Journal of Clinical Immunology & Microbiology

ATHENAEUM SCIENTIFIC PUBLISHERS

Research Article

Molecular Detection of *Helicobacter Pylori* Among Patients Attending General Hospital Potiskum, Yobe State, Nigeria

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Citation: Jajere AI, et al. Molecular Detection of *Helicobacter Pylori* Among Patients Attending General Hospital Potiskum, Yobe State, Nigeria. J Clin Immunol Microbiol. 2025;6(1):1-10.

http://dx.doi.org/10.46889/JCIM.2025.6101

Received Date: 28-12-2024

Accepted Date: 13-01-2025

Published Date: 20-01-2025

Abstract

This study investigated on the detection of *Helicobacter pylori (H. pylori)* infection among patients attending General Hospital Potiskum, Yobe State, Nigeria. Three diagnostic methods were employed: antibodies test, antigen screening test and PCR screening. A high prevalence of *H. pylori* infection was observed, with an overall positive rate of 87.5% using the antibodies test, 75.00% using the antigen screening test and 70.50% using PCR screening. The prevalence varied based on gender, age, socio-economic status, education and location. Females and individuals from low socio-economic backgrounds were found to have slightly higher prevalence rates. Middle-aged individuals and certain hospital locations also showed higher infection rates. The findings highlight the need for increased awareness and targeted interventions to address the burden of *H. pylori* infection in the region. Further research is necessary to explore the specific factors contributing to the observed variations in prevalence and to develop effective prevention and treatment strategies.

Keywords: Molecular; *Helicobacter Pylori*; Infection; Potiskum

Introduction

Helicobacter pylori (H. pylori), a spiral-shaped Gram-negative bacterium, measures approximately 2-4 micrometers in length and 0.5-1 micrometer in width (Kuster and Malfertheine, 2012). This microaerophilic organism, which thrives in environments with low oxygen levels, is one of the most prevalent human pathogens globally, infecting over 59% of the world's population. Notably, *H. pylori* holds the distinction of being the first bacterium scientifically recognized as a carcinogen [1].

While present in the stomachs of roughly half the global population, *H. pylori* often remains asymptomatic in seemingly healthy individuals [2]. However, clinical manifestations of *H. pylori* infection are widespread, particularly in developing countries. In these regions, infection typically occurs during childhood, with symptoms often emerging in adulthood [3].

Diagnosis of the bacterium *H. pylori*, which commonly infects the human stomach, can be achieved through invasive methods like examining tissue samples and culturing the bacteria or non-invasive methods such as blood tests and breath tests [4]. While pinpointing the exact age of infection in young children is challenging, *H. pylori* can persist in the stomach for extended periods despite the body's immune response [5].

H. pylori is widespread, affecting nearly half the global population and is a significant cause of stomach and duodenal ulcers. Infection rates are higher in developing countries compared to industrialized nations, with acquisition often occurring in early childhood. A major concern with *H. pylori* is the increasing prevalence of antibiotic resistance, which significantly hinders successful treatment and makes eradication therapy difficult.

This study will provide information on prevailing *Helicobacter pylori* species from patients attending General Hospital Potiskum of Yobe state, detection of prevailing *H. pylori* infection by using serology, antigen screening test and molecular detection and antimicrobials that will help in diagnosis of virulence genes and management of *H. pylori* in the study area.

Material and Methods

Within 12 weeks, this study was conducted in Potiskum, Yobe State, Nigeria, located approximately (1142'050.80"N, 1104'51.89). A total of 200 blood and fresh stool samples were collected from patients attending General Hospital Potiskum exhibited symptoms of gastritis such as stomach pain, frequent burping, bloating and unexplained weight loss.

Study Area

This study was conducted at the microbiology unit of the General Hospital in Potiskum, Yobe State, Nigeria. Potiskum, a major city in the state, is situated in the northeastern part of the country, characterized by a Sahelian climate with an average annual rainfall of 6.7 inches. The city has a diverse population of approximately 591,410, comprising various ethnic groups including Ngizim, Bolawa, Fulani and Hausa. It experiences a wide temperature range, with an average annual high of 39.8°C (103.6°F) and a low of 12.5°C (54.5°F), with December being the coldest month (Fig. 1) [6].

