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Seroprevalence and Molecular Detection of *Helicobacter pylori* among Patients with Dyspepsia attending Dutse General Hospital, Jigawa State - Nigeria

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Abstract

The impacts of Helicobacter pylori affect almost 90% of the world's population which varies substantially between nations and within populations. A total of 302 patients were included in an analytical cross-sectional study. Patients between the ages of 18 and 83 were recruited between March 2020 and March 2021, and closed-ended questionnaires were used to gather data. Five milliliters of blood were drawn from individuals with dyspepsia and centrifuged at 3000 rpm for 5 minutes. A H. pylori test kit was used to perform a serological assay for IgG antibodies. Approximately 232 individuals (76.8% greatest prevalence by age group) in this study had dyspepsia; the prevalence was 31.8% in females (96 patients) and 68.2% in males (206 patients). The findings indicated a high prevalence of H. pylori in the studied area, with a higher rate in males compared to females. Among the participants, those aged 31-40 years had the highest prevalence at 31.5%, with an average age of 35.5 years. The prevalence differs significantly based on geographic location, age, and gender. Screening of younger dyspeptic patients should be prioritized to prevent further complications, and assessing the effectiveness of diagnostic tests in younger individuals is clinically significant. Additionally, raising public awareness about the causes, transmission modes, and risk factors of H. pylori infection in the region is essential.

KEYWORDS: Helicobacter pylori, seroprevalence, dyspepsia, seropositive and seronegative

INTRODUCTION

Helicobacter pylori (*H. pylori*) is a spiral-shaped, Gram-negative bacterium that resides in the gastric mucous layer or adheres to the epithelial lining of the stomach (Ali &AlHussaini, 2024). This bacterium causes persistent infections that can lead to gastroduodenal complications, including peptic ulcer disease, gastric adenocarcinoma, and gastric mucosa-associated lymphoid tissue lymphoma (Reyes, 2023). It has been associated with acid peptic diseases of the stomach and duodenum, as well as stomach neoplasms (Retnakumar *et al.*, 2022). The human stomach serves as the primary reservoir for *H. pylori*, which can potentially spread to the external environment through feces, vomit, or gastric regurgitation. *H. pylori* is recognized as the main cause of gastritis in humans and plays a crucial role in the development of peptic ulcers (Duan *et al.*, 2023). Numerous studies conducted in Brazil and globally aim to better understand the disease's pathogenesis, assess its epidemiological and diagnostic aspects, reduce the incidence of *H. pylori* infections, and enhance patient outcomes. In Iran, the seroprevalence of *H. pylori* among the pediatric population exceeds 65% (Mladenova, 2021). The prevalence of *H. pylori* varies significantly across the globe, with developing countries experiencing rates as high as 90%, while industrialized nations report lower rates (Secka *et al.*, 2013). For instance, in South America, Bangladesh, and Pakistan, the prevalence is around 80%, whereas it is 26% in Switzerland, 11% in Sweden, and between 20% and 50% in France (Parisi *et al.*, 2020).

Epidemiological studies indicate that the prevalence of *H. pylori* infection increases with age and is more common in developing countries, including Nigeria, as well as among populations with low socioeconomic status (Leja *et al.*, 2019). This is likely due to factors that facilitate the acquisition of the infection, such as poor hygiene, overcrowded living conditions, and lack of sanitation (Smith *et al.*, 2022). The bacterium can survive in the acidic environment of the stomach, primarily due to its high urease activity, which converts urea in gastric juice into alkaline ammonia and carbon dioxide (Khedia *et al.*, 2025). *H. pylori* infection is widespread globally, but its prevalence varies significantly across different countries and among various population groups within the same country (Zhu

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et al., 2025). The infection is typically acquired through the oral ingestion of the bacterium and is most often transmitted within families during early childhood (Kouitcheu *et al.*, 2025). Other modes of transmission include person-to-person spread via vomit, saliva, or feces, and in developing countries, water may also serve as a key route of transmission (Swalehe, 2025).

Dyspepsia is characterized by chronic or recurrent pain or discomfort in the upper abdomen, along with sensations of fullness, feeling full earlier than usual when eating, and may also involve symptoms such as belching, bloating, nausea, and vomiting (Malone, 2024). It can also be described as a symptom complex involving epigastric pain or discomfort believed to originate from the upper gastrointestinal tract. This may include symptoms like heartburn, acid regurgitation, excessive belching, increased abdominal bloating, nausea, indigestion, or early satiety (Malone, 2024).

