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Seroprevalence of *Helicobacter pylori* infection and risk factors among patients presenting with symptoms of peptic ulcer in Akure metropolis

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ABSTRACT

Background: *Helicobacter pylori* (*H. pylori)* is a causative agent of peptic ulcer which presently affects more than half of the world's population. This study determined *H. pylori* prevalence and risk variables among peptic ulcer patients in Akure, Ondo State, Nigeria. **Methods:** Two-hundred (200) study participants consented at local hospitals. A pre-tested, structured questionnaire collected socio-demographic and risk factor information from participants. Participants' blood samples were tested with a fast chromatographic immunoassay kit for *H. pylori* antibodies. **Results:** 73.5 %of the 200 tested subjects had *H. pylori.* Prevalence was greater among women (74.8%) than men (71.6%). The most heavily impacted age group for *H. pylori* infection is 21–30 years with 78.4% prevalence, while the least affected is 51–60 years with 66.7% prevalence. Married respondents (77.2%) had a greater prevalence of *H. pylori* than singles (71.1%). The difference in prevalence rate based on individuals' education and occupation was not statistically significant (p=0.407 and 0.999, respectively). *Helicobacter pylori* infection was significantly associated with NSAID use (X^2= 8.917, p=<0.001), smoking (X^2=4.988, p=0.02), residing in a crowded room (X^2=4.439, p=0.03), and a family history of peptic ulcer (X^2=19.70, p=<0.0001). **Conclusion:** This study found substantial *H. pylori* prevalence among peptic ulcer patients. *Helicobacter pylori* testing should be considered relevant in clinical practice, especially in patients with peptic ulcer symptoms, and not only antacid prescriptions. For efficient patient treatment and to prevent chronic gastritis and stomach cancer, *H. pylori* must be thoroughly investigated and treated.

Introduction

Helicobacter pylori (*H. pylori)* is the aetiologic cause of peptic ulcer disease. It is a Gram-negative, spiral-shaped bacterium [1]. A peptic ulcer is described as a sore on the lining of the stomach or duodenum. The two common types of peptic ulcers are "gastric ulcers" which are formed in the lining of the stomach and "duodenal ulcers" which are formed in the small intestine [2]. *Helicobacter pylori* infection may also lead to gastritis, gastric adenocarcinoma and gastric mucosa-associated lymphoid tissue (MALT) lymphoma [3], however, most infected subjects remain asymptomatic. *Helicobacter pylori* infection is globally widespread, more than half of the world's population is infected with *H. pylori* and it is acquired almost always within the first 5 years of life. Most infected

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patients remain asymptomatic, with only minimal inflammation [4].

Although the precise mode of *H. pylori* transmission remains unproven, it has been shown that *H. pylori* spread directly from one person to another, mainly by fecal-oral or oral-oral routes [5]. This microaerophilic bacterium is usually located within the mucous layer of the stomach, and it is able to survive in the environment because of its sheathed flagella and its ability to produce urease [6].

The most common symptoms of peptic ulcer are burning abdominal pain that extends from the navel to the chest region, which can range from mild to severe. Other symptoms include; changes in appetite, nausea, bloating, belching, blood or dark stool (melena), indigestion, fever and weight lost. Complications of peptic ulcer disease include bleeding, perforation, gastric outlet obstruction and gastric cancer [7]. The most common risk factors for peptic ulcer disease include: *Helicobacter pylori* infection and non-steroidal anti-inflammatory drugs (NSAIDs) while the less common risk factors include alcohol consumption, smoking, family history of peptic ulcers, severe illness, autoimmune diseases, radiation therapy, Crohn's disease and so on [7].

Prevalence of *H. pylori* infection varies between and within countries [8]. It is common worldwide with prevalence rates ranging from 30 to 40% in the United States, 80 to 90% in South America and 70 to 90% in Africa [9]. Studies by Malu et al. [10], in Jos (Nigeria), found a prevalence of 87% while Bashir and Ali [11] reported an *H. pylori* prevalence of 81% in Kano, Nigeria. This shows that *H. pylori* infection is more common in developing countries [12].