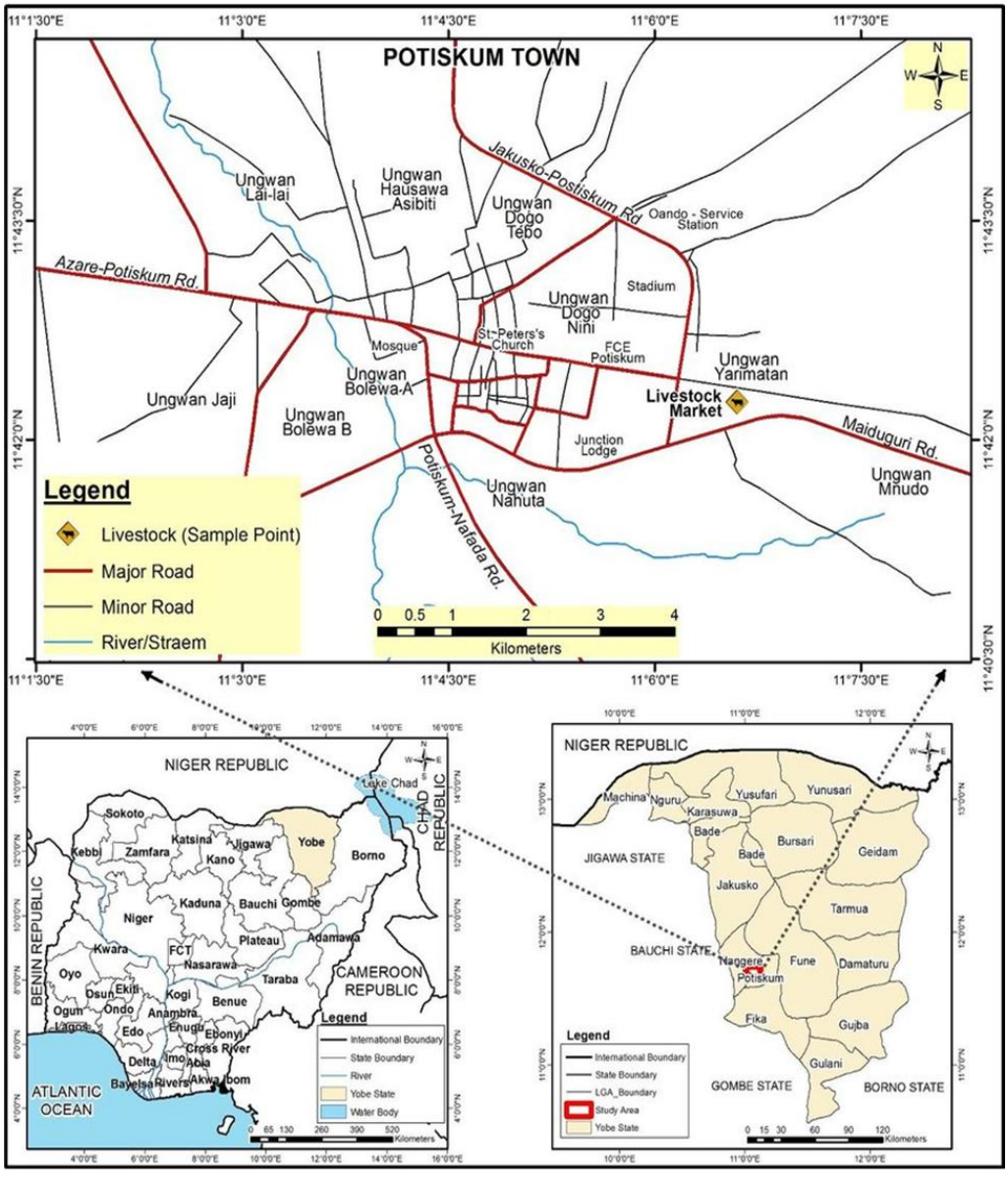

Figure 1: Map Potiskum, Yobe State Nigeria.

Study Population

The study population consisted of male and female patients aged between 10-89 years in General Hospital Potiskum, LGA of Yobe State.

Sample Size Determination

Sample Size Calculation: The sample size (n) was estimated using the formula: $n = (1.96)^2 pq/d^2$

Where;

n = required sample size,

p = proportion of the population having *H. pylori* infection from previous study,

q = 1 - p and

d = the degree of precision

For the calculation, a 95% confidence interval, a p value of 0.865, i.e., a prevalence rate of 86.5% was reported by Ejiludeet, al., and margin of error (d) set at 0.05 was used to determine the minimum sample size required [7]. To minimize errors arising from the likelihood of non-compliance, 10% of the sample size was added giving a final sample size of 200.

