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Helicobacter pylori Infection among Symptomatic Adults in a Tertiary Hospital in Southwestern Nigeria: A Retrospective Study

Oluwole T. O. [a,b*], Okunbor H. N. [a], Otaigbe I. I. [a,b], Nwadiokwu. J. I. [c], Sadare O. A. [a] and Elikwu C. J. [a,b]

[a] Department of Medical Microbiology, Babcock University Teaching Hospital, Nigeria.
[b] Department of Medical Microbiology, Babcock University, Nigeria.
[c] Department of Anatomic Pathology and Forensic Medicine, Babcock University Teaching Hospital, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To determine the prevalence of *Helicobacter pylori* (*H. pylori*) infection among symptomatic adults in a tertiary hospital in a peri-urban setting in Southwestern Nigeria.
Methodology: It was a retrospective, cross-sectional study conducted in the Medical Microbiology Laboratory, Department of Medical Microbiology and Parasitology, Babcock University Teaching Hospital, Ilisan-Remo, Ogun State, Nigeria, between January 2022 and June 2024. The study

**Corresponding author: E-mail: treeyof@yahoo.com;*

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involved a review of the medical microbiology laboratory records to evaluate the *H. pylori* stool antigen results of samples obtained from adults with gastrointestinal symptoms suggestive of *H. pylori* infection.

Results: A total of 1061 adults were included in the study with females accounting for 56.2% of the participants. The age range of the participants was 18 – 95 years with a mean age of 34.59 ± 15.51. The prevalence rate of *H. pylori* infection was 32.4% (344/1061). The infection was higher in females (50.6%) than in males (49.4%) and it was statistically significant (P = 0.011). However, a higher proportion (36.6%) of males had the infection than females (29.2%). The age group 21 – 30 years accounted for 23.3% of the *H. pylori*-positive participants while 37.6% of participants in the age group 41 -50 years were *H. pylori*-positive, however it was not statistically significant.

Conclusion: *H. pylori* infection is prevalent among symptomatic adults in this locality. Hence, screening for *H. pylori* is recommended for detection, prompt treatment and eradication of *H.* pylori infection to prevent long-term complications.

Keywords: Helicobacter pylori; prevalence; stool antigen test; adults; Southwest Nigeria.

1. INTRODUCTION

Helicobacter pylori (*H. pylori*) is a spiral Gram-negative bacterium which selectively colonizes the gastric epithelium in humans [1,2]. It is the most prevalent bacteria resulting in chronic bacterial infection worldwide [3,4]. It infects more than half of the world's population [5]. A meta-analysis reported a global prevalence rate of 44.3% with the prevalence varying between and within countries, within a single city, and also subgroups within a population [6,7]. The prevalence was higher in developing countries,50.8% and lower in developed countries, 34.7% [8,9]. A prevalence rate as high as 87.8% was reported in Northern Nigeria [10] while 51.4% and 34.2% were reported in Southern Nigeria [11,12]. In Africa, prevalence rates of 70.41%, 88%, 75%, 70.8% and 66.1% have been reported in Togo [13], Ghana [14], Rwanda [15], Burundi [16], and Egypt [17] respectively. Lower prevalence rates have been reported in Germany (20%) [18], North America (23.1%) [19], Australia (24.6%) [20] and Asia (48.8%) [6]. The prevalence rate is influenced by age, gender, host genetic makeup, the immune response of the host, pathogenicity of the *H. pylori* strain, urbanization, access to health facilities and portable water, socioeconomic status, level of urbanization, sanitation conditions among others [2,6,21–23].

