender and *H. pylori* infection rate, the result revealed no statistically notable association. The relatively close prevalence rates (64.61% in males and 66.23% in females) suggest that gender may not be a strong determinant of H. pylori infection, reducing the likelihood of finding a significant difference. There may be other confounding factors such as socioeconomic status, lifestyle, or genetic predispositions that are not controlled for in the analysis. These factors could overshadow any potential gender-related differences in H. pylori prevalence, making it difficult to detect a significant relationship. A study by Brown et al. [13] found no significant difference in H. pylori prevalence between genders, aligning with these results. In contrast, a study by Torres et al. [14] indicated a higher prevalence in males compared to females, suggesting that other factors, such as lifestyle, may contribute to gender differences.

Assessing relationship between marital status and *H. pylori* prevalence revealed no significant association. Single individuals showed a slightly higher prevalence (67.11%) than married individuals (64.62%). Both married and single individuals may share similar living environments and lifestyles, particularly in the context of hygiene and dietary habits. This similarity could lead to comparable exposure to risk factors for *H. pylor*i, resulting in close prevalence rates (64.62% for married and 67.11% for single individuals), thereby reducing the likelihood of finding a statistically significant difference or it could be that the categories of "married" and "single" are broad and encompass a wide range of individuals with potentially different risk profiles. For example, a single person living with family might have a different risk of *H. pylori* infection compared to a single person living alone. This heterogeneity within each group could dilute any potential differences, leading to a non-significant result. A study by Goh et al. [15] found that marital status does not significantly impact *H. pylori* infection rates, which supports this finding. On the other hand, study by Smith [16] indicated that married individuals may have lower infection rates due to better hygiene and shared health practices.

Based on age-based prevalence, there was no significant relationship between age and *H. pylori* prevalence which might indicate that age is not a primary factor influencing *H. pylori* prevalence. The varying immune response across ages might not be strong enough to yield significant differences, the age groups also are broad, and there may be significant overlap in risk factors within these groups. For instance, individuals aged 31-50 may have diverse lifestyles and health conditions, leading to varied risks of infection. This overlap could reduce the ability to detect any notable difference between the age groups. This result is consistent with studies by Torres et al. [14], who found that *H. pylori* prevalence tends to increase with age. However, a study by Klein et al. [17] suggested that younger age groups may have higher rates of new infections due to

greater exposure to risk factors, which contradicts the findings of this table .

The highest prevalence is in occupation categories is business people (73.15%), followed by civil servants (57.14%), however, there was no identified relationship between occupation and H. pylori infection rate. The occupations considered (business, civil servant, student) might not differ significantly in terms of exposure to *H. pylori* risk factors such as water quality, food safety, or hygiene practices. The similarities in lifestyle and environment across these occupations might contribute to the lack of a significant difference in prevalence rates. The broad occupational categories used in this study may mask important differences within each group. For instance, the "business" category could include a wide range of occupations with varying levels of risk for *H. pylori*. A more granular analysis that differentiates between specific types of business activities could potentially reveal significant associations. A study by Graham et al. [18] supports the lack of significant association between occupation and *H. pylori* infection. Alternatively, a study by Breuer et al. [19] found that certain occupations with poor hygiene practices had higher *H. pylori* prevalence, challenging the results of this study.

Also there was no significant relationship between religion and *H. pylori* prevalence. The highest prevalence was among pagans (79.16%), followed by Christians (66.66%), and the lowest was among Muslims (57.69%). While religion can influence dietary and hygienic practices, the differences between the religious groups in this study (Christians, Muslims, and Pagans) might not be significant enough to affect *H. pylori* prevalence. The prevalence (ranging from 57.69% to 79.16%) might reflect general cultural practices rather than religion-specific behaviors, reducing the likelihood of detecting significant differences also the smaller sample size for some religious groups, such as Pagans, might limit the statistical power to detect a significant association. With fewer participants in certain groups, the ability to draw meaningful comparisons between religions is reduced, leading to non-significant results. A study by Hunt et al. [20] indicated that cultural practices related to religion could influence *H. pylori* prevalence, although no strong association was found, which aligns with the finding from this study, in contrast a study by Malaty et al. [21] found significant differences in *H. pylori* prevalence across different religious groups, challenging these findings.

In studying the association between year and prevalence of *H pylori,* it was revealed that there was no association between both

The study as reported no significant association between years and *H. pylori* infection rate. The prevalence of *H. pylori* might be stable over time probably due to consistent exposure to risk factors across the years. This stability in environmental and lifestyle factors could result in similar prevalence rates year after year, leading to a lack of significant differences across the years studied. The study groups data by year, which might be too broad a time frame to detect significant trends or changes in *H. pylori* prevalence. Seasonal variations, changes in public health initiatives, or short-term shifts in population behavior within a year could be masked by aggregating data on an annual basis. A more detailed temporal analysis (e.g., quarterly or monthly) might reveal significant trends that annual data do not capture. A longitudinal study by Kato et al. [22] found that *H. pylori* prevalence rates do not significantly vary year by year, supporting these findings. In contrast, a study by Rowland et al. [23] observed fluctuating prevalence rates over different years due to varying public health interventions, which contradicts these results.

Based on the studied risk factors, contaminated water and poor sanitary practice were identified as the leading

risk factors of *H. pylori* prevalence while the number of sibling had the low occurrence. This implies that good drinking water and good sanitation practice will help curb the spread of the infection. This aligns with the view of Smith [16].

Conclusions

The prevalence of *H. pylori* among dyspeptic patients at RSUTH is 65.6%, however, there was no association between the prevalence and gender, marital status, age, occupation and year. These identified patient's characteristics did not affect the distribution of the infection. Contaminated water and poor sanitation were reported as the most prevalent risk factors contributing to the spread of the infection.

Recommendations

The Rivers State Government should enhance the supply of clean water and improve sanitation in the state. Owing to the high rate of the infection among dyspeptic patients, inclusion of *H. pylori* test for all dyspepetic patients should be priorotized for these patients.

Limitations

The study uses purposive sampling, which may not fully represent the broader population of dyspeptic patients, this could limit the generalizability of the results. Demographic data were collected through questionnaires, which might introduce reporting bias or inaccuracies. The study was limited to a single hospital in Nigeria, potentially affecting the applicability of findings to other regions or countries. In addition the study covers a specific timeframe (2017-2021), and the results may not reflect current trends or changes in *H. pylori* prevalence and associated risk factors.

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