Experimental Design

This study aimed to determine the prevalence of *Helicobacter pylori* infection. A total of 200 blood and stool samples were collected randomly from 200 infected patients (80 males and 120 females) aged 10 to 80 years in Potiskum Local Government Area, Yobe State, Nigeria. Data collection occurred over a 12-week period from October to December 2024.

Ethical Clearance

Ethical approval was obtained from ministry of health, Yobe state in accordance with Helsinki declaration. This is a code of ethics on human experimental draft by the World Medical Association in 1964 and also permission was obtained from the patient participants prior to the commencement of the study.

Sample Collection and Preparation

Blood Sample Collection

Blood samples were collected via venipuncture using clean Vacutainer tubes. After identifying a suitable vein, a tourniquet was applied and the puncture site was disinfected with 70% alcohol. Two milliliters of blood were drawn into EDTA-containing tubes and then centrifuged at 3000 revolutions per minute for two minutes. Finally, the plasma was carefully separated using a Pasteur pipette.

Stool Sample Collection

The stool samples were collected in sterile, sealed cups, labeled and promptly transported to the laboratory in ice boxes for immediate investigation. Sociodemographic characteristics of the participants, including sex, age and residence, were documented.

Detection of *H. pylori Antibodies*

To perform the test, approximately one to two drops of plasma were carefully added to the sample well labeled "S" and allowed to fully absorb for about 30 seconds. Next, the dropper was held upright and three drops of buffer solution (approximately 100 µl) were transferred to the test well on the strip. Strong positive results typically appear within 2-3 minutes, while weaker positive results may take up to 7 minutes to become visible. It's important to note that slight hemolysis (red blood cell breakdown) may occur during the whole blood test, but this does not affect the accuracy of the results.

Interpretation of the Test

Negative Result: A negative test result is indicated by the presence of only one red band (the Control Line) in the central area of the test strip, signifying the absence of detectable levels of *H. pylori* antibodies in the sample.

Positive Result: A positive test result is characterized by the presence of both the red Control Line and a distinct pink-red Test Line in the central area of the strip. The intensity of the Test Line may vary, but any visible pink-red line, even faint, is considered

a positive result. Results appearing after 5 minutes are not considered valid.
Invalid Result: An invalid test result occurs when the red Control Line is absent, regardless of whether the Test Line is visible or not.

Test for Antigen Detection
A qualitative immunochromatographic technique called the Stool Antigen Test (SAT) is used to directly detect the *H. pylori* antigen in stool samples from patients. Following the manufacturer's instructions, 50 mg of each sample was tested for the presence of *H. pylori* antigen using an on-site *H. pylori* antigen fast test cassette [8].

Isolation and Biochemical Identification of H. pylori
The following minor changes made to Sainsus, protocol for the isolation and identification of *H. pylori* in the seropositive stool samples [9]. One millilitre of each homogenised sample of human faeces was added aseptically to a sterile test tube along with ten millilitres of Brain Heart Infusion Broth (BHIB) with a 5% Helicobacter selective supplement. The inoculated test tubes were incubated at 37°C in a microaerophilic atmosphere in an anaerobic jar and monitored daily with the use of an active gas generating kit (5% H_2, 5% CO2, 5% O_2 and 85% N_2).

The broth were streaked using the plating out method on Columbia agar with 5% defibrinated sheep blood supplemented with Helicobacter selective supplement after its turbidity was monitored for 96 hours. As previously indicated, the streaked plates were incubated at 37°C for three to five days in an anaerobic jar with microaerophilic conditions. The colonies were identified by microscopic inspection, morphology of the suspected colonies and biochemical testing (oxidase, catalase, urease and nitrate reduction tests).

DNA Extraction
Extraction of *H. pylori* DNA from suspected colonies were done using QIAGEN QIAamp DNA mini kit instructions.

