Chapter

Helicobacter pylori Seromarkers in a University Students Population in Central Nigeria

Victor B. Oti, Isa H. Mohammed, Fatima Y. Al-Mustapha and Salamatu B. Buhari

Abstract

Infection due to *Helicobacter pylori* is a public health challenge worldwide as over 3 billion persons are infected with the bacterium globally. There is a serious need to update the knowledge on the epidemiology of this bacterial pathogen and its probable risks factors to generate intervention programs that will reduce the morbidity and mortality of infected individuals. This chapter evaluated the seromarkers of *H. pylori* infection and its predisposing factors among students of Nasarawa State University, Keffi, Central Nigeria. This study was done between June through August 2019; blood and stool specimens were collected from 400 students of the institution. Before the commencement of the study, ethical clearance and informed consent were retrieved and a structured questionnaire was administered to each participant. Specimens were screened for *H. pylori* antigen and antibody using rapid test kits (CTK Biotech, Inc., San Diego, USA and Biotest Biotech, China). Information obtained were analyzed using SSP version 2.80. P values <0.05 were reflected statistically significant. Out of the 400 students tested, 166 (41.5%) and 128 (32.0%) showed positive for anti-*H. pylori* IgG and Ag markers respectively. The antibody seromarker was higher in female while the *H. pylori* antigen was higher in males. Those students aged 21–30 years old reported the highest prevalence of the seromarkers while those of more than 41 years old had the least prevalence. Location, type of toilet facility and place of residence were statistical associated between *H. pylori* antigen ($P < 0.05$). There was a statistically significant association between anti-*H. pylori* IgG and the sources of water of the students ($P < 0.05$). This is the first public report that has successfully reported the prevalence of these seromarkers among students of a tertiary institution in Nasarawa state. The overall outcomes of this study stressed the need for student-based intervention programs to stem the transmission of this infection in Nasarawa State, Nigeria.

Keywords: *Helicobacter pylori*, students, Keffi, seromarkers, prevalence

1. Introduction

Infections due to *Helicobacter pylori (H. pylori)* is a public health challenge globally as approximately 50% (over 3 billion) of the world population are known to be infected with this organism [1]. In 1983, Warren and Marshall identified *H. pylori*, which were formally called *Campylobacter pylori*, as a flagellated spiral, Gram negative

organism that have the capacity to synthesize urease in greater amounts [2]. Before then, laboratory analysis of upper gastrointestinal diseases that shows dyspepsia was with much complexity [3]. However, *H. pylori* has become a key etiological factor considered in cases of peptic ulcer disease (PUD), chronic gastritis, gastric cancer, and gastric mucosa associated lymphoid tissue (MALT) lymphoma in recent times [4–7].

Transmission of this organism could be person-to-person spread by either fecal-oral or oral-oral routes. Studies have shown that the organism can be isolated in feces, dental plaque, and saliva of few infected persons [8–9]. Most individuals infected with this organism are asymptomatic [10]. But in most situations, infected individuals are shows associated symptoms like mild to severe scorching intestinal ache that outspreads from the navel to the chest region. Nausea, loss of appetite, weight loss, vomiting, indigestion, and melena are other symptoms of this infection [5, 6, 9]. This bacterial pathogen is the primary cause of ulcers and its exact route of spread is still not known [4], there are other factors that has impact in ulcer generation including use of non-steroidal anti-inflammatory drugs (NSAIDs) like; ibuprofen, aspirin and piroxican [11]. Other fewer shared predictors may include smoking, cocaine, severe illness, Crohn's disease, alcoholism, autoimmune problems and radiation treatment among others [9, 12].

There are several diagnostic protocols for *H. pylori* infection [9, 13]. However, fecal antigen and urea breath tests shows utmost precision to check and approve the pathogen [13]. Nevertheless, serologic assays that detect the antibodies of *H. pylori* presence in human serum is commonly used especially in low resource countries like Nigeria [6, 14]. Practicing good hygiene and hand washing, especially with food preparation are keys for prevention of *H. pylori* infection while treatment is best by combination of antibiotics and proton pump inhibitors [4, 15].