Two major diagnostic methods are used to detect *H. pylori* infection; the invasive (e.g. histology and culture of gastric biopsy specimens) and non-invasive (e.g. serology and urea breath tests) techniques [13, 14]. A study by Idowu et al. [15], showed a prevalence rate of 25.9% and 48.9% among 444 patients based on culture analysis and direct PCR method respectively. The two diagnostic methods have been reported to be the gold standards for *H. pylori* detection [16]. However, the method is not without limitation. Due to the long duration of incubation and false negative results, the culture method is usually avoided. Other studies have utilized the seroprevalence approach, which detects the presence of antibodies but is unable to differentiate current infection from previous exposure [15]. Treatment of peptic ulcer involved the combination of drugs in the right proportion aimed at eradicating *H. pylori* and suppressing gastric acid release [17, 18]. Recommended drugs include proton pump inhibitors, H_2 blockers, antacid, mucosal protectants, antibiotic and herbal drugs [19, 17].

Helicobacter pylori infection is the most common cause of chronic gastritis which has strong association with gastric cancer although gastric cancer does not frequently manifest until old age. Hence, the high need to determine the pattern of *H. pylori* infection in various age groups. Early detection of *H. pylori* infection might prevent peptic ulcer disease and its complications. Since there is dearth of information on the percentage prevalence of *H. pylori* infection in Akure, Ondo State, this study was conducted in order to have the baseline statistics of the infection in the community and factors predisposing individuals to the infection.

Material and Methods

Study area

Akure is a city in south-western Nigeria, and is the largest city and capital of Ondo State. It lies about 7°25 north of the equator and 5°19 east of the Meridian. It is about 700 km (430 mi) southwest of Abuja and 311 km (193 mi) north of Lagos State. Residential districts are of varying density, some area such as Arakale, Ayedun Quarters, Ijoka, and Oja-Oba consist of over 200 inhabitants per hectare (81/acre), while areas such as Ijapo Estate, Alagbaka Estate, Avenue and Idofin have between 60 and 100 inhabitants per hectare (24 and 40/acre) [20]. The town is situated in the tropical rainforest zone in Nigeria.

Study design

This is a descriptive study conducted to determine the seroprevalence and risk factors associated with *H. pylori* infections in peptic ulcer patients in Akure, Ondo State, Nigeria. Subjects presenting with symptoms suggestive of peptic ulcer from the medical out-patient departments of selected hospitals in Akure comprising; University of Medical Science Teaching Hospital, Akure with GPS coordinates 7.24066 N, 5.19589 E. Nigeria Police Hospital, with GPS coordinates 7.2396373B N, 5.2052537 E. Arakale Health Centre with GPS coordinates 7.2513894 N, 5.193505 E and Don Bosco Hospital with GPS coordinates 7.26859 N,

5.19463 E were used for the study as shown in **figure (1)**.

Sample size

The sample size of 200 was determined using the formula below:

$n = Z^2 PQ/d^2$

Where n - sample size,

Z - 1.96 (at 95% confidence level)

P - proportion of the population having *H. pylori* infection from previous study

Q - 1 - p

d- Desired precision limit = 5%

For the calculation, a 95% confidence interval was used; a *p* value of 0.865, i.e., a prevalence rate from previous study by Elujide et al. [21] and margin of error (d) set at 0.05 was used.

Ethical consideration and consent

All participants were informed about the objectives and purposes of the study, and those that consented were asked to fill the informed consent. The study was conducted after the approval from the Ondo State Health Research Ethics Committee (OSHREC), University of Medical Sciences Teaching Hospital ethical review committee and that of the other selected hospitals was given. To maintain and uphold confidentiality in this study, the samples and questionnaires from the participants had no names, instead they were assigned numbers.