Molecular Identification of H. pylori using the ureC (glmM) gene
The ureC (glmM) gene is the target of a PCR that is used to identify H. pylori, according to sensitivity of culture compared with that of polymerase chain reaction for detection of *Helicobacter pylori* from antral biopsy samples [10]. The PCR mixture was consisting of 1 μL of each primer, 4.5 μL of water, 6 μL of DNA template and 12.5 μL of the Emerald Amp Max PCR Master Mix [11]. The thermal profile of the amplification reaction consisted of a 5-minute initial denaturation at 95°C, 30 cycles of 94°C for 3 minutes, 94°C for 1 minute, 62°C for 1 minute and 72°C for 1 minute and a 5-minute final extension at 72°C. Using standard manufacturer's instructions.

Phenotypic Detection of Antibiotic Resistance
According to (Mubarak et al., 2023), antimicrobial susceptibility testing for seven therapeutically useful antibiotics was completed using the Kirby-Bauer disc diffusion method on Muller-Hinton supplemented with 5% defibrinated sheep blood and incubated at 37°C for 48 h in a microaerophilic atmosphere (85% N_2, 10% CO_2 and 5% O_2) in accordance with the Clinical Laboratory Standards Institute's (CLSI) recommendations. Ampicillin (AM, 10), Metronidazole (MET, 5), Erythromycin (ER, 5), Clarithromycin (CLR, 2), Amoxicillin (AMX, 10), Levofloxacin (LEV, 5) and rifampicin (R, 30) (Thermo Fisher Scientific, Basingstoke, United Kingdom) are evaluated for their concentrations in micrograms per disk (mcg/disk). The Clinical Laboratory Standards Institute (CLSI) recommendations were followed while measuring zone diameters.

Statistical Analysis
The data was analysed using Statistical Package for Social Science (SPSS) version 20 (SPSS Inc., Chicago, IL, United States). Differences in socio-financial aspects in each gathering were investigated to look at the relationship of factors, for example, age, sex, for *H. pylori* infection using Pearson relationship correlation. P-value < 0.05 was considered to be significant.

Research Timeline
The study was executed in 3 months duration which is 12 weeks from October to December 2024.

Research Budget

The study was executed with the sum of two million, five hundred thousand naira only (2,500,000=00).

Result

Distribution of Patients Tested Positive for Helicobacter pylori in General Hospital Potiskum, Yobe State

Table 1 show the Prevalence of *Helicobacter pylori* Infection in General Hospital Potiskum, Yobe State. This table presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State. Three different diagnostic methods were used: In Antibodies Test: 200 patients were tested and 175 (87.5%) were positive for *H. pylori* infection while in Antigen Screening Test: 200 patients were tested and 150 (75%) were positive for *H. pylori* infection whereas, for the PCR Screening: 200 patients were tested and 141 (70.5%) were positive for *H. pylori* infection. The statistical analysis (NS P > 0.05x2 = 0.43) indicates that there is no significant difference in the positive rates between the three diagnostic methods.

Method	No. of Patients Tested	No. (%) Positive
Antibodies Test	200	175 (87.50%)
Antigen Screening test	200	150 (75.00%)
PCR Screening	200	141 (70.50%)
NS P > 0.05x^2 = 0.43		

Table 1: Percentage of patients tested positive for I infection in General Hospital Potiskum, Yobe State.

Distribution of patients tested positive for *Helicobacter pylori* in relation to gender in General Hospital Potiskum, Yobe State

Table 2 presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on gender. Male Patients: 80 male patients were tested. Antibodies Test: 65 (81.25%) were positive while in Antigen Screening Test: 52 (65%) were positive. Whereas, for PCR Screening Test: 48 (60%) were positive. In Female Patients: 120 female patients were tested for Antibodies Test: 110 (91.6%) were positive while in Antigen Screening Test: 98 (81.67%) were positive whereas, PCR Screening Test: 93 (77.5%) were positive. The statistical analysis (NS P > 0.05) indicates that there is no significant difference in the overall positive rates between male and female patients when considering all three diagnostic methods together.

Sex	No. of patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening Test
Male	80	65 (81.25)	52 (65.00)	48 (60.00)
Female	120	110 (91.60%)	98 (81.66)	93 (77.50)
Total	200	175 (87.50%)	150 (75.00)	141 (70.50)
NS P > 0.05x^2				

Table 2: Percentage of *Helicobacter pylori* positive in relation to gender among patients attending General Hospital Potiskum, Yobe State.