In developing countries the bacterial infection is high when compared to developed nations, maybe because of lack of basic social amenities, poor sanitary conditions, low socio-economic status, and reduced use of antibiotics for dissimilar pathologies [10, 16–18]. The prevalence rate of the infection ranges from 30–40 percent in the United States and parts of Europe [19–20], 80–90 percent in South America and 70–90 percent in Africa continent [6, 15, 16]. In a hyper-endemic area of this bacterial infection like Nigeria [6, 7, 21, 22], there is a serious need to update the knowledge on the epidemiology of this bacterial infection and its related predictors to generate intervention programs that will reduce the morbidity and mortality of infected individuals. Therefore, this chapter principally determined the sero-markers for *H. pylori* infection among students of Nasarawa State University Keffi, Central Nigeria. It also identified possible predisposing factors such as gender, age, marital status, sources of water, toilet facilities among others from results obtained.

2. Material and methods

2.1 Study area

This study was done at Nasarawa State University, Keffi (NSUK), Nasarawa State, Nigeria. NSUK is a higher educational institution with a student population of approximately twenty thousand. The institution is situated in Keffi which is about 68 Km from Abuja, the Federal Capital Territory and 128 Km from Lafia, the Capital of Nasarawa State. The area lies in latitude eight 5'N of the equator and longitude seven 8′E, it is situated on height of 850 M up sea level [23]. The mean yearly shower is ±2,000 millimeters (79 in), and is heavy in the rainy months with its highest downpour during July to September [24]. The inhabitants mostly engage in trading, farming, schooling and petty jobs.

2.2 Study population

Four hundred (400) students of both sexes with a mean age of 24.8 years who are studying at the institution were recruited to be part of this cross-sectional study between June through August 2019. After knowledgeable agreement was retrieved from each student who was between the ages of 16 and above and eligible for the study was identified during the study period and involved in the study. Data concerning the participants socio-demographic and risk factors were retrieved by a self-structured questionnaire.

2.3 Sample size determination

Determination of sample size used for this study was done with the formula by Naing, [25] for calculation at 0.05 level of precision;

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

Where:

n = required sample size.

Z = standard normal deviation at the necessary confidence interval (1.96) which agrees to 95% confidence interval.

p = prevalence of *H. pylori* from previous study (56.3%) (0.2) [26].

q = 1 – p = 0.9.

d = degree of precision expected (0.05)

$$n = (1.96)^2 (0.2)\ (0.9) / (0.05)^2 = 3.8416 \times 0.18 / 0.0025 \quad (1)$$

$$3.8416 \times 0.18 / 0.0025 = 0.6915 / 0.0025 \quad (2)$$

$$0.6915 / 0.0025 = 276.6 \quad (3)$$

$$n = 277 \quad (4)$$

To minimize error, this was however rounded up to 400 samples.

2.4 Ethical approval and administration clearance

Ethical clearance for this chapter was collected from the Health Research Ethics Committee (HREC) of the Federal Medical Centre, Keffi, Nigeria (FMC/KEF/HREC/212/19). Official permission and administrative clearance was also received from the management of South Atlantic Petroleum Medical Center Keffi, Nasarawa State where specimens were obtained. In addition, each participant included in this study willingly completed and signed an informed consent form. Individual anonymity was treated with privacy and for the aim of the study.

2.5 Blood sample collection

Approximately 3 ml of blood specimen was drawn from each study participant by venipuncture into a plain tube and was labeled. Samples were left to clot at a minimal room atmosphere and spun at 3, 000 rpm for 5 minutes. The subsequent sera were collected into labeled cryovials and kept at -20 °C till set for analysis.

2.6 Stool sample collection

Each participant was given a labeled, germ-free leak proof universal bottle and instructed on how to obtain the stool sample aseptically [27]. The specimens were stored at 4 °C in the refrigerator until ready for the test.

2.7 Laboratory analysis

2.7.1 Detection of H. pylori *serum antibody*

All sera were tested for *H. pylori* antibody (IgG) presence using the one-step *H. pylori* antibody quick diagnostic screening kit (CTK Biotech, Inc., San Diego, USA). The tests protocol and results readings were done based on the instructions of the manufacturer.

2.7.1.1 Test procedure

The test kit and other reagents were taken to room temperature. The test device was placed on a flat dehydrated surface and about 2 droplets of the separated serum were added to the specimen well. It was allowed for 10 mins before reading was taken.

2.7.2 Detection of H. pylori *stool antigen*

H. pylori antigen was identified from stool samples using a one-step *H. pylori* antigen rapid test device (Biotest Biotech, China). The tests protocol and results readings were done based on the instructions of the manufacturer.

