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Helicobacter Pylori Infection Using Stool Antigen Test and Its Associated Factors among Adult Rural Dwellers in Southwest Nigeria

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ABSTRACT

Background: In developing countries, the prevalence of *H. pylori* infection is generally higher compared to developed countries due to different geographical regions, socioeconomic status, age groups, lifestyle behaviors and dietary habits.
Objectives: The study evaluated the prevalence of *Helicobacter pylori* infection using stool antigen test and its associated factors among adult rural dwellers in Southwest Nigeria.
Methods: A hospital based cross- sectional study was conducted between July 10th and October 11th 2024 among 252 adult rural dwellers with gastro-intestinal tract (GIT) symptoms. Data on the respondents' socio-demographics, source of drinking water, waste disposal method, hand-washing practices, and lifestyle behaviors such as tobacco smoking, alcohol consumption, over the counter drugs' intake, and eating habits were collected through interviewer administered questionnaire. Stool antigen test was conducted on stool specimen and analyzed for *Helicobacter pylori* infection. ABO blood grouping and packed cell volume were measured and recorded. Data were analyzed using SPSS version 22. The level of statistically significant was set at p-value <0.05.
Results: The prevalence of *Helicobacter pylori* infections was 63.1% (95% CI: 56.8-69.1). Patients with informal education (AOR= 1.252, (95% CI: 1.041- 1.507), low-income level (AOR=1.393, (95% CI: 1.082-1.792), eaten unwashed fruits/vegetables (AOR= 3.892, 95% CI: 1.590-9.527), and took NSAID (AOR= 2.522, 95% CI: 1.791-3.551) were significantly associated with *Helicobacter pylori* infection.
Conclusion: The study revealed high burden of *Helicobacter pylori* infection and its associated factors. The findings would assist the stakeholders in designing appropriate targeted interventions at reducing the transmission of *Helicobacter pylori* infection in rural Southwestern Nigeria.

Key words: *Helicobacter pylori*, Prevalence, Associated factors, Rural Southwest, Nigeria

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INTRODUCTION

Helicobacter pylori (H. pylori) infection is a Gram-negative bacterium that lives in the human gastric mucosa.[1] Worldwide, 50% of the population is known to be infected with the organism.[1,2] *H. pylori* is implicated in the cause of gastric cancer and occupying the second position in the cause of death due to cancer in the world.[3]

The prevalence of *H. pylori* infection varies significantly across different geographical regions, socioeconomic status, and age groups.[4,5] In developing countries, the prevalence of *H. pylori* infection is generally higher compared to developed countries due to lack of access to good health care services, portable water and associated poor sanitation and dietary habits.[6,7] Prevalence also differs across Nigeria with rates of 34.2% in Benin, Southwest Nigeria,[8] 78.9%% in Sokoto,[9] and 81.7% in Kano,[10] Northwest Nigeria, and 87.7% in Lagos, Southwest Nigeria,[11]due to variation in geographical location, socio-economic factors and access to healthcare.[7-10] Other studies have linked the incidence of *H. pylori* infection to an unhealthy lifestyle behaviors,[18,12-13] such as alcohol consumption,[8,13] eating unwashed vegetables,[15] use of non-steroidal anti-inflammatory drug (NSAID),[12, 16-18] while few other studies have found blood group O and A with higher tendencies of *H. pylori* infection.[19-20] In order to recommend targeted interventions and management strategies to curtail the spread of H. pylori infection, there is need to have data on factors influencing this organism in rural Southwest Nigeria.

Diagnostic tests that are available for detection of H. pylori infection ranged from invasive to non-invasive methods.[21,22] Invasive test is performed during endoscopy with biopsy taken for histology, culture, rapid urease test, and polymerase chain reaction while non-invasive test includes serology, stool antigen test, urea breath test, salivary and urinary antibody tests.[21] The non-invasive test is preferred because it is cost effective and the *Helicobacter pylori* stool antigen (HpSA) test seems to be more promising.[22] The diagnostic performance of different Stool Antigen Tests (SATs) is diverse and could be Enzyme Immunoassay (EIA), Immuno Chromatographic Assay (ICA) or selection of monoclonal and polyclonal antibody.[23] SAT is used for direct detection of *H. pylori* antigen which exist in the faeces.[23, 24] This test is simple to perform, fast, cheap and several researchers have demonstrated that SAT could give more information to clinicians and guidelines for the management of *H. pylori* infection.[23, 25] Study by Kato et al suggested that SAT has great diagnostic performance, with sensitivity of 96-100% and specificity of 97-100% before eradication.[22]