The infection is usually acquired in childhood with the probable mode of transmission being oral-oral or faecal-oral route [6,11]. *H. pylori* infection is asymptomatic in most individuals and when symptomatic, the symptoms are non-specific [7]. However, common symptoms experienced include dyspepsia, heartburn, nausea, emesis, constipation or diarrhoea [24,25]. Chronic *H. pylori* infection has been implicated in several gastrointestinal disorders. It is involved in the pathogenesis of chronic gastritis, peptic ulcer disease, gastric cancer, and gastric mucosal-associated lymphoid tissue lymphoma (MALT) [1,2,6]. Furthermore, *H. pylori* has been categorized by the World Health Organization (WHO) as a group-I carcinogen due to the report of it being the greatest single risk factor for the development of gastric cancer [26]. In addition, *H.* pylori has been implicated in the aetiology of colorectal cancer, myocardial infarction and liver cirrhosis [22,23]. It is recommended that individuals with symptoms suggestive of peptic ulcer disease should be tested and treated to prevent the long-term sequelae [3,7]. Therefore, it is essential to accurately detect the organism to enhance effective treatment and prevention of its long-term sequelae.

The modalities in diagnosing *H. pylori* infection can be invasive and non-invasive with each having its merits and demerits. The invasive tests require obtaining biopsies through an endoscope for histology, culture, rapid urease test, polymerase chain reaction, and fluorescence in-situ hybridization [6,27,28]. The non-invasive diagnostic modalities include stool antigen test, ^{13}C urea breath test, serology, salivary, urinary or blood antibody tests, and stool PCR [1,6,27]. Non-invasive tests are crucial in primary care as they are more convenient, faster and cheaper with better patient compliance. The HpSA test is simple and effective at detecting ongoing infection as it identifies the antigen of the bacterium [4].

There is a paucity of data on the burden of *H.* pylori infection in our locality. Hence, this study sought to determine the prevalence of *H. pylori* infection among symptomatic adult patients in

Babcock University Teaching Hospital, Ilishan-remo, Southwestern Nigeria. This will provide insight into the burden of the disease and may facilitate improved clinical practice and decisions regarding the management of the infection.

2. MATERIALS AND METHODS

2.1 Study Site

The study was conducted in the Department of Medical Microbiology, Babcock University Teaching Hospital, Ilishan-Remo, Ogun State, Southwestern Nigeria. The hospital is a 240-bed tertiary hospital located in a peri-urban setting of Ogun state. The hospital serves as a referral centre for primary and secondary health facilities in the state and the neighbouring states in Southwestern Nigeria. It provides general outpatient services, specialist clinics, antenatal care, radiological, pharmaceutical and laboratory services. Patients suspected of having *H. pylori* infection are usually referred by clinicians to the laboratory for laboratory diagnosis.

2.2 Study Design

Data from symptomatic adults (persons $\geq$ 18 years) referred to the medical microbiology laboratory for *H. pylori* stool antigen (HpSA) test between January 2022 and June 2024 were retrospectively analysed.

2.3 Inclusion Criteria

The inclusion criteria included all patients older than 17 who had undergone the *H. pylori* stool antigen test between January 2022 and June 2024.

2.4 Sample Size and Sampling Method

The laboratory records were carefully reviewed to identify all patients that met the inclusion criteria. A total of 1,061 fulfilled the criteria and were included in the study.

2.5 Laboratory Procedure

Fresh stool samples sent to the Medical Microbiology Laboratory for HpSA test are routinely collected in plain universal bottles and tested using a rapid strip *H. pylori* stool antigen kit (Lotus NL B.V, The Hague, Netherlands) as per the manufacturer's instruction. This is a rapid, qualitative, sandwich, solid-phase immunochromatographic assay based on the lateral flow chromatography technique and detects *H. pylori* antigen in human stool. The kit's sensitivity and specificity were 99.0%, and 97.9% respectively and the positive and negative predictive values were 99.0% and 97.9% respectively.

2.6 Data Collection and Analysis

Data was collected using a checklist designed for this study. Data collected included age, gender, symptoms and results of the HpSA test. Data was analysed using IBM_SPSS Statistics for Windows software version 21 (IBM, Armonk, New York, USA). Descriptive statistics such as proportions, means, standard deviation, and cross-tabulations were used to characterize the study participants. Chi-square test was used to determine the associations between demographic characteristics and the prevalence of *H. pylori* infection. A *P*-value (*P*) of < .05 with a 95% confidence interval was considered statistically significant.