2.7.2.1 Test procedure

A sterilized swab stick which is inside the stool kit was used to take fecal specimen from the bottle. The specimen was introduced into the tube that has the assay diluents. The swab stick was swirled approximately 10 times inside the diluents until the specimen is totally liquefied. The specimen gathering tube was capped and left for approximately 5 minutes. Three droplets of prepared fecal specimen was placed in the specimen well of the test kit and the result was read in 15 minutes.

2.7.3 Interpretation of results

The test is positive when two red lines which depicts control (C) and test (T) is seen on the test device. It is negative when just a red line which depicts control is seen. Test is invalid when no line or only the T line is seen, in such situation, the test was repeated.

2.8 Data analysis

The information realized from this study was subjected to descriptive statistical investigation using Smith's Statistical Package (SSP version 2.80, Claremont, California-USA). Chi-square statistical analysis was used to decide associations. Data gotten were reflected statistically significant at $p \leq 0.05$.

3. Results

In this study, we investigated the epidemiology of *H. pylori* infection by serum antibody and stool antigen determination approaches among students of Nasarawa State University, Keffi. A total of 400 students consisting of 192(48.0%) males and 208 (52.0%) females were screened for both antibody and antigen to *H. pylori* using rapid diagnostic methods. Of the 400 students screened, 166 (41.5%) showed positivity to *H. pylori* IgG, and 128 (32.0%) showed positivity to *H. pylori* antigen (**Figure 1**).

There was no statistically significant difference between age and seromarkers of *H. pylori* ($P > 0.05$). However, the infection was highest both antibody (46.4%) and antigen (36.6) among those aged 21–30 years old. Also, students aged ≥40 years had the least prevalence of *H. pylori* infection (Ab = 25.0%, Ag = 16.7%) when compared to other age groups. There were more females (208) than males (192) and among the 192 males tested, 79 (41.2%) and 59 (30.7%) showed positivity for antibody and antigen of *H. pylori* respectively. Nevertheless, of the 208 females, 87 (41.8%) tested positive for *H. pylori* antibody while 69 (33.2%) were positive for stool antigen. However, this variation was not found to be statistically significant ($P > 0.05$). There was no statistical significant association between *H. pylori* seromarkers and marital status ($P > 0.05$). Of the 92 married students, 45 (48.9%) showed positivity for serum antibody while 35 (38.0%) showed positivity for stool antigen. Similarly, 121 (39.3%) of the unmarried reported positive for serum antibody and 93 (30.2%) tested positive for stool antigen. The rate of serum antibody was reported high among students from rural areas (44.4%) than those from urban areas (39.4%) ($P < 0.05$). But surprisingly, considering stool antigen as a marker for *H. pylori* infection, both those from rural (33.1%) and urban (33.2%) areas almost had equal infection burden (**Table 1**).

No statistically significant association was reported between the bacterial infections and socio-economic status ($P > 0.05$). Notwithstanding, students with poor socio-economic status had higher prevalence of both serum antibody (46.2%) and stool antigen (48.1%) while the least prevalence of the infections (Ab = 38.2%, Ag = 25.5%) was recorded among those with very good socio-economic status.