Data collection

Prior to sample collection, socio-demographic and clinical information of the participants were obtained using well-structured questionnaires which were administered to the participants. Each questionnaire had a unique participant identification number (PIDN). The pre-test questionnaires were administered to the participants directly. The questionnaires contained the biodata of the participants such as age, gender, occupation, symptoms (abdominal pain, bloating, nausea, heart burn etc.), risk factors and type of medications used. All filled questionnaires were examined for completeness.

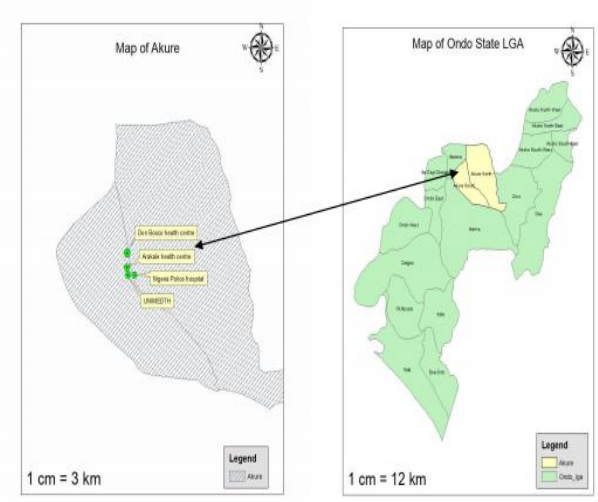
Sample collection and laboratory analysis

Two (2) ml of venous blood sample was aseptically collected from each participant into a labelled EDTA bottle. The plasma was separated by centrifugation at 3000rpm for 5 minutes. The presence of *H. pylori* antibodies was detected using a rapid qualitative membrane strip based immunoassay kit, one step *H. pylori* test (Promed® Diagnostics, China) as described by the manufacturer. The device was placed on a clean levelled-surface of the laboratory bench. One drop (approximately 35µl) of the plasma was transferred into the specimen well of the device using a dropper, one drops of buffer (approximately 50µl) was added and left for 15 minutes before reading. The results were interpreted as indicated by the manufacturer. The presence of two colour bands (Test - T band and Control - C band) within the result window indicate a positive result. The presence of only one colour band within the result window indicated a negative result. The test was recorded as invalid if control line fails to appear, if there is no distinct visible colours both in the test and control regions, or there is a visible line only in the test region but not control region.

Statistical analysis of data

Data were analysed using the Statistical Package for Social Sciences (SPSS software version 25.0). Association of risk factors with seroprevalence of *H. pylori* was done using Chi-square. expressed in percentage. Proportions were compared by the chi-square test. The level of significance was set at $p<0.05$.

Figure 1. Locality map of hospital settings; UNIMEDTH, Nigeria police hospital, Arakale Health centre and Don Bosco health centre in Akure metropolis adopted for the study**.**



Results

Demographic characteristics of the participants

Table 1 presents the socio-demographic profile of the participants. Out of the 200 participants that were recruited, 59.5% were females and 40.5% were males. The age group ranged from 0 to above 60 years. A major proportion of the participants were single i.e. 60.5%, compared to 39.5%which were married.

Frequency of the presenting symptoms suggestive of peptic ulcers in the subject participants

All the 200(100%) subject participants in this study had an history of abdominal pain/burn. Other associated symptoms included heartburn (n = 98, 49.0%), belching (n = 72, 36.0%), nausea (n = 29.0%), fever (n = 32, 16.0%), headache (n = 43, 21.5%), bloating (n = 93, 46.5%), Diarrhoea (n = 39, 20.0%) and dark stool (n=21,11.5%) **(Figure2)**.