3. RESULTS

A total of 1,061 patients were included in the study with 465 (43.8%) males and 596 (56.2%) females giving a male-to-female ratio of 1:1.3. Their ages ranged between 18 – 95 years with a mean age of 34.59 $\pm$ 15.51. The mean age for females was 33.5 $\pm$ 16.44 years while that of males was 35.9 $\pm$ 14.15 years. The age group $\leq$ 20 were the highest proportion of the participants (272, 25.6%) next was the age group 21 – 30 years (238, 22.4%), while those $\geq$ 60 years made up the least proportion (79, 7.4%) (Table 1). The symptoms reported among the participants were dyspepsia, epigastric pain, chest pain, and abdominal pain.

3.1 Prevalence of *H. pylori* infection

The prevalence of *H. pylori* infection among the participants was 32.4% (344/1061). The prevalence was slightly higher in females (16.4%) compared to males (16.0%) and it was statistically significant (*P* = .01) (Table 2). The prevalence rates varied among the age groups with the age group 21 – 30 having the highest prevalence (7.5%) while the age group > 61 had the lowest prevalence (2.4%). However, this finding was not statistically significant (*P* = .43).

Further analysis of *H.* pylori infection among the age groups shows that about a third of participants in almost all the age groups tested

positive for *H. pylori* (Table 3) with about 40% of the age group 41 - 50 having *H. pylori* infection. The age group 21- 30 accounted for about a quarter of the participants that tested positive for *H. pylori* while the age groups ≤ 20, 31 - 40, and 41 – 50 years each accounted for about a fifth of *H. pylori*-positive participants

Females contributed a larger proportion of the number of *H.* pylori-positive participants (50.6%) compared to males (49.4%) (Fig. 1). However, a larger proportion of males tested positive for *H. pylori* (36.6%) compared to females (29.2%) (Table 4).

Table 1. Characteristics of the participants

Variables		Frequency	Percentage
Gender	Female	596	56.2
	Male	465	43.8
Age group (years)	≤ 20	272	25.6
	21 -30	238	22.4
	31 – 40	214	20.2
	41 – 50	178	16.8
	51 - 60	80	7.5
	≥ 60	79	7.4
	Total	1,061	100.0

Table 2. Distribution of *H. pylori* infection with the characteristics of the participants

Variables		*H. pylori*-positive (N=344) n (%)	*H. pylori*-negative (%) (N=717) n (%)	Total (N=1,061) n (%)	X^2	p-value
Gender	Female	174 (16.4)	422 (39.8)	596 (56.2)	6.466	**0.011**
	Male	170 (16.0)	295 (27.8)	465 (43.8)		
Age (years)	≤ 20	76 (7.2)	196 (18.5)	272 (25.6)	4.889	0.430
	21 – 30	80 (7.5)	158 (14.9)	238 (22.4)		
	31 – 40	70 (6.6)	144 (13.6)	214 (20.2)		
	41 – 50	67 (6.3)	111 (10.5)	178 (16.8)		
	51 – 60	26 (2.5)	54 (5.1)	80 (7.5)		
	≥ 61	25 (2.4)	54 (5.1)	79 (7.4)		
	Total	344 (32.4)	717 (67.6)	1,061 (100.0)		

Table 3. Prevalence of *H. pylori* infection within and across the age groups of the participants