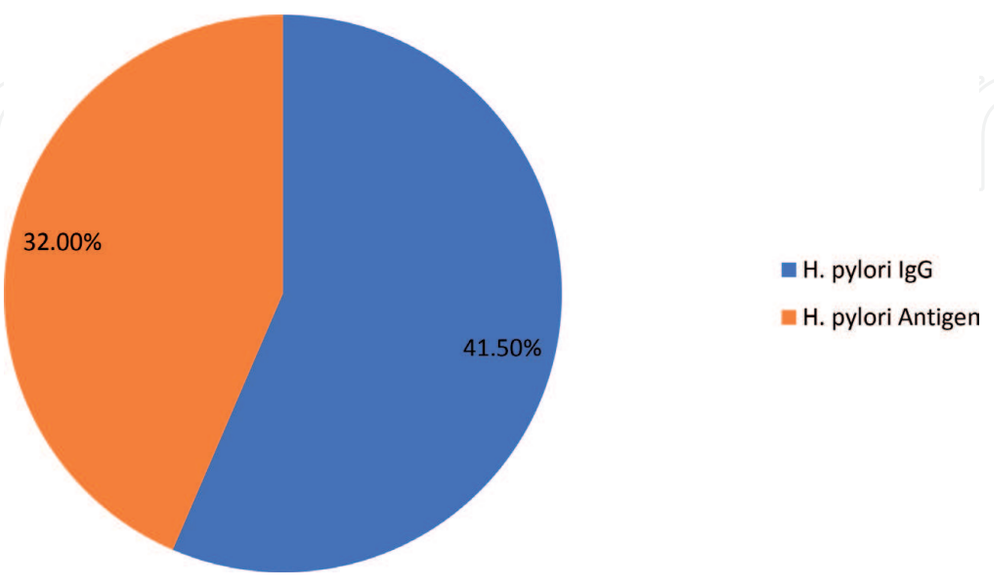

Figure 1.
Distribution of markers for H. pylori *infections among students of a tertiary institution in Central Nigeria.*

Socio-demographics	No. Examined	Prevalence (%)	
	(N = 400)	Serum IgG	Stool Ag
Age (Years)			
15–20	120	45(37.5)	35(29.2)
21–30	224	104(46.4)	82(36.6)
31–40	44	14(31.8)	9(20.5)
≥41	12	3(25.0)	2(16.7)
P-value		**0.1762**	**0.2417**
Gender			
Male	192	79(41.2)	59(30.7)
Female	208	87(41.8)	69(33.2)
P-value		**0.3010**	**0.2993**
Marital Status			
Married	92	45(48.9)	35(38.0)
Unmarried	308	121(39.3)	93(30.2)
P-value		**0.2811**	**0.1902**
Location			
Urban	231	91(39.4)	72(31.2)
Rural	169	75(44.4)	56(33.1)
P-value		**0.0814**	**0.0424***

**Statistically Significant.*

Table 1.
Distribution of markers of H. pylori *infections among students of a tertiary institution in Central Nigeria in relation to socio-demographic factors.*

Furthermore, *H. pylori* serum antibody was highest among students who source water from river/stream (54.2%) than those who source water from tap (43.1%), well (39.8%) and borehole (38.4%) ($P < 0.05$). However, those who source water from well (39.8%) had the highest prevalence of stool antigen when compared to other sources of water. Similarly, there was statistically significant association between type toilet and *H. pylori* stool antigen in this study ($P < 0.05$), as higher rate was recorded among students who use pit toilet (39.0%) than those who use toilet with water system (29.8%). On the other hand, higher rate of *H. pylori* serum antibody was recorded among those with toilets with water system (43.9%) compared to those with pit toilets (33.7%). Additionally, place of residence was also associated with *H. pylori* stool antigen ($P < 0.05$). Higher prevalence of both stool antigen (36.2%) and serum antibody (43.6%) To*h. pylori* were reported among students residing in the hostel as compared to those who reside at home/off-campus (Ab = 40.1%, Ag = 29.1%). Surprisingly, both smoking and alcoholism were not significantly associated with *H. pylori* infections in this study ($P > 0.05$). However, higher prevalence of the infections was recorded among smokers (Ab = 47.3%, Ag = 40.5%) than those who do not smoke (Ab = 40.2%, Ag = 30.4%). Nonetheless, the infections was higher among those who do not take alcohol (Ab = 42.4%, Ag = 33.1%) than those who take alcohol (Ab = 38.2%, Ag = 28.1%). Self-medication was also not significantly associated with *H. pylori* infections ($P > 0.05$). However, those who do not self-medicate were more infected (Ab = 42.7%, Ag = 33.7%) than those who self-medicates (Ab = 41.2%, 31.5%) (**Table 2**).

Risk factor	No. Examined	Prevalence (%)	
	(N = 400)	Serum IgG	Stool Ag
Socio-economic status			
Very good	55	21(38.2)	14(25.5)
Average	239	96(40.2)	63(26.4)
Poor	106	49(46.2)	51(48.1)
P-value		**0.0711**	**0.1002**
Water sources			
Tap	72	31(43.1)	24(33.3)
Borehole	172	66(38.4)	46(26.7)
Well	108	43(39.8)	43(39.8)
River/stream	48	26(54.2)	15(31.3)
P-value		**0.0432***	**0.6711**
Types of toilet			
Water system	305	134(43.9)	91(29.8)
Pit	95	32(33.7)	37(39.0)
P-value		**0.0991**	**0.0440***
Place of residence			
Home/off-campus	237	95(40.1)	69(29.1)
Hostel	163	71(43.6)	59(36.2)
P-value		**0.0672**	**0.0336***
Smoking Habit			
Yes	74	35(47.3)	29(40.5)
No	326	131(40.2)	99(30.4)
P-value		**0.1102**	**0.3447**
Alcohol intake			
Yes	89	34(38.2)	25(28.1)
No	311	132(42.4)	103(33.1)
P-value		**0.5048**	**0.6590**
Self-medication			
Yes	311	128(41.2)	98(31.5)
No	89	38(42.7)	30(33.7)
P-value		**0.0821**	**0.9115**