Epidemiological studies have shown that the prevalence of *H. pylori* infection increases with age and is more common in developing countries, such as Nigeria, as well as among populations with low socioeconomic status (Rafeey *et al.*, 2013). The infection is widespread globally, affecting approximately 90% of the world's population (Secka *et al.*, 2013). In developed countries, 30% to 40% of people are infected with *H. pylori*, whereas in developing countries, the prevalence is higher, ranging from 70% to 90% (Saad *et al.*, 2008). This higher prevalence is likely linked to factors that promote infection acquisition, such as poor hygiene, overcrowded living conditions, inadequate sanitation, contaminated drinking water, a poor diet, occupational exposure to dyspeptic patients, a family history of gastric diseases, and genetic predisposition. *H. pylori* infection can be transmitted through various routes, including person-to-person contact.

This study aimed to investigate the seroprevalence and molecular detection of H. pylori infection among dyspepsia patients at Dutse General Hospital in Jigawa State, Nigeria, taking into account sociodemographic factors, clinical data, interviews, and responses to the administered questionnaires.

MATERIALS METHOD

Study Area

The research was conducted at Dutse General Hospital in Jigawa State, Nigeria (Figure 1) from March 2020 to March 2021. Jigawa State is located in the Northwestern part of Nigeria that lies between latitudes 11.00°N and 13.00°N, and longitudes 8.00°E and 10.00°E. Jigawa State is composed of 27 Local Government Areas and is bordered to the west by Kano and Katsina States, to the east by Bauchi State, and to the northeast by Yobe State. To the north, Jigawa shares an international border with the Zinder Region of the Republic of Niger, providing a unique opportunity for cross-border trade activities.

Study population

The estimated population of Jigawa State was 6,779,080, as reported by the National Bureau of Statistics in 2019 (Olumoh *et al.*, 2025). In this research, a sample size of 302 was used. The study involved recruiting patients with suspected dyspepsia, whose ages ranged from 18 to 83.

All consenting adult patients aged 18 years and above and of both genders who presented to the hospital on the account of dyspepsia.

Exclusion criteria involved

Patients below 18 years of age and those who do not give their consent

The sample size of the study was calculated using experimental formula introduced by Ndububa *et al.* (2001):

$$n = \frac{Z^2 pqn}{d^2}$$

Where: z = score for 95% confidence interval = 1.96, p = prevalence, q = 1-p

d = tolerable error = 5%

A proportion (prevalence) of 73% was used in the study

Sample size (n) = $(1.96)^2$ X (0.73) (1-0.73)/0.05^2

= 3.8416X0.73 X 0.27/0.0025

= 302

302 Sample size was used in this study

Source: (Ndububa *et al.*, 2001).