Seroprevalence of *Helicobacter pylori* in the participants recruited for the study

Out of the 200 participants screened, 147(73.5) were positive for *H. pylori* infection while 53(26.5%) were negative **(Figure 3)**. **Table 2** shows the socio-demographic profile of the participants and the rate of *H. pylori* prevalence. The prevalence rate among the female subjects was 74.8% whereas the prevalence rate among their male counterparts was 71.6%, however the difference is not statistically significant (p>0.05). The most affected age group for *H. pylori* infection was age group, 21-30 years with percentage prevalence of 78.4%, while the least affected age group was age group, 51-60years with a prevalence rate of 66.7%. This difference too was also not statistically significant (p>0.05) on the prevalence of *H. pylori* among the different age groups. Although higher prevalence of *H. pylori* was also observed among the subjects that were married (77.2%) than the unmarried (71.1%), the difference however did not reach statistical significance (X^2=0.910, p-value=0.337). The difference in the prevalence rates with regards to the level of education of the subjects and their occupational status were also not statistically significant with p-value of 0.407 and 0.999 respectively.

The results of the evaluation of the associated risk factors of *H. pylori* infection among the 200 recruited subjects are presented in Table 3. The results showed that the participants who drink well water, had the highest occurrence (76.7%) of *H. pylori* infection but those who drink pipe borne water had the least infection prevalence of 71.1%. However, there is no significant association between respondent's source of drinking water and *H. pylori* positivity (p= 0.919). There was also no significant association between the recruited subjects who consume alcohol or not and *H. pylori* infection. There was however significant association of *H. pylori* infection with factors such as intake of non-steroidal anti-inflammatory drugs (X^2= 8.917, p=<0.001), smoking (X^2=4.988, p=0.02), living in over-crowded room (X^2=4.439, p=0.03) and family history of ulcers (X^2=19.70, p=<0.0001).

Types of treatment used among the subject

Table 4 shows the types of medication used by the recruited subjects. Out of the 200 subjects recruited, 175(87.5%) of them are on one kind of treatment or the other. A larger proportion of the patients had monotherapy; antacids (n = 85, 48.6%), PPIs (n = 33, 18.9%), H_2 blockers (n = 12, 6.9%), antibiotics (n = 2, 1.1%) and herbal concoctions (n = 14, 8.0%). Combination therapy of PPIs + antibiotics + antacids was observed in 12 patients (6.9%), 3 (1.7%) were on H_2 Blockers + antibiotics, 9 (5.1%) on antibiotics + antacid and 5 (2.8%) on herbal concoctions + antacids).

Table 1. Demographic characteristics of participants in the study.

Variables	Number N=200	Percentage (%)
Gender		
Female	119	59.5
Male	81	40.5
Age Range(years)		
0-10	13	6.5
11-20	22	11.0
21-30	37	18.5
31-40	49	24.5
41-50	40	20.0
51-60	21	10.5
61≥	18	9.0
Marital Status		
Single	121	60.5
Married	79	39.5

Table 2. Socio-demographic characteristics of the participants and *Helicobacter pylori* seroprevalence.

Variables	Number screened	*Helicobacter pylori*		X^2	*p*-value
		Positive N(%)	Negative N(%)		
Gender					
Female	119	89(74.8)	30 (25.2)		
Male	81	58(71.6)	23(28.4)	0.240	0.622
Age group (years)					
0-10	13	9(69.2)	4(30.8)		
11-20	22	17(77.3)	5(22.7)		
21-30	37	29(78.4)	8(21.6)		
31-40	49	36(73.5)	13(26.5)		
41-50	40	29(72.5)	11(27.5)		
51-60	21	14(66.7)	7(33.3)		
≥61	18	13(72.2)	5(27.7)	1.100	0.982
Marital status					
Single	121	86(71.1)	35(28.9)		
Married	79	61(77.2)	18(22.8)	0.910	0.337
Level of educational					
Informal	41	30(73.2)	11(26.8)		
Primary	39	25(64.1)	14(35.9)		
Secondary	45	33(73.3)	12(26.7)		
Tertiary	75	59(78.7)	16(21.3)	2.900	0.407
Occupation					
Civil servants	41	31(75.6)	10(24.4)		
Self-employed	34	25(73.5)	9(26.5)		
Private sectors	31	23(74.2)	8(25.8)		
Unemployed	43	31(72.1)	12(27.9)		
Students	51	37(72.5)	14(27.5)	0.100	0.999

X^2: Chi-square

Table 3. The clinical features and associated risk factors of *H. pylori* infection in the studied population.