**Statistically Significant.*

Table 2.
Distribution of markers of H. pylori *infections among students of a tertiary institution in Central Nigeria in relation to risk factors.*

4. Discussion

Helicobacter pylorus is a ubiquitous bacterium which is found in about two-third of the world's population [15, 28]. This current study was conducted to investigate the seromarkers and predisposing factors of *H. pylori* infections among students of Nasarawa State University, Kefii, Nigeria. A total of 400 students participated in the

study and they were screened for both stool antigen and serum antibody (IgG) to *H. pylori* using rapid diagnostic approaches. Out of the 400 students screened, 166 (41.5%) showed positivity to serum antibody (IgG) and 128 (32.0%) were positive to stool antigen.

It is worthy of note that, presence of serum antibody (IgG) and absence of stool antigen in an individual is an indication of immunity to *H. pylori* due to past exposure to the bacterium. But when an individual is tested positive for both the antigen and the antibody at the same time, it means that there is an existing infection, while those that shows negative to both stool antigen and serum antibody are prone to *H. pylori* infections [22, 28, 29].

The 41.5% *H. pylori* IgG seroprevalence recorded in the study is higher than the 28.0% reported by Enitan *et al.* [22] among students of tertiary institution in Ogun, 35.0% by Ombugadu *et al.* [5] among dyspeptic patients in Jos and 15.4% by Moujaber *et al.* [30] in Australia. However, it is lower than the 57.9% found by Oti *et al.* [26] among patients in North-Central Nigeria, 51.9% by Gide *et al.* [6] among dyspeptic patients in Damaturu and 47.0% by Bastos *et al.* [20] among adult in Portugal.

On the other hand, the 32.0% stool antigen positivity recorded in this study is higher than the 22.8% reported by Adeniyi *et al.* [31] in malnourished children in Lagos and 23.5% by Enitan *et al.* [22] among students of tertiary institution in Ogun. Nevertheless, higher rates have also been reported. It was 38.8% among dyspeptic patients in Jos [5], 35.0% among malnourished children in Iraq [32] and 84.0% among African refugee children from resettlement in Australia [33]. The differences in the rates of *H. pylori* infection markers observed in different studies may be due to differences in population type and location with different peculiar risk factors.

Although, there is no statistically significant association between age and infections due to *H. pylori* ($p > 0.05$), students aged 21–30 years old were more infected than other age groups. This is indicated by high serum IgG (46.4%) and stool antigen (36.6%) among those in this age bracket. The results of this study were not in consonance with the reports of other previous studies [26, 34–38]. The higher prevalence of the infection among younger students in this current study might be because a good number of them reside in the hostel where there is overcrowding and poor hygienic conditions.

In this current study, gender was not statistically associated with infections due to *H. pylori* ($p > 0.05$) as both males (IgG = 41.2%, Ag = 30.7%) and females (IgG = 41.8%, Ag = 33.2%) were almost equally infected. This is consistent with the report of Ombugadu *et al.* [5] among dyspeptic patients in Jos but they however recorded higher prevalence of the infection among males (IgG = 43.2%, Ag = 45.5%) than females (IgG = 25.0%, Ag = 30.6%) which they attributed to higher exposure of males to possible environmental sources of infection such as smoking and alcohol intake.

In a related development, *H. pylori* infection was not associated with marital status ($p > 0.05$). This report is in consonance with the reports from other researchers [12, 22, 26]. However, the higher prevalence of the bacterial infection markers recorded among married (Ab = 48.9%, Ag = 38.0%) than unmarried (Ab = 39.3%, Ag = 30.2%) in this study might be unconnected to the engagement of married people particularly women in house chores such as washing of toilets, bathrooms and taking care of babies which may probably put them at high risk of the pathogenic agent through fecal-oral routes.