Age (years)	*H. pylori*-positive (N= 344), (Row%, Column %)	*H. pylori*-negative (%) (N=717), (Row%, Column %)	Total (N=1061), (Row%, Column %)	X^2	p-value
≤ 20	76 (27.9, 22.1)	196 (72.1, 27.3)	272 (100, 25.6)	4.889	0.430
21 – 30	80 (33.6, 23.3)	158 (66.4, 22.0)	238 (100, 22.4)		
31 – 40	70 (32.7, 20.3)	144 (67.3, 20.1)	214 (100, 20.2)		
41 – 50	67 (37.6, 19.5)	111 (62.4, 15.5)	178 (100, 16.8)		
51 – 60	26 (32.5, 7.6)	54 (67.5, 7.5)	80 (100, 7.5)		
≥ 61	25 (31.6, 7.3)	54 (68.4, 7.5)	79 (100, 7.4)		

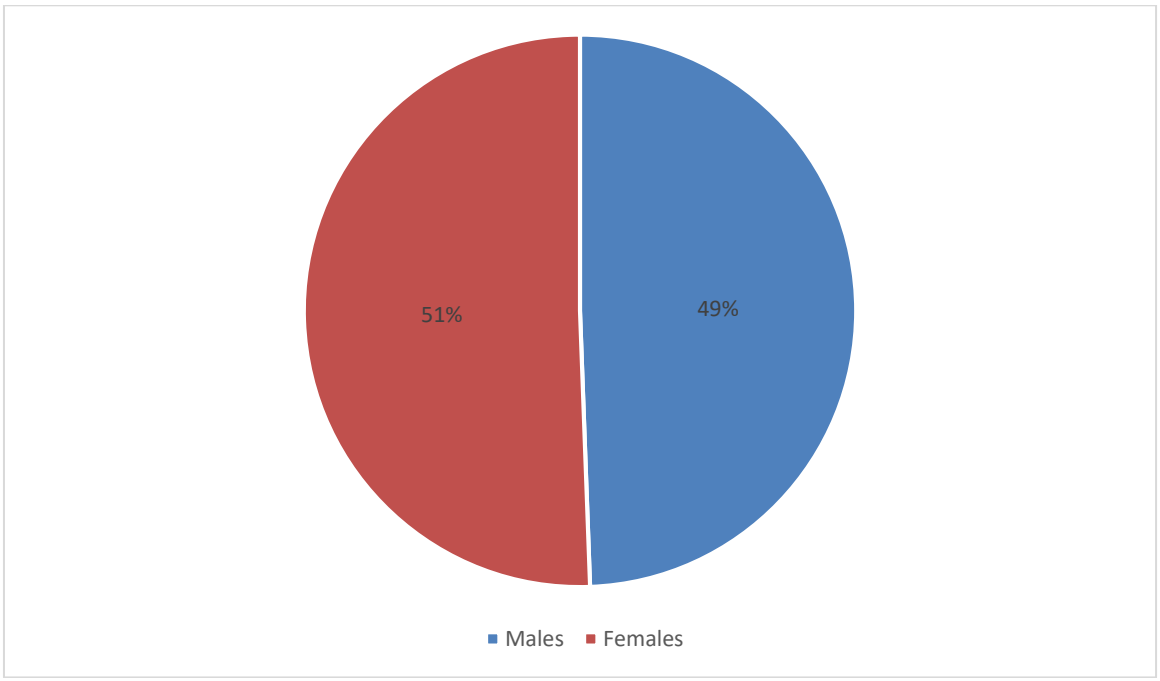

Fig. 1. Prevalence of *H. pylori* infection by gender

Table 4. Prevalence of *H. pylori* infection within and across the gender of the participants

Gender	*H. pylori*-positive (N= 344), (Row%, Column %)	*H. pylori*-negative (%) (N=717), (Row%, Column %)	Total (N=1061), (Row%, Column %)	X^2	p-value
Female	174 (29.2, 50.6)	422 (70.8, 58.9)	596 (100, 56.2)	6.466	**0.011**
Male	170 (36.6, 49.4)	295 (63.4, 41.1)	465 (100, 43.8)		
Total	344 (34.2, 100)	717 (67.6, 100)	1061 (100.0, 100)		