In rural areas of Southwest Nigeria, the prevalence of *H. pylori* infection and its associated factors has not been well documented. Known previous studies, [21, 26] were based on serological prevalence of *H. pylori* infection while data regarding antigenic prevalence of *H. pylori* infection is not known in rural setting. This study would help to bridge this gap for targeted interventions at reducing the incidence of *H. pylori* in rural Nigeria.[9] Hence this study determined the prevalence of *Helicobacter pylori* infection and its association with socio-demographics, environmental factors, lifestyle behaviors and hematological parameters among adult rural dwellers in Southwest Nigeria.

MATERIALS AND METHODS

Study Area: This study was conducted at the General Outpatients Clinic (GOC) of the three annexes of Federal Teaching Hospital Ido Ekiti South West Nigeria. Federal Teaching Hospital is located in Ido Ekiti whose headquarters is in Ido -Osi Local government of Ekiti State. Ido- Ekiti is one of the rural communities in Ekiti State with a total land area of 332km^2, and as at the last population census of 2006, it had a total population of 159,114 with an annual growth rate of 3.2%.[27] The inhabitants of the area are engaged majorly in farming and trading activities while few others in the formal sector are the working population and retirees.

Study Design: This study was hospital based cross sectional study.

Study Population::This included population of all adult patients with gastro-intestinal tract (GIT) symptoms who presented to GOC.

Inclusion Criteria: This included adult patients with gastro-intestinal tract (GIT) symptoms, aged 18 years and above, and consented to the study.

Exclusion Criteria: This included respondents who required medical emergency or those with mental disorder that could not follow the study protocol. Also included were respondents who had completed treatment for *H. pylori* within the previous three months of diagnosis, tested for *H. pylori* and those who were unable to provide stool sample.

Sample size determination: The sample size was determined using the formula according to Araoye formula [28]

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$n=z^2$ pq/d^2, where n=sample size, Z=1.96, p=prevalence of *Helicobacter pylori* infection from previous study, and q=1-p, where d =0.05. P = Prevalence of 81.7% in a study by Ahmad et al.[26] The minimum sample size (n) =229. With 10% attrition to cater for possible drop-out, the minimum sample size (n) =252

Study duration: The study was conducted over a period of 13 weeks from July 10th to October 11th 2024.

Sampling Technique: The respondents were selected by systematic random sampling technique. From the records of adult patients with GIT symptoms at the GOC, an average of 10 patients were seen daily. This translated to 50 patients per week (Monday – Friday) and 650 patients over a period of three months that the study was conducted. Given the formula K = Sample frame (650) / Sample size (252), K = approx. 2. After obtaining informed written consent, the first respondent on each clinic day was selected by simple random sampling, thereafter, every 3rd respondent was selected by systematic random sampling until the sample size of 252 is attained.

Data collection method: The instrument of data collection was questionnaire and clinical form which was developed by the researchers following review of previous literature. The questionnaire was validated for face and content validity and Cronbach's alpha was used to determine the reliability of the instrument which revealed a reliability co-efficient of 0.83. This represents an accepted value within the normal range. To ensure construct validity, the instrument was pretested on 25 respondents who were recruited haphazardly at GOC of a sister's tertiary hospital within the State. Feedback from the pretest and validity assessment led to some modifications in the questionnaire. Three resident doctors who were trained as research assistants collected the data. Their training was to equip them on ethical standard, correctly collect the data and provide a brief explanation to the respondents. The questionnaire was a semi structured interviewer administered questionnaire and divided into A and B sections.

Section A: The questionnaire was used to record respondents' socio-demographics profiles which were age, sex, marital status, occupation, education, place of domicile, income level, and family type.