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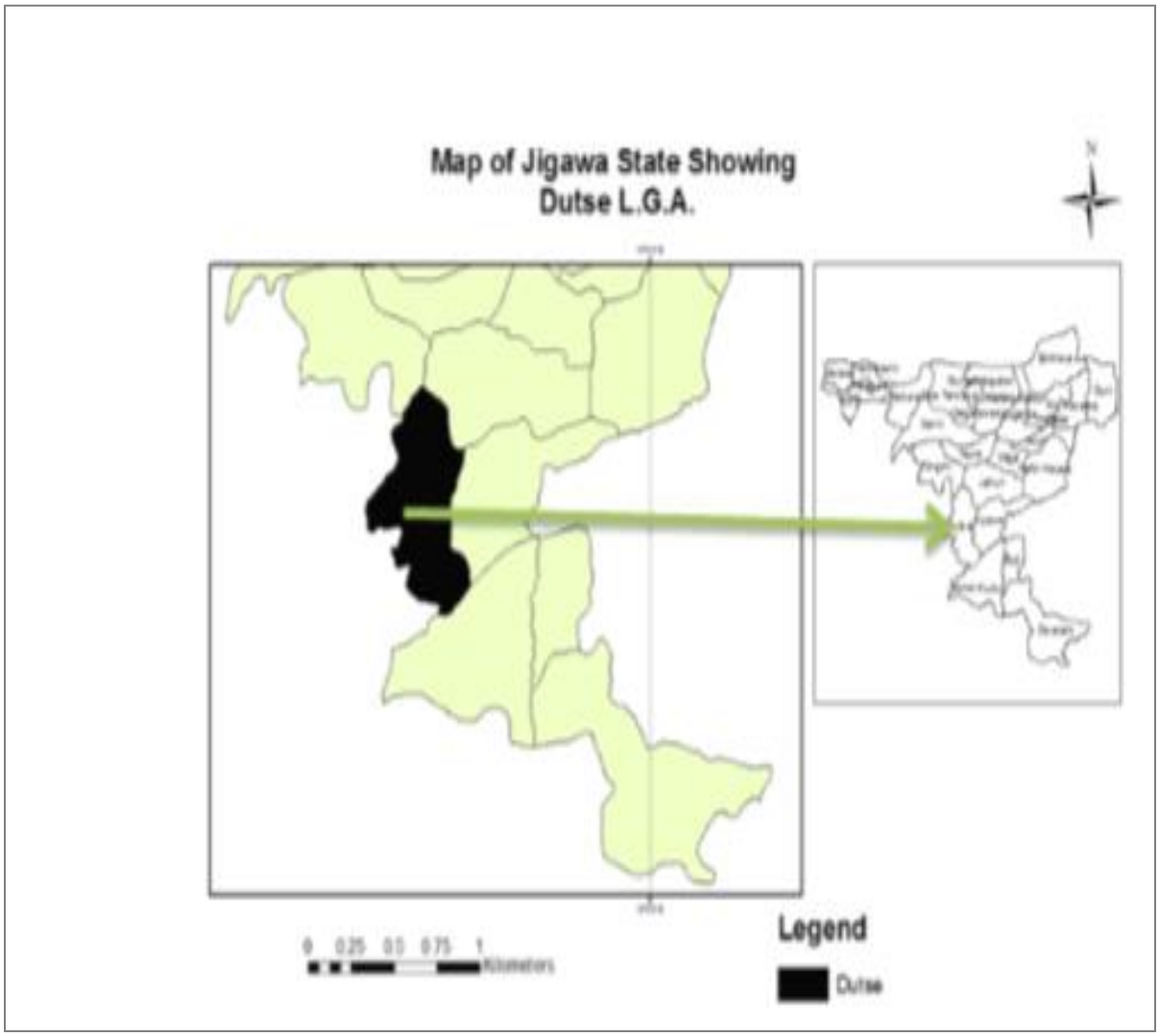

Figure 1: Map of Jigawa State showing Dutse Local Government

Ethical Considerations

Prior to the commencement of the research, ethical approval was obtained from the Ministry of Health, Jigawa State, Nigeria, through the Head of the Microbiology and Biotechnology Department at the Federal University Dutse, Jigawa State, Nigeria. Consent forms were completed and signed by the patients or their guardians for those admitted for the serologic diagnosis (Appendix I).

Specimen Collection and Preservation

Approximately 5 mL of blood sample was aseptically collected from the patients and transferred into an EDTA container for processing. Each sample was centrifuged at 3000 rpm for 5 minutes to separate the plasma from the cellular components. The sera were then stored at -20°C. A serological assay for Immunoglobulin G antibodies against *H. pylori* was performed using a *H. pylori* Rapid Test Device with the serum from the collected blood specimens. The serum was separated as quickly as possible to prevent hemolysis, and only clear, non-hemolyzed specimens were used for testing.

Serological Diagnosis of *H. pylori*

The overall duration of this study was 12 months, from March 2020 to March 2021. The extended duration of the clinical tests was primarily due to the COVID-19 pandemic, which necessitated social distancing measures during the study period, resulting in delays in participant recruitment and data collection.

Serological Diagnosis of *H. pylori*

Helicobacter pylori infection was identified using a noninvasive serological test—the Bio-Save Rapid Diagnostic Test for *H. pylori* (intended for in vitro diagnostic use only; reagent manufactured in the United Kingdom) (Talebi, 2018). The test was chosen based on the

clinical condition of each patient. The study included 302 participants, consisting of 206 males and 96 females, aged between 18 and 83 years.

