

Helicobacter pylori Prevalence by Urea Breath Test in a Southwestern Nigerian Population

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ABSTRACT

BACKGROUND: There is no ambiguity about the fact that *Helicobacter pylori* (*H. pylori*) is strongly associated with several upper gastrointestinal conditions including gastric cancer which manifest clinically as dyspepsia. Nigeria is believed to have one of the highest prevalence of *H. pylori* globally but the prevalence obtained from different Nigerian studies varies widely (35.7% to 94.5%) depending on the diagnostic method utilized. We observed that few studies have utilized the urea breath test, considered to be the gold standard noninvasive test, to determine the prevalence rate of the infection among Nigerians. Considering the role *H. pylori* infection plays in the etiopathogenesis of dyspepsia and the reliability of the urea breath test, it is desirable that more prevalence studies are conducted with the test in Nigeria.

MATERIALS AND METHODS: A cross-sectional study conducted at the Gastroenterology Unit of Babcock University Teaching Hospital, (BUTH), Ilisan-Remo, Nigeria. The study population consisted of male and female dyspeptics aged 18 and above referred to the unit for urea breath test from February 2015 to December 2018. Patients' demographic information and *H. pylori* status were extracted from the test logbook and analyzed with IBM-SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

RESULTS: A total of 203 patients who had pre-eradication test within the period considered were included. The mean age was 44.6 (± 16.4) while the age range was 18- 83 years. Eighty-two (40.4%) were males while 121 (59.6%) were females. A total of 106 (52.2%) tested positive for *H. pylori* among all the subjects. There was no significant age-related difference in the prevalence ($p = 0.333$). The female gender was observed to have a higher prevalence (56.2%) than the male gender (46.3%) but the difference was not statistically significant ($p = 0.198$).

CONCLUSION: The prevalence rate of *H. pylori* infection in Nigeria is high but it varies widely from one study to another depending on the diagnostic method used. A nationwide population-based study utilizing a user-friendly and reliable diagnostic method like the urea breath test is highly desirable.

Key words: Helicobacter pylori; Dyspepsia; Peptic ulcer disease; Gastric cancer; Nigeria

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INTRODUCTION

Since Warren and Marshall discovered *Helicobacter pylori* (*H. pylori*) in 1982^[1], it has been demonstrated beyond reasonable doubt that the organism is strongly associated with several upper gastrointestinal conditions that manifest clinically as dyspepsia such as chronic gastritis, gastric and duodenal ulcers, gastric adenocarcinoma and mucosal associated lymphoid tissue (MALT)

lymphoma^[2,3]. The organism was classified as a class 1 (definite) carcinogen in the etiopathogenesis of gastric malignancies in 1994 by the World Health Organization^[2].

Various diagnostic tests for *H. pylori* exist which can be generally classified into invasive and non-invasive tests^[2]. The invasive tests employ endoscopic gastroduodenal biopsies and are used when patient requires upper gastrointestinal endoscopy either because of alarm features or treatment failure. The commonly used invasive tests include histology, rapid urease test (RUT), culture, and polymerase chain reaction (PCR). The non-invasive tests do not require gastroduodenal biopsies. They are preferred in patients who do not have any clinical indication for upper endoscopy. The commonly used ones include urea breath test (UBT), stool antigen test (SAT) and serology.

Helicobacter pylori is reliably identified in gastric biopsy material stained with hematoxylin and eosin and with a special stain like Giemsa, Warthin-Starry silver or cresyl-fast violet. Culture is the method of choice in cases of antibiotic resistance for antibiotic susceptibility and selection of adequate eradication therapies^[2,4]. Serological tests assay *H. pylori* IgG antibodies in patients' serum but have a major drawback of being unable to differentiate current infections from past infections^[2,4].

In resource-challenged environments where there could be paucity of equipment and expertise for biopsy based diagnostic methods, the non-invasive carbon 13 or carbon 14 (¹³C or ¹⁴C) UBT and SAT remain the diagnostic methods of choice. These tests are of comparable diagnostic accuracy with biopsy-based tests and may be more appropriate in the test-and-treat setting^[5]. Owing to the user-friendly and non-invasive features of UBT, it is preferred in many clinical settings as some societies find the stool handling associated with SAT offensive^[5]. Some physicians prefer the ¹³C test to the ¹⁴C because it is nonradioactive, particularly in children and pregnant women, though the radiation dose is very minimal (about 1 microCi), not exceeding the daily acceptable dose of radiation exposure^[6].