Section B: The questionnaire was used to assess the environmental factors such as source of drinking water, waste disposal method, and hand-washing practices. Also assessed were lifestyle behaviors of respondents such as tobacco smoking, alcohol consumption, over the counter drugs' intake, and eating habits. These were all self - reported. Response options regarding alcoholic intake were either yes or no. If the answer was yes, then a follow-up question would be asked regarding the frequency of alcohol consumption, with response options of daily, weekly or monthly. Tobacco smoking was grouped into smoker (both passive and active) and never smoker.

Section C: **Clinical Data Collection Method**:

Stool specimen collection and Analysis for *H. pylori*.

The stool antigen test (SAT) which is also known as Enzyme immunoassay-based test using monoclonal antibody was chosen for this study. This was because SAT has the potential of detecting acute infection and differentiate it from previous exposure.[16] After explaining to the respondents on how to collect representative stool specimens, a clean cupped plastic container was given to them to collect fresh fecal sample. Each sample was properly labeled for date, time of collection, laboratory number, and consistency of the stool. The specimen was sent to the Microbiology department of the hospital's laboratory for testing for the presence of *H. pylori* antigen by Enzyme immunoassay-based test using monoclonal antibody.[23]

Hematological parameters

About 5ml of patient's blood were obtained intravenously with the assistance of a phlebotomist under aseptic procedure. The blood was transferred into an ethylene-diaminetetra-acetic acid (EDTA) bottle to prevent blood coagulation.

Packed Cell Volume (PCV): A micro-hematocrit tube was filled with blood and centrifuged in a micro-hematocrit rotor at 10,000rpm for five minutes. PCV was read using the micro-hematocrit reader and recorded as no anaemia (PCV≥30%), mild anaemia (25-29%), moderate anaemia (20-24%) and severe anaemia (<20%).[29]

Screening for ABO blood group: Four concentric zones containing a clean slide was placed on the table where one ml of blood sample was put on the slide. The blood sample was mixed with a drop of anti-sera anti-A, anti-B and anti-D using a sterile stick. Agglutination method was employed to determine the blood groups. Details of the procedure have been described by Ibrahim et a.[29]

Data Quality Control: Quality control test was carried out on the *H. pylori* antigen testing Kit prior to the actual

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work. The principal investigator on a daily basis ensured that all laboratory procedures were supervised and checked by 5% of the collected data randomly and scrutinized for correctness. Also, two medical laboratory scientists were engaged independently to carry out the investigation in the laboratory. And when there is discrepancy between the results of the two scientists, another senior scientist who was placed on standby was drafted in to confirm the result which was accepted as final. The reporting of this study conforms to the strengthening the Reporting of observational studies in Epidemiology (STROBE) statement.[30]

Ethical Considerations and Consent: Before conducting the research, ethical clearance was obtained on 7th September, 2024 from the Ethics and Research Committee (ERC) of the Federal Teaching hospital Ido Ekiti (FETHI) with approval number ERC/2024/07/09/1141A. The reason for the study was provided to the respondents and a written consent form was signed voluntarily. Respondents' information obtained and kept confidentially by not taken any of their personal information such as names and each respondent was given equal treatment. Participation in the study was on voluntary basis and respondents were informed about their full right to withdraw or refuse at any stage of the study if they so desire without interfering with their treatment plan. The research was conducted at no cost to the respondents. The results of their investigation were communicated to each of the respondent.

Treatment of Positive Respondents: The patients who tested positive to *H. pylori* were treated with first line drugs by a physician in the clinic.

Data Analysis: Data were analyzed using Statistical Package for Social Sciences (SPSS) version 22.0 (IBM SPSS Inc.IL Chicago USA. The prevalence of *H. pylori* infection was presented by frequency distribution tables and percentages after descriptive statistics were generated. Categorical variables were compared with Pearson's Chi-square and significant P-value was taken as <0.05. Factors whose p-value were <0.05 in the bivariate analysis were entered into multivariate logistic regression where the associated factors for *H. pylori* were determined using the odds ratio at 95% confidence interval.

RESULTS

A total of 252 patients were studied. The mean age of the study was 38.7±13.8 (range 18-74) years and young adults within the ages of 20-39 (60.3%) were the predominant. There were more females (54.4%) than males (45.6%). Majority were married (67.9%) and had formal education (72.6%). Farming was the predominant occupation (33.3%) of respondents and majority lived below the poverty level (91.0%). In this study, 63.1% of the respondents tested positive for *H. pylori* infections (95% CI: 56.8-69.1). This is shown in Table 1.