Before testing, the test components, including the specimen, buffer, and/or controls, were allowed to reach room temperature (approximately 30°C). The sealed test pouch was stored at room temperature and opened only when ready for use. The test device was immediately removed and placed on a clean, level surface. For serum samples, two drops (approximately 50 µL) were dispensed into the specimen well using a vertical dropper, followed by one drop of buffer. The timing of the reaction was carefully monitored, and the appearance of colored lines was observed. Test results were interpreted at 10 minutes. The device contains *H. pylori* antigen-coated particles and anti-human IgG immobilized on the membrane.

Isolation of Plasmid DNA from *Helicobacter pylori*

H. pylori cultures were grown in nutrient broth under microaerophilic conditions at 37°C for 48 hours. Post-incubation, 1.5 mL of the culture was transferred to a microcentrifuge tube and centrifuged at 10,000 rpm for 5 minutes to pellet the bacterial cells. The supernatant was discarded, and the pellet was resuspended in 250 µL Buffer from a plasmid extraction kit. Cell lysis was performed by adding 250 µL of Lysis Buffer (containing SDS and NaOH), followed by gentle inversion of the tube 46 times and incubation at room temperature for 5 minutes. Lysis was neutralized by adding 350 µL of Neutralization Buffer, with gentle inversion until a white precipitate appeared. The sample was centrifuged at 12,000 rpm for 10 minutes, and the clear supernatant containing plasmid DNA was transferred to a silica-based spin column. The column was centrifuged at 12,000 rpm for 1 minute to bind the DNA, and then washed sequentially with 500 µL each of Washing Buffers 1 (W1) and 2 (W2), with centrifugation at 12,000 rpm for 1 minute after each wash. Plasmid DNA was eluted by adding 200 µL of Elution Buffer (nuclease-free water), incubating for 1 minute at room temperature, and centrifuging at 12,000 rpm for 1 minute. The purified DNA was stored at 4°C for subsequent analysis (Azami *et al.*, 2024).

PCR Amplification of *cagA* Gene

The *cagA* gene of *H. pylori* was amplified using specific primers and the AccuPowerHotStart PCR premix (Bioneer, Korea). The forward primer sequence was CTGCAAAAGATTGTTTGGCAGA, and the reverse primer sequence was CTGCAAAAGATTGTTTGGCAGA, with an expected amplicon size of 349 bp. The PCR reaction mixture was prepared in a total volume of 25 µL, containing 12.5 µL of the 2X PCR premix, 1 µL of each primer (10 µM concentration), 1 µg of the plasmid DNA template, and 10.5 µL of nuclease-free water (Xue *et al.*, 2024).

The PCR amplification was carried out in a Thermal Cycler (PTC 100, MJ Research, USA) with the following cycling conditions: an initial denaturation at 95°C for 5 minutes, followed by 35 cycles of denaturation at 94°C for 30 seconds, annealing at 54°C for 30 seconds, and extension at 72°C for 40 seconds. A final extension was performed at 72°C for 5 minutes. The amplified PCR products were then stored at 4°C until further analysis (Xue *et al.*, 2024).

Presented below is the sizes of the amplified DNA fragments, determined by comparing the bands to the DNA ladder.

Gene	Primer Sequence (5'→3')	Band Size (bp)	Reference
cagA	Forward: CTGCAAAAGATTGTTTGGCAGA Reverse: CTGCAAAAGATTGTTTGGCAGA	349	Green *et al.* (2019)

Gel Electrophoresis of PCR Products

Agarose gel electrophoresis was used to analyze PCR products. A 3% agarose gel was prepared by mixing 3 g of agarose powder with 100 mL of 1X TAE buffer in a microwavable flask and heating it in a microwave until the agarose was completely dissolved. After allowing the solution to cool to approximately 50°C, 5 µL of ethidium bromide (0.5 µg/mL) was added to the gel mixture to enable visualization under UV light. The gel was then poured into a gel tray with a well comb in place and left to solidify at room temperature for 20 minutes (Green & Sambrook, 2019).