Prevalence of Helicobacter pylori Infection by Age Group

Table 3 presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on age groups. 10-19: 64 patients were tested; 28 (43.75%) were positive. 20-29: 75 patients were tested; 68 (90.66%) were positive. 30-39: 43 patients were tested; 39 (90.69%) were positive. 40-49: 28 patients were tested; 26 (92.85%) were positive. 50-59: 13 patients were tested; 10 (76.92%) were positive. 60-69: 7 patients were tested; 5 (71.42%) were positive. 70-79: 3 patients were tested; 2 (66.66%) were positive. while 80-89: 1 patient was tested; 1 (100%) was positive. The statistical analysis (NS P > 0.05x2) indicates that there is no significant difference in the overall positive rates across different age groups when considering all three diagnostic methods together.

Age Group	No. of Patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening
10 - 19	64	28 (43.75)	22 (34.38)	22 (34.38)
20 - 29	75	68 (90.66)	58 (77.33)	55 (73.33)
30 - 39	43	39 (90.69)	35 (81.40)	33 (84.61)
40 - 49	28	26 (92.85)	22 (78.57)	20 (71.43)
50 - 59	13	10 (76.92)	8 (61.54)	6 (46.15)
60 - 69	7	5 (71.42)	3 (42.86)	3 (42.86)
70 - 79	3	2 (66.66)	1(33.33)	1(33.33)
80 - 89	1	1 (100.00)	1(100.00)	1 (100.00)
Total	200	175 (87.5)	150 (75.00)	141 (70.50)
NS P > 0.05x² = 0.43				

Table 3: Age group percentage of patients tested positive for *helicobacter pylori* in General Hospital Potiskum, Yobe State.

Prevalence of Helicobacter pylori Infection by Socio-Economic Status

Table 4 presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on their socio-economic status. Low Socio-Economic Status: 110 patients were tested; 106 (96.36%) were positive. Middle Socio-Economic Status: 60 patients were tested; 59 (98.33%) were positive. High Socio-Economic Status: 30 patients were tested; 10 (33.33%) were positive. The statistical analysis (NS P > 0.05x2) indicates that there is no significant difference in the overall positive rates across different socio-economic statuses when considering all three diagnostic methods together.

Socio Economic Status	No. of Patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening
Low	110	106 (96.36)	93 (84.55)	89 (80.91)
Middle	60	59 (98.33)	49 (81.67)	45 (75.00)
High	30	10 (33.33)	8 (26.67)	7 (20.00)
Total	200	175 (87.5)	150 (75.00)	141 (70.50)
NS P > 0.05x² = 0.60				

Table 4: Percentage of *helicobacter pylori* infection in relation to socio-economic status among patients attending General Hospital Potiskum, Yobe state.

Prevalence of Helicobacter pylori Infection by Education Status

This table presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on their education status. Primary Education: 52 patients were tested; 47 (90.38%) were positive. Secondary Education: 38 patients were tested; 32 (84.21%) were positive. Tertiary Education: 43 patients were tested; 41 (95.24%) were positive. No Education: 67 patients were tested; 55 (82.0%) were positive. The statistical analysis (NS P > 0.05x2 = 0.38) indicates that there is no significant difference in the overall positive rates across different education levels when considering all three diagnostic methods together.

The data suggests that education level may not be a significant factor in determining the risk of *H. pylori* infection among patients at General Hospital Potiskum, Yobe State. Further research may be needed to explore other potential factors contributing to the observed variations in infection rates and to understand the implications for prevention and treatment strategies (Table 5).

Education Status	No. of Patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening
Primary	52	47(90.38)	38 (73.08)	34 (65.38)
Secondary	38	32(84.21)	27 (71.05)	26 (68.42)
Tertiary	43	41(95.24)	37 (86.05)	36 (83.72)

None	67	55(82.0)	48 (71.64)	45 (67.16)
Total	200	175(87.5)	150 (75.00)	141 (70.50)
NS P > 0.05x² = 0.38				

Table 5: Percentage of *Helicobacter pylori* infection in relation to education status in General Hospital Potiskum, Yobe State.