Table 1. Respondents' socio-demographic profiles (N=252)

Variable	Frequency *N* = 252	Percentage (%)
Age (in years) <20	10	4.0
20–39	152	60.3
40–59	65	25.8
⩾60	25	9.9
Mean age ± SD	38.7 ± 13.8	
Range (min.–max.)	18–74	
Gender		
Male	115	45.6
Female	137	54.4
Marital status		
Single	60	23.8
Married	171	67.9
Separated/Divorced	9	3.6
Widowed	12	4.7
Education		
Informal	69	27.4
Formal	183	72.6
Occupation		
Civil servant	40	15.9
Farming	84	33.3
Artisan	32	12.7
Trader	50	19.8
Student	32	12.7
Unemployed	14	5.6
Income level		
Below poverty	179	71.0
Above poverty	73	29.0
Tested positive for *H. pylori* Yes	159	63.1
No	93	36.9

The study showed that there was a statistically significant association between *H. pylori* infections and level of

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education (P =0.029), with majority of respondents who were illiterates (73.9) tested positive for *H. pylori* infections. Similarly,68.7% of the respondents that tested positive for *H. pylori* infections lived below poverty level and the association between *H. pylori* infections and income level was statistically significant (P =0.004). This is shown in Table 2.

Table 2. Association between socio-demographic factors and *H. pylori* infection (*N* = 252).

Variable	***H. pylori*** **Positive *n* (%)**	***H. pylori*** **Negative *n* (%)**	Chi-square	***p*-value**
Age (in years)				
<20	5 (50.0)	5 (50.0)	11.380	0.060
20–39	85 (55.9)	67 (44.1)		
40–59	49 (75.4)	16 (24.6)		
⩾60	20 (80.0)	5 (20.0)		
Gender				
Male	76 (66.1)	39 (33.9)	0.813	0.367
Female	83 (60.6)	54 (39.4)		
Marital status				
Single	31 (51.7)	29 (48.3)	10.175	0.067
Married	109 (63.7)	62 (36.3)		
Separated/Divorced	8 (88.9)	1 (11.1)		
Widowed	11 (91.7)	1 (8.3)		
Education				
Informal	51 (73.9)	18 (26.1)	4.775	0.029*
Formal	108 (59.0)	75 (41.0)		
Occupation				
Civil servant	26 (65.0)	14 (35.0)	7.460	0.189
Farming	45 (53.6)	39 (46.4)		
Artisan	24 (75.0)	8 (25.0)		
Trader	32 (64.0)	18 (36.0)		
Student	24 (75.0)	8 (25.0)		
Unemployed	8 (57.1)	6 (42.9)		
Income level				
Below poverty	123 (68.7)	56 (31.3)	8.381	0.004*
Above poverty	36 (49.3)	37 (50.7)		

In this study, majority of respondents that tested positive for *H. pylori* infections (77.5%) had their source of drinking water from stream/river (P<0.001), and 77.4% of respondents that tested positive for *H. pylori* infections adopted open mode of defecation (P<0.001) and were statistically significant. With regards to family size, majority of respondents that tested positive to *H. pylori* infections (84.2%) belong to the large family size (P<0.001). Also, majority of the respondents that tested positive to *H. pylori* infections were neither wash their hands with water before meal (91.7%), nor use soap to wash their hands (67.0%) and there was a statistically significant association between *H. pylori* infections and washing hands with water (P=0.036), sand washing hands with soap (P= 0.012). In the same vein, majority of respondents that tested positive to *H. pylori* infections belong to those who eat unwashed fruits/vegetables and was statistically significant (P<0.001). This is shown in table 3.