Once solidified, the gel was placed in the gel box, and the electrophoresis chamber was filled with 1X TAE buffer until the gel was completely submerged. The PCR products were mixed with

a loading buffer and carefully loaded into the wells of the gel along with a 1 kb DNA ladder (Fermentas, Germany) in the first lane. The gel was run at 150 V for 1 to 1.5 hours, or until the dye front had migrated approximately 75-80% of the gel length. After electrophoresis, the gel was removed and placed in a gel documentation system (BioRad, USA) for visualization under UV light. The sizes of the amplified DNA fragments were determined by comparing the bands to the DNA ladder.

Statistical analysis and Data management

Data obtained from the questionnaires and the serological findings recorded on the data entry forms were entered into Microsoft Excel 23 and subsequently analyzed using SPSS 23. Each form was assigned a unique identifier corresponding to the patient or laboratory number. Numerical data are expressed as means, standard deviations (±SD), and ranges. Categorical variables are presented as proportions and were analyzed using the Chi-square test. Statistical significance was determined at a p-value of less than 0.05. The Chi-square test was the primary statistical tool employed for analysis in this study.

RESULTS

Table 1.0 presents the distribution of patients by gender, marital status, educational level, religion, occupation, and ethnicity. The participants' ages ranged from 18 to 83 years, with a mean age of 35.5 years. The median and modal age group was 31–40 years, which also exhibited the highest prevalence of *H. pylori* infection at 31.5%. Among males, the ages ranged from 18 to 83 years, while female participants ranged from 18 to 70 years old. The study cohort comprised 206 males (68.2%) and 96 females (31.8%). The highest infection prevalence, 78.0%, was recorded within the 31-40 age group.

Table 2.0 presents the prevalence of *H. pylori* infection across different socio-demographic groups within the study population. The 31–40 age group recorded the highest prevalence, accounting for 31.5% of infections among 95 dyspeptic patients. Of the total 302 participants, 206 were male (68.2%) and 96 were female (31.8%), resulting in a male-to-female ratio of approximately 2.1:1.

Table 3.0 outlines the clinical characteristics of the dyspeptic patients. A total of 18 respondents (5.94%) were identified as having co-existing medical conditions. Among them, 2 patients (0.66%) had systemic hypertension, 1 patient (0.33%) had type 2 diabetes mellitus, 4 patients (1.32%) had sickle cell disease, and 8 patients (2.64%) were diagnosed with malaria. Additionally, 1 patient each (0.33%) had typhoid fever, hepatitis, and bronchial asthma, respectively.

Table 4.0 presents the clinical symptoms reported by respondents, as listed in the questionnaire. Two hundred and thirty two respondents 232(100% of the positive patients) had one or more co-existing medical illnesses; 95 of the respondents had systemic hypertension (40.95%), 85 of the respondents had Postprandial fullness (36.64%), 4 of the respondents had Dysphagia (1.72%), 10 of the respondents had early satiety (4.31%), 30 of the respondents had History of peptic ulcer (12.93%), 8 of the respondents had cigarette smoking habit (3.44%).

Table 1.0: Socio-demographics Characteristics of the suspected Dyspeptic Patients

Variables	N= 302	%	p-value
Age Range (Yrs)			
11-20	52	17.2	
21-30	84	27.8	
31-40	95	31.5	
41-50	49	16.2	
51-60	9	3.0	
61-70	6	2.0	
71-80	4	1.3	
81-90	3	1.0	0.336*
Gender			
Female	96	31.8	
Male	206	68.2	0.354*
Marital Status			
Single	90	29.8	
Married	201	66.6	
Divorced	4	1.3	
Widowed	7	2.3	0.002
Educational Status			
Informal	172	57.0	
Primary	82	27.2	
Secondary	41	13.6	
Tertiary	7	2.3	0.000
Religion			
Islam	300	99.3	
Christianity	2		
Occupation			
C. Servants	5	1.7	
Farmers	205	67.9	
Others	92	30.5	0.000
Ethnicity			
Hausa/Fulani	299	99.0	
Others	3	1.0	0.200*

Key: %=percentage, N=No of patients, * = statistically significant

Table 2.0: Prevalence of *H. pylori* infection based on the Socio-demographic Characteristics of the Dyspeptic Patients in Dutse General Hospital