Variables	Number screened	*Helicobacter pylori*		X^2	*p*-value
		Positive N (%)	Negative N (%)		
Source of water					
Well	73	56(76.7)	17(23.3)		
Tap	43	31(72.1)	12(27.9)		
Borehole	84	60(71.4)	24(28.6)		
Stream	0	0(0.0)	0(0.0)	0.500	0.919
(NSAIDs) intake					
Yes	67	58(86.6)	9(13.4)		
No	133	89(66.9)	44(33.1)	8.917	<0.0001*
Alcohol consumption					
Yes	39	32(82.1)	7(17.9)		
No	161	115(71.4)	46(28.6)	1.900	0.164
Family history of peptic ulcer					
Yes	116	99(85.3)	17(14.7)		
No	84	48(57.1)	36(42.9)	19.700	<0.0001*
Smoking					
Yes	35	29(82.9)	6(17.1)		
No	165	118(71.5)	47(28.5)	4.988	0.020*
Living in over-crowded room					
Yes	85	56(65.9)	29(34.1)		
No	115	91(79.1)	24(20.9)	4.439	0. 030*

NSAIDs: Non-steroidal anti-inflammatory drugs, X^2: Chi-square, *=statistically significant

Table 4. Types of medication used by the subjects.

Variables	Total number of patients	Proportion undergoing treatment N=175 (%)
Antacids	200	85(48.6)
PPIs	200	33(18.9)
H_2 blockers	200	12(6.9)
Antibiotics	200	2(1.1)
Herbal concoction	200	14(8.0)
PPIs + Antibiotics + Antacids	200	12(6.9)
H_2 blockers + Antibiotics	200	3(1.7)
Antibiotics + Antacids	200	9(5.1)
Antacids + Herbal concoctions	200	5(2.8)

PPIs: Proton pump inhibitors; H_2 blockers: Histamine receptor blockers.

Figure 2. Frequency of symptoms suggestive of peptic ulcers presented by the subject participants (n=200).