Although the most commonly used tests have good sensitivity and specificity, the question of which method should be considered as a gold standard remains unsettled^[2,8]. The UBT is now being considered as the gold standard for the noninvasive tests^[2,3,7]. A meta-analysis of 23 studies that considered the diagnostic accuracy of UBT yielded a pooled sensitivity of 0.96 (95%CI: 0.95-0.97) and a pooled specificity of 0.93 (95%CI: 0.91-0.94)^[6].

Helicobacter pylori infection occurs worldwide but the prevalence varies widely from one population to another. In general, developing countries tend to have higher prevalence than the developed countries. It is believed that at least 50% of the world's population currently harbors the organism^[6]. Nigeria is believed to have the highest infection rate globally^[9] but the prevalence obtained from different studies varies widely from 35.7% to 94.5% depending on the diagnostic method utilized in conducting the study^[7,10,21]. This wide disparity could have resulted from the differences in the sampling methods and the diagnostic accuracies of the tests used in the conduct of the studies. Our literature review showed that few studies have utilized the UBT to determine *H. pylori* infection rates among Nigerians^[7,20,21]. Considering the role *H. pylori* infection plays in the etiopathogenesis of dyspepsia and the reliability of UBT, it is desirable that more prevalence studies are conducted with the test in Nigeria.

MATERIALS AND METHODS

Study design

A cross-sectional study

Study setting

The study was conducted at the Gastroenterology Unit of Babcock University Teaching Hospital, (BUTH), Ilisan-Remo. The Babcock University Teaching Hospital is a fairly new tertiary health facility that provides inpatient, outpatient and 24-hour emergency services. It serves as a referral center to primary and secondary healthcare facilities in Ilisan-Remo and the adjoining communities in Ogun and Lagos States, Nigeria.

Study population

The study population consisted of male and female dyspeptics aged 18 and above referred to the Gastroenterology Unit of BUTH, Ilisan-Remo for UBT from February 2015 to December 2018. Routinely, patients who took proton pump inhibitor (PPI) two weeks preceding test request and those who used antibiotics four weeks before test request were initially denied the test and rescheduled for an appropriate time. Pregnant women were denied the test. Patients who had post-*H. pylori* eradication test were excluded from the study. A total of 210 patients had pre-eradication test within the period considered. Six were excluded because they were less than 18 years. One was excluded because of missing data. In the final analysis, data of 203 patients were included in the study.

Data collection

Patients' data were extracted from the test record book. Demographic information (age and gender), and *H. pylori* status (positive or negative) of patients were copied into a spreadsheet with columns for each of identifier, age, gender, and *H. pylori* status.

Urea Breath Test

Urea breath test was performed during the period under consideration with the Heliprobe® System, Kibion, Sweden. The system consists of a ¹⁴C capsule (HeliCap™), a card for capturing the breath sample (BreathCard™) and the analyzer unit (Heliprobe® Analyzer). The Analyzer is a small, compact desktop sized unit with a simple interface meaning that tests can be performed in the office with the results available immediately. The system has excellent diagnostic accuracy with a sensitivity of 95% and specificity of 100%^[22].

The patient swallows the capsule with 30ml of water. After 10 minutes, he breaths into the card which holds the breath sample. The card contains a medium designed to trap the breath being tested. It has an indicator window that changes color from yellow to orange when enough breath has been collected. The card is then inserted into the analyzer and a button pressed to initiate analysis. The result of the test is available after 250 seconds. 0 indicates negative, 1 indicates indeterminate while 2 indicates a positive result.

Statistical analyses

We analyzed data with IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Continuous variables are presented as Means (±SD) and categorical variables as frequencies and percentages. Means of continuous variables were compared by Student's t-test. Univariate analysis was conducted to determine the possible predictor(s) of *H. pylori* infection. Multivariate logistic regression analysis was not done because none of the factors was statistically significant during univariate analysis. The cutoffs for statistical significance were P-value < 0.05 and odds ratio (OR) > 1.

Ethical consideration

Ethical clearance was obtained from the Ethics Review Board of

the Babcock University, Ilisan-Remo. Patients' information and data were treated with utmost confidentiality. Only the essential study staff members had access to the extracted data.

RESULTS

A total of 203 subjects were included in the study. The mean age was 44.6 (± 16.4) while the age range was 18- 83 years (Table 1). Eighty-two (40.4%) were males while 121 (59.6%) were females. Of the total number of subjects, 102 (50.2%) were aged 18-44 years (young), 77 (37.9%) were aged 44 -64 years (middle-aged) and 24 (11.8%) were 65 years and above (old).

Table 2 depicts the age and gender-related prevalence of *H. pylori* among the study population by univariate analysis. A total of 106 (52.2%) tested positive for *H. pylori* among all the subjects (Table 2). The middle-aged group had the highest prevalence (62.5%) followed by the old aged (52.2%) and the young age (49.0%) respectively, though the observed differences were not statistically significant ($p = 0.496$). Also, the female gender was observed to have a higher prevalence (56.2%) than the male gender (46.3%) but the difference was not statistically significant (0.198).