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Table 3. Association between living environment / personal hygiene and *H. pylori* infections (*N* = 252**).**

Variable	Positive *n* (%)	*H. pylori* Negative *n* (%)	Chi-square	*p*-value
Source of drinking water				
Tap/well	**42 (41.6)**	59 (58.4)	33.496	<0.001*
River/stream	**117 (77.5)**	34 (22.5)		
Waste disposal method				
Water closet	**7 (26.9)**	19 (73.1)	38.174	<0.001*
Latrine/pit	**32 (45.1)**	39 (54.9)		
Open defecation	**120 (77.4)**	35 (22.6)		
Family size				
<4	**95 (54.0)**	81 (46.0)	20.836	<0.001*
⩾4	**64 (84.2)**	12 (15.8)		
Hand washing with water Before meal				
Yes	**148 (61.7)**	92 (38.3)	4.417	0.036*
No	**11 (91.7)**	1 (8.3)		
After meal				
Yes	**148 (64.1)**	83 (35.9)	1.129	0.288
No	**11 (52.4)**	10 (47.6)		
Hand washing with soap				
Yes	**25 (48.1)**	27 (51.9)	6.347	0.012*
No	**134 (67.0)**	66 (33.0)		
Eating unwashed fruits/vegetables				
Yes	**155 (67.7)**	74 (32.3)	22.705	<0.001*
No	**4 (17.4)**	19 (82.6)		

In this study, persons with blood group A (71.0%), rhesus positive (63.4%) and Pack cell volume less than 20 (70.6) were not statistically significant (P >0.05) for *H. pylori* infection. Table 4.

Table 4. Association between hematological parameters and *H. pylori* infection (*N* = 252).

Variable	*H. pylori* Positive *n* (%)	*H. pylori* Negative *n* (%)	Chi-square	*p*-value
Blood group				
O	72 (63.2)	42 (36.8)	3.173	0.366
A	44 (71.0)	18 (29.0)		
B	31 (55.4)	25 (44.6)		
AB	12 (60.0)	8 (40.0)		
Rhesus factor				
Rh Positive	147 (63.4)	85 (36.6)	0.089	0.765
Rh Negative	12 (60.0)	8 (40.0)		
Pack cell volume				
<20	12 (70.6)	5 (29.4)	5.791	0.122
20–24	30 (63.8)	17 (36.2)		
25–29	38 (52.1)	35 (47.9)		
⩾30	79 (68.7)	36 (31.3)		

In terms of lifestyle behaviors, respondents who smoked tobacco and consumed diet spicy food recorded prevalence of 80.0%, and 66.7% *H. pylori* infection respectively but were not statistically significant (P > 0.05). Meanwhile, respondents

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who used NSAID (P<0.001) and consumed alcohol (P=0.009) recorded 77.6% and 78.2% prevalence of *H. pylori* infections respectively and were statistically significant. This is shown in table 5.

Table 5. Association between lifestyle behaviors and *H. pylori* infection (*N* = 252).

Variable	***H. pylori*** **Positive *n* (%)**	***H. pylori*** **Negative *n* (%)**	Chi-square	***p*-value**
Tobacco smoking				
Yes	20 (80.0)	5 (20.0)	3.406	0.065
No	139 (61.2)	88 (38.8)		
Diet spicy food				
Yes	24 (66.7)	12 (33.3)	0.230	0.631
No	134 (62.5)	81 (37.5)		
Taken NSAID				
Yes	135 (77.6)	39 (22.4)	50.696	<0.001*
No	24 (30.8)	54 (69.2)		
Taken coffee				
Yes	34 (60.7)	22 (39.3)	0.175	0.675
No	125 (63.8)	71 (36.2)		
Taken alcohol				
Yes	43 (78.2)	12 (21.8)	6.877	0.009*
No	116 (58.9)	81 (41.1)		

Using multivariate logistic regression model after controlling for possible con-founders, the odds of tested positive to *H. pylori* infections was 1.252 times (AOR= 1.252, 95% CI: 1.041- 1.507, P= 0.041) more likely in respondents with informal education compared to respondents with formal education, 1.393 times (AOR=1.393, (95% CI: 1.082-1.792, P=0.011), more likely in respondents that lived below poverty level compared to respondents with above poverty level, and 3.892 times (AOR= 3.892, 95% CI: 1.590-9.527,P=0.001), more likely in respondents that eat unwashed fruits/vegetables compared to respondents who did not. Similarly, the odds of tested positive to *H. pylori* infections was 2.522 times (AOR= 2.522, 95% CI: 1.791-3.551, P=0.002), more likely in respondents that took NSAID compared to respondents who did not. This is shown in Table 6.