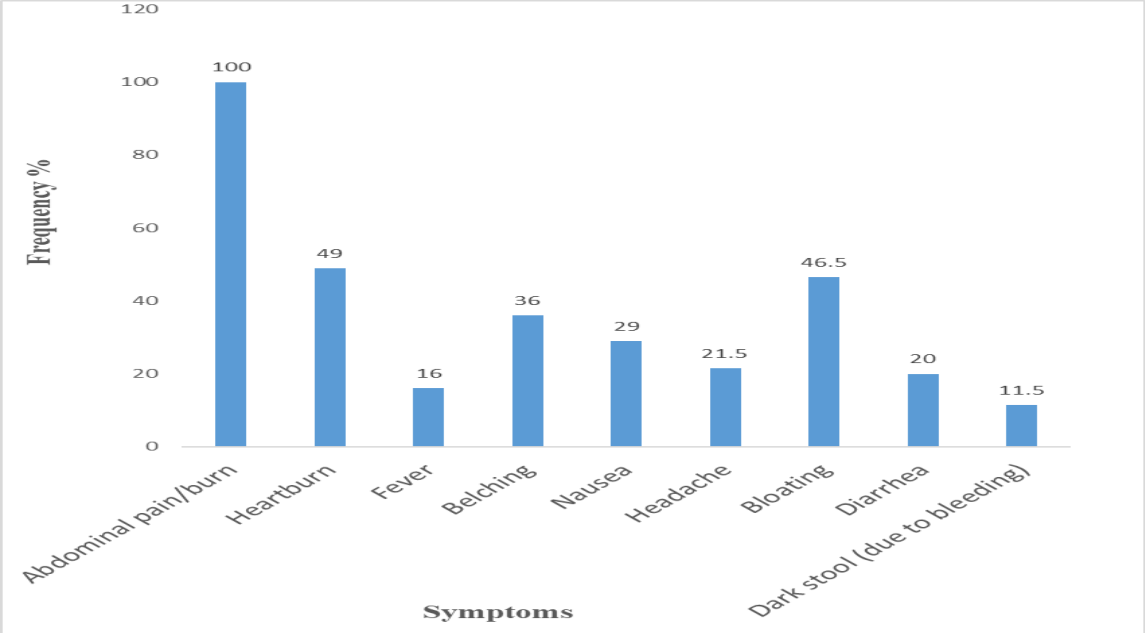
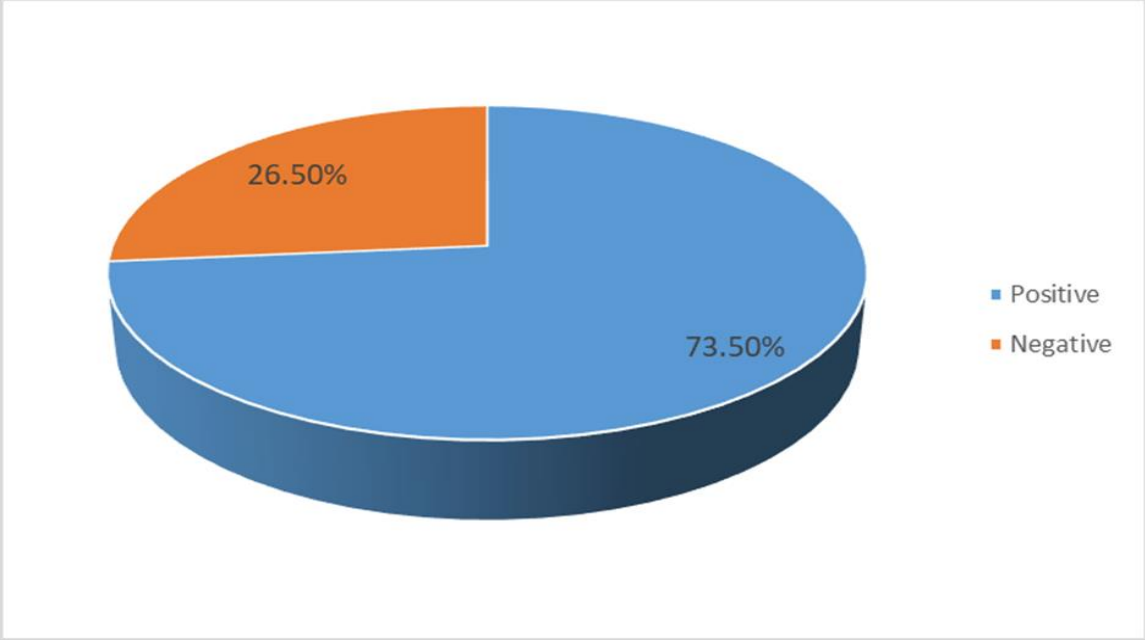


Figure 3. Pie chart representation of the overall seroprevalence of *H. pylori* in the studied population.



Discussion

In this study, the prevalence of *H. pylori* which causes peptic ulcer disease among subjects with symptoms suggestive of the disease was carried out in Akure, Ondo State, Nigeria. The result of this study based on qualitative serology test revealed that *H. pylori* infection in the community studied has an overall seroprevalence of 73.5%. The high seroprevalence of *H. pylori* in this study is consistent with the reports of **Solomon et al.** [22] who reported a prevalence rate of 76.0% in Ekiti State and **Okoroiwu et al.** [23] who reported a prevalence rate of 74.2% in Owerri, Imo State. It is however lower than the report of the studies conducted by **Ombugadu et al.** [24] who reported a prevalence rate of 35% in Jos, Nigeria and **Nwachukwu et al.** [25] who reported a prevalent rate of 52.0% in Nnewi, Anambra State, South-south Nigeria. For other countries, Walker et al. [26] reported 75.0% rate of *H. pylori* prevalence in Rwanda and Rahul et al. [27] reported 51.0% in Pune, Marashtra. Differences in the seroprevalence rates could be attributed to the type of research methodology used and sample size.