4. DISCUSSION

This study documents the prevalence of *H. pylori* infection among symptomatic adults in a peri-urban setting in Southwestern Nigeria with a prevalence of 34.2%. It is important to note that the prevalence observed in this study may not be the actual prevalence rate in this locality as asymptomatic individuals were not included. Furthermore, the HpSA test utilized in this study is less sensitive compared to the gold standard of the non-invasive tests- the urease breath test.[29] The prevalence rate observed in this study is high and suggests that *H. pylori* infection is significant among adults in the locality. This finding is similar to the high prevalence rates reported in Nigeria and other developing countries [6,29]. However, Ophori *et al.* [30] and Omosor *et al.* [1] in Delta State reported relatively higher prevalence rates of 89.7% and 52.5% respectively among asymptomatic adults in Delta State, Nigeria. Nwachukwu *et al.* also reported a high prevalence of 52% in Nnewi, Southeast, Nigeria [31].

The relatively lower prevalence rate observed in this study may be attributable to the diagnostic modality employed as the HpSA test detects the *H. pylori* antigen excreted in the faeces of infected persons. This antigen is present only during an ongoing infection and disappears upon the elimination of the bacteria; hence it is also used in monitoring the effectiveness of therapy [7]. In contrast, Ophori *et al.,* Omosor *et al.,* and Nwachukwu *et al.* employed a serological test, which detects *H. pylori* antibody (Immunoglobulin G). This antibody develops following exposure of individuals to *H. pylori* during the infection and persists for a long time even after eliminating the bacteria [7]. Hence, it does not differentiate an ongoing *H. pylori* infection from a past infection [32]. Based on this, all individuals exposed to *H. pylori* in these studies would have tested positive, unlike our study, whereby only

individuals with an ongoing infection would test positive.

Furthermore, the HpSA test may cause a false-negative result when there is a low bacterial load or following recent use of antibiotics, proton pump inhibitors (PPIs) and colloidal bismuth while the outcome of serological tests is not affected by prior use of these medications [33]. In addition, the results of the serological test are not affected by the patient's condition such as atrophic gastritis, and gastrointestinal bleeding compared to that of HpSA which may result in a false-negative result [33]. All these might also contribute to the lower prevalence rate observed in this study as the clinical condition of the participants and history of use of antibiotics, PPIs, N-acetylcysteine and bismuth could not be obtained due to the retrospective nature of the study and inability to access the clinical notes of the participants.

Jemilohun *et al.* reported a prevalence of 64% among symptomatic patients in Ibadan, Southwest, Nigeria [34] and Aboderin reported 73% in Ile-Ife in Southwest Nigeria [35]. These studies by Jemilohun *et al.* and Aboderin *et al.* were conducted in referral hospitals hence the high prevalence observed might be skewed due to the need for participants' referral to the units in the hospitals thereby limiting the study population to only individuals who were referred to the unit in these hospitals. Zawaya *et al.* reported 65% in North Central Nigeria [36]. A study by Smith *et al.* reported a prevalence rate of 37.5% among symptomatic adults in 6 tertiary hospitals in Nigeria [37]. However, a study among university students in Karu, North-central Nigeria reported a very low prevalence of 5.5% [38]. Other possible reasons for the disparity in the prevalence rates observed in the various regions of the country include variation in the socio-economic status, diet, literacy level, overcrowding and urbanization with better access to potable water and healthcare facilities.

Other African countries have reported prevalence rates of 70.41% in Togo [13], 88% in Ghana [14], 75% in Rwanda [15], 70.8% in Burundi [16], and 66.1% in Egypt [17]. A study in Saudi Arabia reported a prevalence rate of 55% among symptomatic adults [39]. Meanwhile, lower prevalence rates have been reported in Germany (20%) [18], North America (23.1%) [19] and Australia (24.6%) [20]. These variations in the prevalence rates of these studies agree with the reports that prevalence rates differ within and between countries, within a city and subgroups of a populace as well as developing countries having higher prevalence rates than developed countries [6–8,32]. Factors attributed to the variation in the prevalence include socioeconomic status, sanitation, hygiene and water supply [4,10–12]. Other factors contributing to the variation in the prevalence rates reported in developing and developed countries include improved and balanced diets, urbanization with better access to potable water and healthcare facilities in the developed countries [6]. Furthermore, there have been reports of a reduction in the prevalence rates of *H. pylori* infection in cities, countries and globally, and this has been attributed to improvement in the standard of living, and living conditions [40]. However, these could not be explored in this study due to the retrospective nature of the research and the inability to access the clinical notes of the participants.

