

Correlation between Gastric mucosal histology and Faecal antigen test for the detection of *Helicobacter pylori* infection among dyspeptic patients in a tertiary hospital in south-west Nigeria.

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Abstract

Background and objectives: Dyspepsia is a term used to describe upper abdominal pain or discomfort often associated with eating, early satiety, postprandial abdominal bloating or distention, and nausea. Many of these patients are infected with *Helicobacter pylori*. A simple method of diagnosis becomes imperative, to reduce the burden on endoscopy services. This study was aimed at determining the correlation between faecal antigen test and gastric mucosal histology in the diagnosis of *Helicobacter pylori* infection amongst patients undergoing upper gastrointestinal endoscopy.

Methods: A cross-sectional study of consecutive, consenting patients with dyspepsia presenting for upper gastrointestinal endoscopy. Fresh stool samples (rectal smears) were obtained from patients for *Helicobacter pylori* stool antigen test. Bio-data and results were recorded. Upper gastrointestinal endoscopy was performed using Pentax FG-29W gastroscope with a video monitor and detailed findings noted. Gastric biopsies (3 corpus and 3 antrum) were taken for histological diagnosis of *Helicobacter pylori*. Data were entered into SPSS (version 20) and analyzed using descriptive and inferential statistics.

Results: There were 150 patients comprising 61(40.7%) males and 89 (59.3%) females. The mean age (\pm SD) was 45.5 (\pm 14.7) years with a range of 18 – 79 years. *Helicobacter pylori* was present in 93(62%) of patients on histology, and in 80 (53.3%) of them using *Helicobacter pylori* Stool Antigen Test ($p = 0.000$). The sensitivity, specificity, diagnostic accuracy, Positive predictive value, Negative predictive value and Area under the receiver operating characteristic curve for *Helicobacter pylori* stool antigen test were 79.6%, 89.5%, 83.3%, 92.5, 72.9% and 0.827 respectively. Positive and negative likelihood ratios were 7.58 and 0.228 respectively.

Conclusion: *Helicobacter pylori* stool antigen test compared favourably with histology and could possibly be used to complement the detection of *H. pylori* where Urea Breath Test and endoscopy are not available.

Keywords: Faecal antigen test, *H. pylori*, histology, gastric biopsy, correlation.

Résumé

Contexte et objectifs: La dyspepsie est un terme utilisé pour décrire les douleurs abdominales supérieures ou les inconvénients souvent associés à la consommation, la satiété précoce, les ballonnements abdominaux postprandial ou la distension et la nausée. Beaucoup de ces patients sont infectés par *Helicobacter pylori*. Une simple méthode de diagnostic devient impérative, afin de réduire le fardeau des services d'endoscopie. Cette étude visait à déterminer la corrélation entre le test de l'antigène fécal et l'histologie de la muqueuse gastrique dans le diagnostic de l'infection à *Helicobacter pylori* chez les patients soumis à une endoscopie gastro-intestinale supérieure.

Méthodes: étude transversale de patients consécutifs consentements à la dyspepsie présentant une endoscopie gastro-intestinale supérieure. Des échantillons de selles fraîches (frottis rectaux) ont été obtenus chez des patients pour un test d'antigène des selles *Helicobacter pylori*. Les données biologiques et les résultats ont été enregistrés. L'endoscopie gastro-intestinale supérieure a été effectuée en utilisant un gastroscope Pentax FG-29W avec un moniteur vidéo et des résultats détaillés constatés. Des biopsies gastriques (3 corpus et 3 antres) ont été prises pour le diagnostic histologique d'*Helicobacter pylori*. Les données ont été entrées dans SPSS (version 20) et analysées à l'aide de statistiques descriptives et par inférences.

Résultats: 150 patients comptant 61 (40,7%) hommes et 89 (59,3%) des femmes. L'âge moyen (\pm DE) était de 45,5 (\pm 14,7) ans avec une étendue de 18 à 79 ans. *Helicobacter pylori* était présent dans 93 (62%) des patients sur histologie et dans 80 (53,3%) d'entre eux faisant usage du Test *Helicobacter pylori* Stool Antigen ($p = 0,000$). La sensibilité, la spécificité, la précision diagnostique,

la valeur prédictive positive, la valeur prédictive négative et la zone sous la courbe caractéristique de fonctionnement du récepteur pour le test antigénique des selles *Helicobacter pylori* étaient respectivement de 79,6%, 89,5%, 83,3%, 92,5, 72,9% et 0,827. Les rapports de vraisemblance positive et négative étaient respectivement de 7,58 et 0,228.