DISCUSSION

The prevalence of *H. pylori* varies considerably from one region of the world to the other. The prevalence of 50.2% obtained from this study is consistent with a prevalence of 49.2% from a recent study by Smith et al among a population of dyspeptics in Nigeria with UBT^[21]. However, two other Nigerian studies by Smith et al and Harrison et al that utilized UBT yielded lower prevalence rates of 37.5% and 35.7% respectively^[17,20]. This observed prevalence disparity may be as a result of differences in participants' selection methods in these studies. Studies that excluded prospective subjects with recent history of PPI and antibiotics use are expected to have higher infection rates compared to those that did not strictly comply with such criteria.

In Nigerian, we observed that studies conducted with histology, RUT, and SAT generally showed lesser prevalence rates (53% to 78.3%)^[10,11,14-17] compared to those conducted with serological test (67.4% to 94.5%)^[11-13,18,19]. Moreover, studies conducted with UBT seems to have the lowest infection rates among Nigerians (35.7% - 49.2%)^[7,20,21]. Since serological tests cannot discriminate between previous and current infections, it is expected that studies conducted with such a diagnostic test will have a higher prevalence rate than better performing tests, especially in a high endemic area. Also noted is the fact that studies conducted with diagnostic test with better diagnostic accuracies were largely hospital-based and mostly among patients with dyspepsia. Hence, it can be inferred that the ideal prevalence of *H. pylori* in Nigeria remains largely undetermined since population-based studies that utilized diagnostic methods with high diagnostic accuracies like the UBT are generally unavailable.

Although we could not find *H. pylori* prevalence studies conducted with the UBT in other West African countries for comparison, a study conducted with RUT in Ghana yielded a comparable result (51.3%) to ours^[23]. However, other studies conducted with RUT from Ghana (75% and 75.4%)^[24,25] and Senegal (72.8%)^[26] had higher prevalence rates compared to our study.

Several reports have documented the relationship between the prevalence of *H. pylori* and age of study participants. While some reported statistically significant association between increasing prevalence of *H. pylori* with age^[27-29], others have reported increasing prevalence with age without statistical significance^[17,30,31]. In the

Table 1 Age and gender distribution among participants ($n = 203$).

Age in years	Male (%)	Female (%)	Total (%)
Young (18-44)	50(49.0)	52(51.0)	102 (100)
Middle age (45-64)	26 (33.8)	51(66.2)	77(100)
Old (≥ 65)	6(25.0)	18 (75.0)	24 (100)
Total	82 (40.4)	121(59.6)	203 (100)

Mean (\pm SD) = 44.6 (± 16.4), Range = 18-83.

Table 2 Age and gender related prevalence of *H. pylori* infection ($n = 203$).

Variables	Positive N (%)	Negative N (%)	Unadjusted Odds ratio	P value
Age* (Mean \pm SD)	45.7 \pm 17.2	43.4 \pm 15.4	1.01(0.99-1.03)	0.333
Age* group				0.484
Young (18-44)	50 (49.0)	52 (51.0)	1(Reference)	
Middle-aged (45-64)	41 (62.5)	36 (37.5)	1.18(0.66-2.14)	0.576
Old (≥ 45)	15 (52.2)	9 (47.8)	1.73(0.70-4.32)	0.238
Gender				0.168
Female	68 (56.2)	53 (43.8)	1(Reference)	
Male	38 (46.3)	44 (53.7)	0.67(0.38-1.18)	

*Age in years.

present study, the middle-aged group had the highest prevalence (62.5%) but there was no statistical significance. Increasing age of the participants also showed no statistically significant association with the prevalence of *H. pylori*.

In the present study, the prevalence of *H. pylori* was higher in the female gender than in the male (56.2% vs 46.3%) but this was not statistically significant. Several studies with varying *H. pylori* prevalence rates between male and female participants have also found no statistical significance in the differences like our study^[17,27,29,31,32].

The major limitations of this study are the fact that the study population is restricted to patients with dyspeptic symptoms and the fact that it is hospital based. Hence, the infection rate obtained may not be a true representation of the prevalence rate in the general population.

CONCLUSION

It is not in doubt that the prevalence rate of *H. pylori* infection in Nigeria is high but the prevalence rate varies widely from one study to another depending on the diagnostic method used. Also noted is the fact that most studies in Nigeria were not community-based. Therefore, a community-based study utilizing a user-friendly and reliable diagnostic method like the UBT is highly desirable.

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