Prevalence of Helicobacter pylori Infection by Marital Status

Table 6 presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on their marital status. Single: 40 patients were tested; 25 (62.5%) were positive. Married: 70 patients were tested; 63 (90.0%) were positive. Divorced: 30 patients were tested; 29 (96.6%) were positive. Widowed: 60 patients were tested; 58 (96.67%) were positive. The statistical analysis (NS P > 0.05x2 = 0.40) indicates that there is no significant difference in the overall positive rates across different marital statuses when considering all three diagnostic methods together.

Marital Status	No. of Patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening
Single	40	25(62.5)	20 (50.00)	20 (50.00)
Married	70	63(90.0)	54 (77.14)	50 (71.43)
Divorced	30	29(96.60)	25 (83.33)	23 (76.67)
Widow	60	58(96.67)	51 (85.00)	48 (80.00)
Total	200	175(87.5)	150 (75.00)	141 (70.50)
NS P > 0.05x² = 0.40				

Table 6: Percentage of *Helicobacter pylori* infection in relation to marital status in General Hospital Potiskum, Yobe State.

Prevalence of Helicobacter pylori Infection by Location

This table presents the results of a study investigating the frequency of *Helicobacter pylori (H. pylori)* infection among patients at General Hospital Potiskum, Yobe State, based on their location within the hospital. Nahuta: 15 patients were tested; 13 (86.67%) were positive. Lowcost: 29 patients were tested; 24 (82.70%) were positive. Rugan Fulani: 32 patients were tested; 31 (96.87%) were positive. T. Junction: 10 patients were tested; 9 (90.0%) were positive. Afghanistan: 26 patients were tested; 22 (84.61%) were positive. Roseline: 22 patients were tested; 18 (81.81%) were positive. Travelers: 36 patients were tested; 34 (94.44%) were positive. Old Army Barracks: 12 patients were tested; 11 (91.67%) were positive. Dogon Zare: 5 patients were tested; 3 (60.0%) were positive. Savannah: 13 patients were tested; 10 (76.92%) were positive.

The statistical analysis (Significant P < 0.05x² = 0.02) indicates that there is a significant difference in the overall positive rates across different locations within Potiskum town. The data suggests that the prevalence of *H. pylori* infection may vary significantly among different areas within Potiskum, Yobe State. Further research may be needed to explore potential factors contributing to these variations, such as differences in sanitation, hygiene practices or exposure to contaminated sources. Understanding these factors could inform targeted prevention and control strategies for *H. pylori* infection within the hospital.

Location	No. of Patients Tested	No. (%) Positive Antibodies Test	No. (%) Positive Antigen Test	No. (%) Positive PCR Screening
Nahuta	15	13(86.67)	10 (66.67)	9 (60.00)
Lowcost	29	24(82.70)	22 (75.86)	21(72.41)
Rugan Fulani	32	31(96.87)	28 (87.50)	27 (84.38)
T. Junction	10	9(90.0)	6 (60.00)	6 (60.00)
Afghanistan	26	22(84.61)	18 (69.23)	16 (61.54)
Roseline	22	18(81.81)	15 (68.18)	15 (68.18)
Travelers	36	34(94.44)	30 (83.33)	27 (75.00)
Army Barracks	12	11(91.67)	10 (83.33)	10 (83.33)
Dogon Zare	5	3(60.0)	3 (60.00)	2 (40.00)

Savannah	13	10(76.92)	8 (61.54)	8 (61.54)
Total	200	175(87.50)	150 (75.00)	141(70.50)
Significant $P < 0.05 x^2 = 0.02$				

Table 7: Percentage of *Helicobacter pylori* infection in relation to location in General Hospital Potjskum, Yobe State.

Discussion

The prevalence of *Helicobacter pylori (H. pylori)* infection among patients attending General Hospital Potiskum, Yobe State, Nigeria, was investigated in this study. Three diagnostic methods were employed: antibodies test, antigen screening test and PCR screening.

Overall, a high prevalence of *H. pylori* infection was observed, consistent with previous studies conducted in Nigeria. This is concerning as *H. pylori* infection is associated with various gastrointestinal diseases, including peptic ulcers, gastritis and gastric cancer [12.]

The study revealed that gender, age, socio-economic status, education and location may influence the prevalence of *H. pylori* infection. Females were found to have a slightly higher prevalence than males, which aligns with findings from other studies [13]. This could be attributed to hormonal factors or differences in lifestyle and dietary habits.

Age-related variations in *H. pylori* infection were also observed. Middle-aged individuals were more likely to be infected, suggesting that exposure to the bacterium may occur during adulthood. However, the overall statistical analysis did not reveal a significant difference between age groups.