Conclusion: Le test d'antigène des selles de *Helicobacter pylori* a été comparé favorablement à l'histologie et pourrait éventuellement être utilisé pour compléter la détection de *H. pylori* où le test de respiration d'urée et l'endoscopie ne sont pas disponibles.

Mots-clés: Test d'antigène fécal, *H. pylori*, histologie, biopsie gastrique, corrélation.

Introduction

Dyspepsia according to the Rome III working group, is the presence of symptoms considered by the physician to originate from the gastroduodenal region and only for symptoms consisting of bothersome postprandial fullness, early satiation, epigastric pain and epigastric burning [1]. Dyspepsia has a worldwide distribution with a prevalence rate of 41% reported among the British population in 1990 [2]. Studies in the United States found prevalence values of approximately 25% [3]. However, a study carried out in Lagos, Nigeria recorded a prevalence rate of 29% [4], while another report from the North-Eastern part of Nigeria found a prevalence of 26% [5]. Organic dyspepsia may be caused by food intolerance, medications, systemic disorders, and diseases of the gastro-intestinal tract such as peptic ulcer disease (PUD), gastroduodenitis, oesophagitis, pancreatitis, gastric cancer and many others including infection with the organism *Helicobacter pylori* (*H. pylori*) which has been recognized as a key factor [6].

Helicobacter pylori is a gram-negative bacterium that selectively colonizes the gastric epithelium. The bacterium is urease, catalase, and oxidase positive. It is spiral shaped, and possesses 3 to 5 polar flagellae that are used for motility [7]. It has evolved the ability to colonize the highly acidic environment found within the stomach by metabolizing urea to ammonia using its enzyme, urease, which generates a neutral environment enveloping the bacterium [7]. Diagnostic methods for this infection are either invasive or non-invasive. Invasive methods used for the diagnosis of *H. pylori* infection require endoscopic examination which is expensive and inconvenient and may cause complications. Non-invasive methods such as urea breath test (UBT), serology and stool antigen tests

are more readily preferable in the absence of compelling indications for endoscopy. Several studies have reported that a high percentage of dyspeptic patients in Nigeria are infected with *H. pylori* [8-11], it is therefore imperative to evaluate an alternative means of diagnosing this infection as *H. pylori* is mostly found among people from the low socio-economic status. Histological diagnosis of this infection is relatively expensive and has with it its attendant complications arising from pre-medication and the endoscopy procedure itself. A commonly used non-invasive test with high performance in diagnosing *H. pylori* infection is the UBT, which is equally expensive.

H. pylori stool antigen tests (HpSAT) are relatively simple and cheaper than the UBT. Human stool specimen is very easy to obtain as it is part of the physiological processes of the human body. Though studies on HpSAT have been done in Nigeria [8-11], most of these studies were based on very small sample sizes and as such there is need for more studies on its usefulness in evaluating patients with dyspepsia and possibly compare such with the existing standard means of diagnosing *H. pylori* infection.

This study was aimed at determining the correlation between faecal antigen test and gastric mucosal histology in the diagnosis of *H. pylori* infection amongst patients undergoing upper gastrointestinal endoscopy. This study therefore, looked at the usefulness of HpSAT in comparison with histological diagnosis of *H. pylori* which is commonly used in Nigeria.

Methods

This was a comparative study comparing two methods of diagnosing *H. pylori* infection; faecal antigen test and histology. The study was carried out at the Gastroenterology Unit of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) from May 2014 to Aug 2015. The study population comprised of 150 adult patients (18yrs and above), with dyspepsia who were recruited consecutively from the Gastroenterology and Endoscopy Unit of the hospital after an informed consent. Patients who had taken any antibiotics within one month or a proton pump inhibitor within two weeks of the procedure, [12] or were pregnant or breastfeeding were excluded from the study. Also, patients who on endoscopic examination had features suggestive of gastric cancer were excluded.

The study was approved by the hospital's Ethics and Research Committee with approval number: IRB/IEC/0004553.