Table 6. Multivariate logistic regression for determinants of *H. pylori* infection

Variable	COR (95% CI)	*P*	AOR (95% CI)	*p*
Education	1.968 (1.066–3.631)	0.029*	1.252 (1.041–1.507)	0.041*
Informal				
Formal (ref)	1.000		1.000	
Income level Below poverty	2.257 (1.293–3.941)	0.004*	1.393 (1.082–1.792)	0.011*
Above poverty (ref)	1.000		1.000	
Source of drinking water River/stream	0.207 (0.119–0.359)	<0.001*	0.537 (0.419–0.687)	<0.001*
Tap/well (ref)	1.000		1.000	
Waste disposal method	0.101 (0.039–0.259)	<0.001*	0.343 (0.181–0.649)	<0.001*
Open defecation				
Latrine/pit	0.224 (0.123–0.408)	<0.001*	0.795 (0.367–1.987)	0.035*
Water closet (ref)	1.000		1.000	

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Variable	COR (95% CI)	*P*	AOR (95% CI)	*p*
Family size	0.220 (0.111–0.436)	<0.001*	0.426 (0.236–2.377)	0.114
⩾4				
<4 (ref)	1.000		1.000	
Hand washing with water	0.146 (0.019– 1.152)	0.036*	0.673 (0.552–0.820)	0.048*
Before meal				
No				
Yes (ref)	1.000		1.000	
Hand washing with soap	0.456 (0.246–0.847)	0.012*	0.718 (0.532–0.967)	0.033*
No				
Yes (ref)	1.000		1.000	
Eating unwashed fruits/vegetables	9.949 (3.268–30.287)	<0.001*	3.892 (1.590–9.527)	0.001*
Yes				
No (ref)	1.000		1.000	
Taken NSAID	7.788 (4.281–14.170)	<0.001*	2.522 (1.791–3.551)	0.002*
Yes				
No (ref)	1.000		1.000	
Taken alcohol Yes	2.502 (1.243–5.039)	0.009*	1.328 (0.874–1.593)	0.213
No (ref)	1.000		1.000	

DISCUSSION:

This study aimed at assessing the prevalence of *H. pylori* infection and identified its associated factors in patients with GIT symptoms in rural setting of Ekiti State, Southwest Nigeria. The observed prevalence rate of *H. pylori* infection in this study was high (63.6%), with most of the respondents infected. Our prevalence rate in this study was comparable to 64.0% in Ibadan, Southwest Nigeria,[15] and could be due to similar study design, socio-cultural, socio-demographic and geographical setting. The high prevalence rate in our study is a major cause for concern given the fact that *H. pylori* infection has been implicated in the etiology of gastric cancers.[3] While our prevalence of 63.6% is high, it was lower than the estimated Nigeria prevalence of 87.7% and African prevalence rate of above 70.0%.[16] The high prevalence of *H. pylori* infections in Africa is probably influenced by socio-demographics and geographical factors.[16] Our prevalence rate was equally lower than 78.9% in Sokoto,[9] 81.7% in Kano,[26] and 96.0% in Kano,[31] in North-western Nigeria. The high prevalence rates in these other studies compared to our study could be related to geographical locations of these studies. These studies were conducted in Northern part of Nigeria, a region known to have a highest prevalence compared to other regions of the country.[9] However, our study was greater than 23.5% in Nigeria,[5] 35.7% in Uganda,[32] 34.0% in Debre Tabor,[16] and 37.6% in Gondar.[4] The observed high prevalence of *H. pylori* infection in our study compared to these other studies could be due to patients' poor eating habit, low socioeconomic status and geographical location of our study.

Using multivariate logistic regression model, our study identified *H. pylori* infection patient with informal education, low income, eating unwashed fruits/vegetables, and taken NSAID as factors associated with risk of *H. pylori* infection. The association between informal education and increased risk of *H. pylori* infections in this study was consistent with several other studies.[26, 33] The majority of *H. pylori* infectious' patients with informal education in this study were probably farmers with higher tendency for indiscriminate eating habits and poor hygiene.[34] This link is critical for the development of carriers and host of *H. pylori* infection. The implication of this finding calls for population-based screening in people with no formal education.