Socio-economic status and education level were not found to be significant predictors of *H. pylori* infection in this study. This contradicts some previous research that has linked *H. pylori* infection to lower socio-economic conditions [11]. However, factors such as access to healthcare, sanitation and hygiene practices, which are often associated with socio-economic status, may not have been adequately captured in this study.

Location within the hospital was found to be a significant factor influencing *H. pylori* infection. Certain areas within the hospital had notably higher prevalence rates, suggesting that local factors such as sanitation, hygiene practices or exposure to contaminated sources may play a role in transmission.

The choice of diagnostic method for *H. pylori* infection may also influence the observed prevalence. In this study, all three methods used showed substantial positive rates, indicating their effectiveness in detecting the infection. However, antigen tests may have slightly higher sensitivity, particularly in certain groups.

Our findings revealed discrepancies between the three diagnostic methods. While PCR identified 141 positive cases, antigen testing detected 150 and antibody screening detected 175. This indicates a lack of perfect concordance among the tests.

The observed discrepancies between the tests can be attributed to several factors: Test Limitations: Each test has its own strengths and weaknesses. Antibodies might detect past infections, antigens are more indicative of current infections and PCR is highly sensitive for detecting even small amounts of bacteria.

Individual Variations: Factors like the stage of infection, bacterial load and patient-specific factors can influence test results.
Test Accuracy: The specific tests used might have different sensitivities and specificities, leading to variations in results.

While PCR is generally considered the gold standard due to its high sensitivity and specificity, it's not infallible. False negatives can occur due to factors like inadequate sample collection, PCR inhibition or mutations in the *H. pylori* genome. Antigen tests, though less sensitive than PCR, can be useful for detecting recent infections. Antibodies might indicate past infections, but their sensitivity can vary depending on the individual's immune response.

Our study highlights the importance of considering the limitations of each diagnostic method when evaluating *H. pylori* infection. While PCR is the preferred method due to its high sensitivity and specificity, combining it with antibody and antigen tests can provide a more comprehensive understanding of the infection status. Future studies are needed to further investigate the factors contributing to discrepancies between these tests and to develop more accurate and efficient diagnostic approaches.

Conclusion

In conclusion, this study revealed a high prevalence of *Helicobacter pylori (H. pylori)* infection among patients attending General Hospital Potiskum, Yobe State, Nigeria. While no significant differences were found in the overall positive rates between the three diagnostic methods used, the prevalence of *H. pylori* infection varied based on gender, age, socio-economic status and education, but only location within the hospital. The findings of this study highlight the need for increased awareness and targeted interventions to address the burden of *H. pylori* infection in the region. Further research is necessary to explore the specific factors contributing to the observed variations in prevalence and to develop effective prevention and treatment strategies.

Conflict of Interest

The authors declare that there is no conflict of interest.

Author Contributions

All authors have contributed equally to the final manuscript.

Funding

The research was funded by Tertiary Education Trustfund (TETFUND) Nigeria.

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Appendix

YOBE STATE GOVERNMENT OF NIGERIA

MINISTRY OF HEALTH & HUMAN SERVICES

OFFICE ADDRESS:-
Near Yobe State
Specialist Hospital,
Along Gujba Road, Bye-pass
P.M.B. 1047 Damaturu, Yobe State.

Our Ref: MOH/GEN/747/Vol. 1

Date: 17th July, 2023

Fatima Ibrahim Mainasara.
Department of Biological Science.
Federal University. Gashua.

RE; 'PREVALENCE OF HELICOBACTER PYLORI AMONG PATIENT ATTENDING GENERAL HOSPITAL POTISKUM YOBE STATE'.

Further to your application seeking for ethical clearance dated 10th July, 2023 in respect of the above study/protocol title as above. The Yobe State Health Research Ethics Committee (YOHREC) has reviewed your proposal accordingly.

2. Therefore I am directed on behalf of the committee to grant you Expedited approval to commence your research. You should share with us a soft and hard copy of the results of your findings. The soft copy should be email to: yobehrec@gmail.com

3. The committee requires you to comply with all institutional guidelines, rules and regulations.

4. No. changes are permitted in the research without prior approval by the committee, the committee reserves the right to visit research site with or without research's prior notice.

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