VARIABLES	*Positive*	*Negative*	total	X^2	dF	P-value
AGE RANGE (YEARS)						
11-20	39	13	52			
21-30	63	21	84			
31-40	78	17	95			
41-50	33	16	49	6.47267941	7	0.4857628*
51-60	7	2	9			
61-70	5	1	6			
71-80	4	0	4			
81-90	3	0	3			
Total	232	70	302			
GENDER						
Female	72	24	96	0.26215027	1	0.60864672*
Male	160	46	206			
Total	232	70	302			
MARITAL STATUS						
Single	79	11	90			
Married	148	53	201	16.3753403	3	0.00094975
Divorced	3	1	4			
Widowed	2	5	7			
Total	232	70	302			
EDUCATIONAL STATUS						
Informal	150	22	172			
Primary	60	22	82	38.2941845	3	2.4488-08*
Secondary	20	21	41			
Tertiary	2	5	7			
Total	232	70	302			
RELIGION						
Islam	232	68	300	6.6727619	1	0.00978974
Christianity	0	2	2			
Total	232	70	302			
OCCUPATION						
Civil Servants	4	1	5			
Farmers	170	35	205	14.1279802	2	0.00085536
Others	58	34	92			
Total	232	70	302			
ETHNICITY						
Hausa/Fulani	232	67	299	10.0426183	1	0.0015296
Others	0	3	3			
Total	232	70	302			

Key: %=percentage, X^2=Chi square, N=No of Patients, * = statistically significant

DISCUSSION

The participants' ages ranged from 18 to 83 years, with a median age of 31–40 years and a mean age of 35.5 years. The findings indicate that patients aged 31–40 years are at a higher risk of dyspepsia, as 25.8% of the 78 seropositive patients were within this age range, and the highest prevalence of infection (78.0%) was found in this group. The study population comprised 206 males (68.2%) and 96 females (31.8%), reflecting a higher male representation. This male-to-female seroprevalence ratio is slightly lower compared to studies from Maiduguri (Embiyale, 2019), Kano (Tijjani *et al.*, 2005), and Ibadan (Otegbayo *et al.*, 2004), where the prevalence of *H. pylori* infection among male dyspeptic patients was also higher than that of females, with corresponding male prevalences of 51.8%, 53.7%, and 61.8%, respectively.

In a study by Ndububa *et al. (2001), the prevalence of H. pylori in Ile-Ife, South-West Nigeria, was found to be 73%* using histology and the Campylobacter-like organism (CLO) urease test on gastric mucosal biopsies. This prevalence was lower than that observed in the current

study. Similarly, Ugwu et al. (2007) reported an overall H. pylori prevalence of 26.3% in Abakaliki, Nigeria, which was also lower than the prevalence found in this study. Interestingly, in the present study, the 31–40 age group had the highest H. pylori positivity, with 78 respondents (25.8%) and a mean age of 35.5 years, suggesting they are at a greater risk compared to older age groups. This contrasts with the findings of Ugwuja *et al. (2007)*, *who reported a significantly higher prevalence of H. pylori infection in older patients compared to those aged ≤ 20 years, with rates of 29% versus 11%, respectively, and a mean patient age of 38.6* ± 5.2 years.

Table3.0 Presence of Co-existing medical conditions among dyspeptic patients

Co-existing Condition	Positive	Negative	Total	X2	dF	P-value
Systemic hypertension	2	1	3			
Type 2 DM	1	2	3			
Sickle cell disease	4	0	4			
Malaria	8	4	12	4.5	1	0.6093*
Typhoid fever	1	1	2			
Hepatitis 1	1	1	2			
Bronchial asthma	1	0	1			
Total	18	9	27			

Key: %=percentage, X^2=Chi square, N=No of Patients, * = statistically significant

Clinical Symptoms presented by respondents as contained in the questionnaire

Table 4.0 Clinical Symptoms presented by respondents as contained in the questionnaire

Clinical Symptoms	**Seropositive N (%)**	**Seronegative N (%)**	**X^2**	**P-value**
Epigastric pain	95(40.95)	0(0.00)	171.2	0.00
Postprandial fullness	85(36.64)	0(0.00)	123.6	0.00
Dysphagia	4(1.72)	0(0.00)	24.6	0.00
Early satiety	10(4.31)	0(0.00)	14.2	0.00
Vomiting	0(0.00)	0(0.00)	464.-	0.00
History of peptic ulcer	30(12.93)	0(0.00)	43.5	0.00
Cigarette smoking	8(3.44)	0(0.00)	216.3	0.00
Drinking alcohol	0(0.00)	0(0.00)	464.0	0.00