The results in this study is also consistent with available literatures on the presenting

associated symptoms with *H. pylori* infection such as abdominal pain, heartburn, bloating, belching, nausea and fever [7]. The clinical application of this finding is that the presenting symptoms could be regarded as a diagnostic method for presumptive treatment of *H. pylori* infection in areas where diagnostic facilities are not readily available.

No significant association was found between *H. pylori* infection and the sociodemographic factors assessed. This is in agreement with the findings in Calabar, where no significant difference in prevalence of *H. pylori* infection was found when patients were classified by age, gender, marital status, educational level and occupation [28]. However, this finding is in contrast with the report of previous studies by **Bakka et al.** [29] and **Tanih et al.** [30]. Also there was no significant relationship (p>0.05) between the source of drinking water, alcohol consumption and *Helicobacter pylori* infection in this study. This is in line with the report of **Ombugadu et al.** [24], but the findings of this study disagrees with the findings of **Rana et al.** [31].

The intake of NSAIDs in this study, is statistically associated with the prevalence rate of *H. pylori* infection. NSAIDs are known to impact the mucosal protection through the reduction of the effectiveness of mucus bicarbonate barrier, gastric acid and pepsin, which results to damage of the affected mucosal surface [32]. From this study, high prevalence of *H. pylori* was recorded among cigarette smokers. This agrees with the findings of **Okoroiwu et al.** [23] who reported that smoking is significantly associated with the prevalence rate of *H. pylori* in Owerri, Nigeria. Cigarette smoking alters cell function in the lung; it reduces respiratory function and affects the microbiota. Smoking also increases bile salt reflux rate and gastric bile salt concentration thereby increasing duodenogastric reflux that raises the risk of gastric ulcer in smokers [33, 34]. This study showed a strong correlation between the participants with family history of peptic ulcers and *H. pylori* positivity. Researchers have found some genetic basis for the susceptibility to *H. pylori* infection. This is in line with the studies of **Rahul et al.** [27] and **Okoroiwu et al.** [23] who reported a significant relationship between *H. pylori* infection and family history of peptic ulcers. Also, it could be deduced from this present study that those who lived in an over-crowded room with subjects infected with *H. pylori* are at a high risk of developing the infection. This finding is similar to the study conducted in Libya which revealed that transmission of *H. pylori* among siblings is an important mode of acquiring *H. pylori* infection [31, 35].

Findings on the type of medication used revealed that most of the subjects who are undergoing *H. pylori* treatment carried out self-medication. They consumed drugs singly as against the recommended combination therapy [13]. The subjects readily consume antacids compared to other medications, this could be because antacids may be used alone for mild symptoms caused by stomach acids or because it is relatively inexpensive [36]. The subjects also had treatment with proton pump inhibitors. Proton pump inhibitors are known to decrease the activity of *H. pylori* within the stomach and to shift their distribution proximally [29]. All medications used by the subjects are often recommended for the treatment of peptic ulcer and eradication of *H. pylori* [13,37]. However, the use of non-recommended combination therapy, could result in eradication failure and lead to increase in antibiotic resistance, a major public health issue.

Conclusion

This study revealed the high prevalence of *H. pylori* infection among people with symptoms suggestive of peptic ulcer in Akure metropolis. This high prevalence might constitute a major public health threat to the entire people of Ondo State and Nigeria as a whole. There is therefore the need to put in place interventions and advice on suitable preventive measures and also effective treatments for those who are infected. This will allow for better and prompt management of those who are infected so as to avoid complications associated with the infection and also the spreading of the infection Also there is the need to establish national and regional consensus guidelines on the management of *H. pylori* infection in peptic ulcer disease patients.

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