In this study, the prevalence was higher among males (36.6%) than females (29.2%) and statistically significant. This is similar to other studies which reported significant male predominance among individuals with *H. pylori* infection [41–45]. Studies in Nigeria such as Omosor *et al* [1] and Saidu *et al* [46] have also reported male predominance in *H. pylori* infection. Possible reasons for male predominance include involvement in males in activities which can predispose to the infection such as differential antibiotic exposure, or differential protective immunity in males. Other factors which may also worsen the symptoms in men include the activities males are involved in such as tobacco smoking, alcohol ingestion and stress which can increase the stomach acid levels and worsen the symptoms [47–49]. In addition, smoking has been reported to increase the persistence and lower the efficacy of eradication of *H. pylori* [50]. On the contrary, other studies reported a higher prevalence among females than males [11,12,21,36,38,47]. The higher prevalence in females was attributed to some of the activities among women such as ingestion of coffee which contains caffeine and could also result in an increase in gastric acid level [12,50,51].

The age group 41– 50 years had the highest (37.6%) prevalence of *H. pylori* infection while the lowest was in the age group $\leq$ 20 years. This is possibly due to the increased risk of exposure to the organism with increasing age as the likelihood of acquiring *H. pylori* begins from

childhood [2,52]. There are reports of increasing prevalence of *H. pylori* with age possibly due to continuous risk of acquiring the infection [52,53]. Veldhuyzen van Zanten *et al.* reported a 1%/year continuous risk of acquisition of the infection with a crude annual seroconversion rate of 1% [52]. Furthermore, the rise in prevalence with increasing age could be due to the chronic nature of the infection caused by the organism as *H. pylori* has been reported to be the most prevalent cause of chronic bacterial infection [2,3]. However, there are also reports of subsequent spontaneous elimination of the infection in the latter years possibly due to changes in the standard of living or as an indirect benefit from the use of antibiotics for another purpose [38,40,46,47]. This might explain the reduction in the prevalence among participants older than 50 years.

5. LIMITATIONS

This was a retrospective study hence we were unable to access the clinical records of the participants to determine cessation of the use of antibiotics for 4 weeks, H2 receptor blockers, proton pump inhibitors, N-acetylcysteine, bismuth preparations for 2 weeks, and antacids for 2 days before the test and exclude them from the study. Furthermore, the prevalence observed in this study may not be the actual prevalence rate in this locality as this was a retrospective, laboratory-based study among symptomatic individuals, therefore excluding asymptomatic individuals in the study. In addition, the possible risk factors could not be explored in the study due to the reasons stated earlier. A community-based study is desirable as it would be more representative with the possibility of assessing both symptomatic and asymptomatic individuals including the associated risk factors of *H. pylori* infection among them.

6. CONCLUSION

This study reports a high (32.4%) prevalence of *H. pylori* infection among symptomatic patients in a peri-urban setting in Southwestern Nigeria with a higher proportion of males having the infection than females. Therefore, *H. pylori* screening is recommended for detection, prompt treatment and eradication of *H.* pylori infection to prevent its associated sequelae.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

CONSENT

It's not applicable.

ETHICAL APPROVAL

Ethical approval for the study was obtained from the Babcock University Health Research and Ethics Committee (BUHREC No 693/22). Written informed consent was not required due to the retrospective nature of the study. However, the confidentiality and anonymity of patients' data were ensured in accordance with the Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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