Key: %=percentage, X^2=Chi square, N=No of Patients, * = statistically significant

The prevalence of *H. pylori* infection is highly variable worldwide, with significantly higher rates in developing countries, where it can reach up to 90%, compared to lower rates in industrialized nations (Secka *et al.*, 2013). For example, the prevalence in South America, Bangladesh, and Pakistan is approximately 80%, which is higher than the prevalence observed in this study. In contrast, countries such as Switzerland (26%), Sweden (11%), and France (20–50%) report lower rates of H. pylori infection (Sherif *et al.*, 2004). In Nigeria, studies have shown varying prevalence rates. Bello *et al.* (2018) reported a prevalence of 81.7% in Kano, which is higher than the 78.0% found in this study. Akpa *et al.* (2023) reported a 73% prevalence in Ile-Ife, while a study in Kaduna found a lower prevalence than in the current research. Additionally, studies in Orlu, Imo State, by Obiajuru and Adogu (2013) and in Akwa, Anambra State, by Chukwuma *et al.* (2020) reported prevalence rates of 58% and 51.4%, respectively, which are both lower than the 78% observed in this study. In other African countries, reports include a 75.4% prevalence in Ghana (Baako and Danko, 1996), which is slightly lower than the findings here, while rates in Egypt (>80%, Khedmat et al., 2013) and The Gambia (97%, Secka *et al.*, 2013) were higher. Finally, Shi et al. (2008) reported a 62% prevalence in China, which is also lower than the rate found in this research.

Eighteen respondents (5.94% prevalence) were found to have co-existing medical conditions. These included 2 patients (0.66%) with systemic hypertension, 1 patient (0.33%) with type 2 diabetes mellitus (DM), 4 patients (1.32%) with sickle cell disease, 8 patients (2.64%) with malaria, 1 patient (0.33%) with typhoid fever, 1 patient (0.33%) with hepatitis, and 1 patient (0.33%) with bronchial asthma. Additionally, 232 respondents (100% of the seropositive patients) had one or more co-existing medical symptoms with associated risk factors for *H. pylori* infection. Among these, 95 patients (40.95%) had systemic hypertension, 85 patients (36.64%) reported postprandial fullness, 4 patients

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(1.72%) experienced dysphagia, 10 patients (4.31%) had early satiety, 30 patients (12.93%) had a history of peptic ulcers, and 8 patients (3.44%) were cigarette smokers.