Similar to findings in other studies, our study revealed a statistically significant association between people who lived below poverty line and risk of *H. pylori* infection in them.[11, 35] Our study showed that people who lived below poverty level were 1.393 times more likely to have *H. pylori* infection compared with those with high income. This is comparable with recent study by Mabeku et al who found 79.09% of subjects with low income level to have *H. pylori* infections.[18] The rural dwelling in

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our study is typified by lower income group and poor eating habits as found in other Sub-Sahara African countries.[35] The present study further supports the notion that *H. pylori* infection is a disease of poverty.[10] Obviously, the alleviation of poverty in this setting could provide targeted intervention at controlling the rate of *H. pylori* infection. In contrast to this finding, study by Altamini et al found no association between income level and risk of contracting *H. pylori* infection.[36] The current study showed rural dwellers with habit of eating unwashed fruits/vegetables were 3.892 times more likely to be infected with *H. pylori* infections and was comparable to finding in another study.[15] Study by Yuan et al hypothesize that unwashed vegetables play a role both as an environmental reservoir of infection and as a medium in the faecal-oral transmission of *H. pylori* infection.[6] Faecal-oral and oral-oral routes are considered the most likely routes of transmission of *H. pylori* infection.[15] Previous study had linked contaminated vegetables as source of infection in developing countries.[15] *H. pylori* infection can be cultivated from the vomitus, stool and saliva of individuals with infection, indicating the potential risk of infection via these routes.[6, 15] It was demonstrated that those consuming raw vegetables which are often irrigated with untreated sewage water, had a higher prevalence of *H. pylori* infection.[6-7, 15]

The interaction between people with *H. pylori* infection and use of NSAID is complex, poorly defined, and remain more controversial.[16] However, a previous study by Zhitiao et al showed that people with chronic NSAID use have *H. pylori* infection.[37] Also, study by Mabeku et al showed that 73.07% of people with NSAID use had *H. pylori* infection.[16] Our study found that 77.6 % of respondents with NSAID use had *H. pylori* infection, and were 2.522 more likely to test positive to *H. pylori* infections compared with respondents who did not use NSAID. While several studies had supported the role of *H. pylori* infection in exacerbating the risk of peptic ulcer disease in several populations, [16-17] none of these studies had revealed the association between increased risk of *H. pylori* and use of NSAID. The current study has bridged this gap.

Limitations:

The cross-sectional design of this study limits the possibility to determine causality. This study was hospital-based and therefore limits its generalizability but probably reflect the pattern of the study population. We thereby recommend community- based and longitudinal cohort studies in order to fully understand the prevalence and associated factors of *H. pylori* infection in rural settings. Despite these limitations, the current study provides distinct information regarding the prevalence and associated factors of *H. pylori* infection in rural settings. These findings are important for stakeholders to design appropriate targeted interventions at reducing the incidence of *H. pylori* infections in rural settings.

Implications of findings in this study:

The findings in this study would guide the clinicians and other stakeholders to screen for *H. pylori* infection and the identified associated factors in patients who presented with GIT symptoms. The findings would also serve as a template for future intervention studies in rural settings. Policy makers should recommend targeted interventions such as improved literacy, poverty reduction and personal hygiene. This would help to reduce the transmission of *H. pylori* infection in rural Southwestern Nigeria.

CONCLUSION:

The prevalence of *H. pylori* infection in this study is high. Factors which included participants with informal education, low income, eating unwashed fruits/vegetables, and taken NSAID were associated with increased prevalence of *H. pylori* infection in the study setting. The findings would assist the stakeholders in designing appropriate targeted interventions at reducing the transmission of *H. pylori* infection in rural Southwestern Nigeria.

Declarations:

Ethical approval: Ethical clearance was obtained from the Ethics and Research Committee (ERC) of the Federal Teaching hospital Ido Ekiti with approval number ERC/2024/07/09/1141A

Consent to participate: Written informed consent was obtained from the participants who voluntarily agreed to participate in the study. To ensure confidentiality, no participant's name was recorded.

Consent for publication: None.

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