There is a statistically significant association between location and *H. pylori* stool antigen positivity in this study ($p < 0.05$). It was higher among rural settlers (IgG = 44.4%, Ag = 33.1%) than urban settlers (IgG = 39.4%, Ag = 31.2%). Most studies conducted in Nigeria also reported similar findings [5, 12, 26, 31]. This is

no surprise because most Nigerian rural communities are characterized by lack of basic social amenities, poor hygienic environment and low socio-economic status [31, 36, 39].

This study reported no significant association between *H. pylori* infection and socio-economic status of participants in this study ($p > 0.05$). However, infection with *H. pylori* increased progressively with a decrease in socio-economic status of the participants. This observation agrees with findings of other researchers [5, 6, 36, 38]. Living in overcrowded homes that possess ugly environmental hygiene is associated with poor financial status individuals [12, 31, 39], thus, the possible reason the bacterial infection was high among them. There was a statistically significant association between students' water sources and *H. pylori* IgG seropositivity ($p < 0.05$). The prevalence was highest among those that use river/stream as their source of water (54.2%). This is no surprise because open defecation is common in Nigeria and water from river/stream can be easily contaminated with pathogenic organisms including *H. pylori* which are a fecal-oral pathogen [9]. Nevertheless, students which source of water is well had the highest prevalence of *H. pylori* antigen (39.8%). Other studies have reported similar outcomes [5, 38, 40].

Type of toilet facilities of the students was statistically associated with *H. pylori* antigen positivity in this study ($p < 0.05$). It was high among those that use pit toilets (39.0%). On the other hand, *H. pylori* IgG seropositivity was high among participants that use water system toilets (43.9%) compared to those that use pit toilets (33.7%). This observation may be an indication that the hygienic nature of the toilet and not its types is the reason behind the spread of the bacterial infection [6, 17, 38].

There was a statistically significant difference between place of residence and *H. pylori* antigen positivity ($p < 0.05$). The infection was more for both antigen (36.2%) and antibody (43.6%) among students residing in the hostel. This is expected because most hostels in Nigerian public tertiary institution are characterized with overcrowding and poor sanitary conditions which have been noted previously to be risk factors for the transmission of the infection [12, 33]. In this current study, both smoking and alcoholism were not statistically associated with the bacterial infection ($p > 0.05$) but there were arithmetic differences. This observation agrees with the report of Eshraghian [41]. Most previous studies have documented smoking and alcoholism as potential risk factors for *H. pylori* infection [9, 11, 12, 22, 26]. The higher prevalence of the infection among smokers in this study (IgG = 47.3%, Ag = 40.5%) may be connected with the fact that smoking, taking alcohol and coffee have been reported to increase the volume and concentration of stomach ulcer which can worsen an existing ulcer [22, 37].

Self-medication was not statistically associated with *H. pylori* infections in this study ($p > 0.05$). However, ulcer development has been linked to non-steroidal anti-inflammatory drugs (NSAIDs) usage such as, aspirin, ibuprofen and prioxican [11, 42]. These drugs are commonly used self-medications for headache, tiredness and fever. But surprisingly, in this study, participants who do not engage in self-medication were more infected with *H. pylori* (IgG = 42.7%, Ag = 33.7%) than those who engage in self-medication (IgG = 41.2%, Ag = 31.7%). Students who do not indulge in self-medication may have contracted the bacterium by living in overcrowded environment with poor hygienic and sanitary conditions hence the possible higher prevalence among them.

5. Conclusion

This study confirmed the presence of anti-*H. pylori* IgG and Ag markers with 41.5% and 32.0% for past and current infections respectively. The antibody

seromarker was higher in female while the *H. pylori* antigen was higher in males. Those students aged 21–30 years old reported the highest prevalence of the seromarkers while those of more than 41 years old had the least prevalence. Location, sources of water, types of toilet facility and place of residence were statistically associated with the bacterial infection. This is the first public report that has successfully reported the prevalence of these seromarkers among students of a tertiary institution in Nasarawa state. Priority should be given to personal and environmental hygiene of students to mitigate the spread of the infections.

6. Limitations of the study

This study was limited to a population of undergraduate students of a tertiary institution and the results may not be a true representation of the general population. Additionally, the serum antibody and stool antigen to *H. pylori* were detected using rapid diagnostic methods. Culture and other invasive methods such as endoscopic biopsy were not employed. Thus, the prevalence rates of *H. pylori* infection is likely to be underestimated because most commercially produced rapid diagnostic test kits have sensitivity and specificity of less than 90%.

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Conflict of interest

The authors did not declare any competing interest.

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