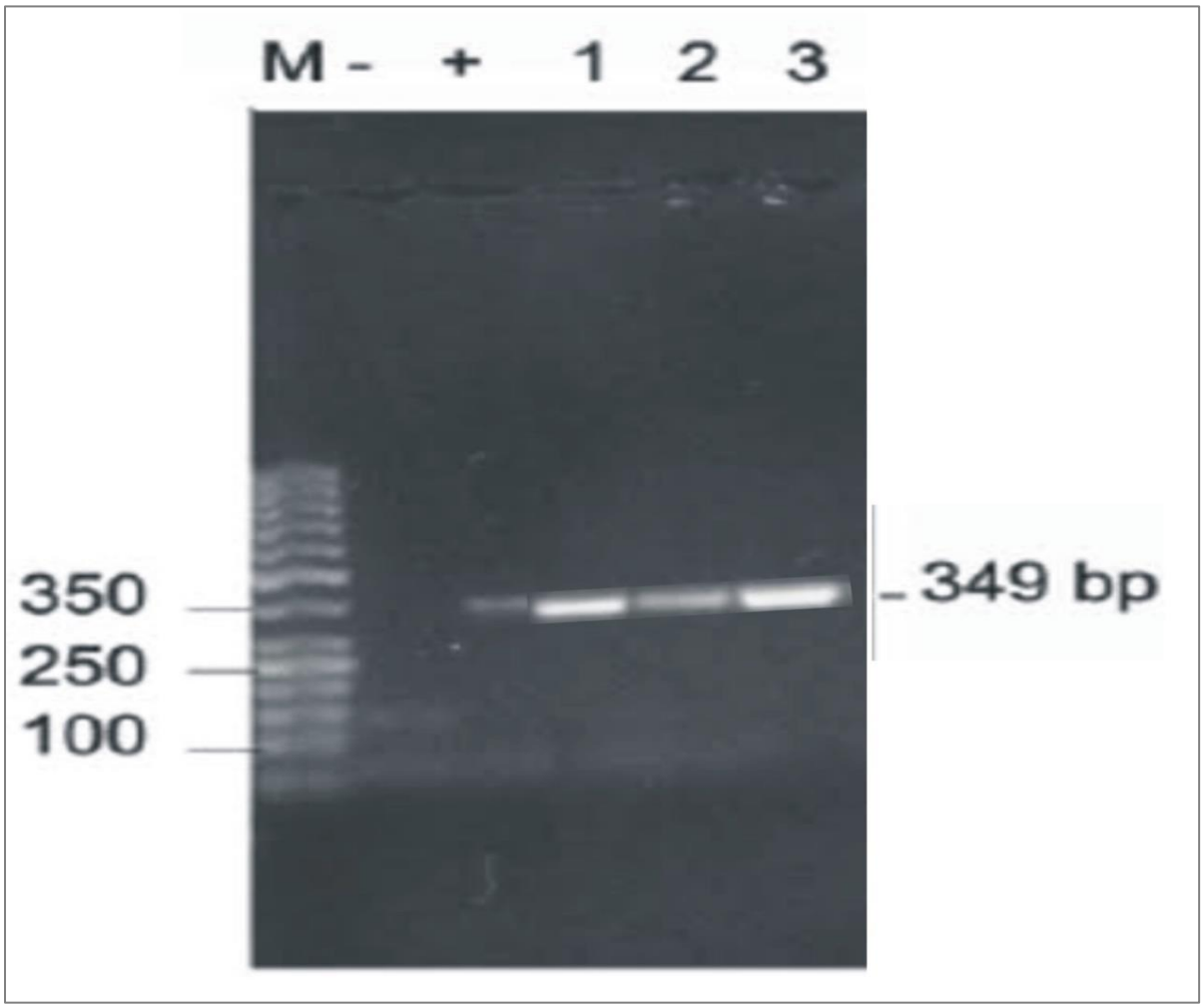

Figure 2.0: Amplified DNA fragment detected
key: bp = base pair (band), M = main ladder, + = positive control, - = negative control, 1 = sample one, 2 = sample two, 3 = sample three

H. pylori infection is widespread globally, affecting approximately 90% of the population, with a higher prevalence in developing countries such as Nigeria. This higher rate is likely due to the fecal-oral transmission route and inadequate sanitation conditions in these regions (Secka *et al.*, 2013). Numerous studies conducted in Brazil and worldwide aim to better understand the disease's pathogenesis, examine epidemiological and diagnostic factors, and reduce the incidence of *H. pylori* infections, thereby improving patient outcomes. In Iran, the seroprevalence of *H. pylori* in the pediatric population exceeds 65% (Salahi-Niri*et al.*, 2024). The prevalence of the infection is notably uneven across the globe, with rates in developing countries reaching up to 90%, while in industrialized nations, the rates are considerably lower (Secka *et al.*, 2013).

Good hygiene practices, adequate nutritional status, drinking natural water free of contamination, should be improved in the area, screening younger dyspeptic patients to eliminate further complications, evaluation of the assay efficacy in younger patients is more clinically relevant, and public awareness on the risk factors, mode of transmission and causes of *H. pylori* infection in the study area.

CONCLUSION

Humans serve as the primary reservoir for *H. pylori*. The prevalence of *H. pylori* infection varies significantly based on geographic location, age, and gender.The results of this study reveal a high prevalence of *H. pylori* infection in the studied area, suggesting the need for further analysis. Therefore, it is recommended that additional epidemiological

interventions and clinical prevention measures be implemented to control the transmission of the organism in the region. *H. pylori serology represents a rapid, non*-invasive test for determining the colonization of the organism.

RECOMMENDATIONS

1. It is therefore recommended that early Serologic screening and diagnosis of younger dyspeptic patients are clinically relevant.

2. Good hygienic and nutritional practices should be encouraged to reduce the risk of dyspeptic infection.

3. Public awareness of the risk factors, mode of transmission, and causes of *H. pylori* infection in the study area.

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