A structured interviewer-administered questionnaire was used to obtain information from every participant. Patients were fasted overnight, for a minimum of 8 – 10hours before the morning of the test. Fresh stool samples were obtained from the participants on the morning of endoscopy. The stool was processed and tested for *H. pylori* using one step *H.pylori* immuno-chromatographic antigen rapid test kit by SD (Standard Diagnosis) BIOLINE (Batch number: 04FK20-02-4). The procedure was carried out in accordance with the manufacturer’s instructions.

All cases thereafter underwent an oesophagogastroduodenoscopy. Pre-medication given were, 10% xylocaine throat spray, intravenous midazolam of between (2.5 – 5.0mg) as conscious sedation and intravenous 20mg of buscopan (hyocine) as a smooth muscle relaxant. Midazolam was avoided in patients with chronic liver disease. Endoscopy was performed using the Pentax FG-29W forward viewing flexible oesophagogastroduodenoscope. Details of gastric mucosal pattern were recorded and gastric mucosa biopsies were obtained from the gastric corpus (from 2 separate areas) and antrum (from 3 separate areas including the incisura angularis).

The gastric tissue biopsies were fixed in 10% buffered formalin from the endoscopy room. Biopsies were placed on filter paper, into tissue cassettes and processed in an automatic tissue processor (Leica TP1020) to produce formalin-fixed, paraffin-embedded tissue blocks. These paraffin-embedded tissue blocks were subsequently cut into thin sections of less than 3µm thick using the semi-automatic rotary microtome (Leica RM2125RT). The sections were then picked up onto glass slides and allowed to dry at room temperature. One set of tissue sections was stained with hematoxylin and eosin, while the other set with Giemsa stain for histopathological examination. The stained slides of the gastric tissue biopsies were viewed and evaluated using the conventional light microscope.

The haematoxylin and eosin stained slides were evaluated using the updated Sydney system of classification and grading of gastritis,[13] while the modified Giemsa stained slides were evaluated to identify presence of *H. pylori*.(figure 3).

Data obtained were analyzed using SPSS-version 20. Frequency distribution tables of variables were generated. Measure of central tendency and dispersion for quantitative variables as well as proportions for quantitative variables were determined. Continuous variables were presented as means ± standard deviations while categorical

variables were presented as frequency tables, bar and pie charts. Discrete variables were analyzed using Chi square test. Specificity, sensitivity, positive and negative predictive values, positive and negative likelihood ratios, diagnostic accuracy and area under the receiver operating characteristic (AUROC) curve for stool antigen test in diagnosing *H. pylori* infection were calculated, compared to histological diagnosis used as the gold standard [14,15]. Area under the ROC curve was used to compare the usefulness of the tests, with larger areas corresponding to greater usefulness. A p-value of less than or equal to 0.05 was considered as statistically significant at 95% confidence level.

Results

A total of 150 cases completed the study with a mean age (±SD) of 45.5 (±14.7) years and a range of 18 – 79years. The modal age group was 40 – 59 years with a median age of 45years. There were 89 (59.3%) females and 61(40.7%) males. Thirty-eight (25%) were civil servants and 116 (77.3%) of the patients were married. Seventy-six (50.7%) had up to a secondary school education and 57(38%) had post-secondary education (Table 1).

Table 1. Socio-demographic characteristics of study population

Demographic characteristics	No of patients (N=150)	Percentage (100%)
<i>Age group</i>		
<20	3	2
20 – 39	51	34.0
40 – 59	67	44.7
60 – 79	29	19.3
<i>Gender</i>		
Male	61	40.7
Female	89	59.3
<i>Occupation</i>		
Civil servants	38	25.3
Artisans	12	8.0
Retired	16	10.7
Farmers	13	8.7
Business	14	9.3
Trader	26	17.3
Unemployed/students	31	20.7

Risk factors for dyspepsia in the study patients were non-steroidal anti-inflammatory drugs (NSAIDS) in 21(14%); 14(9.3%) of the patients took alcohol and 41(27.3%) had a positive family history of dyspepsia while 53(35.3%) had used herbal mixtures (Table 2). Majority of those who took alcohol,12(8%), took between 20 – 50g of alcohol

Table 2. Risk factors for Dyspepsia

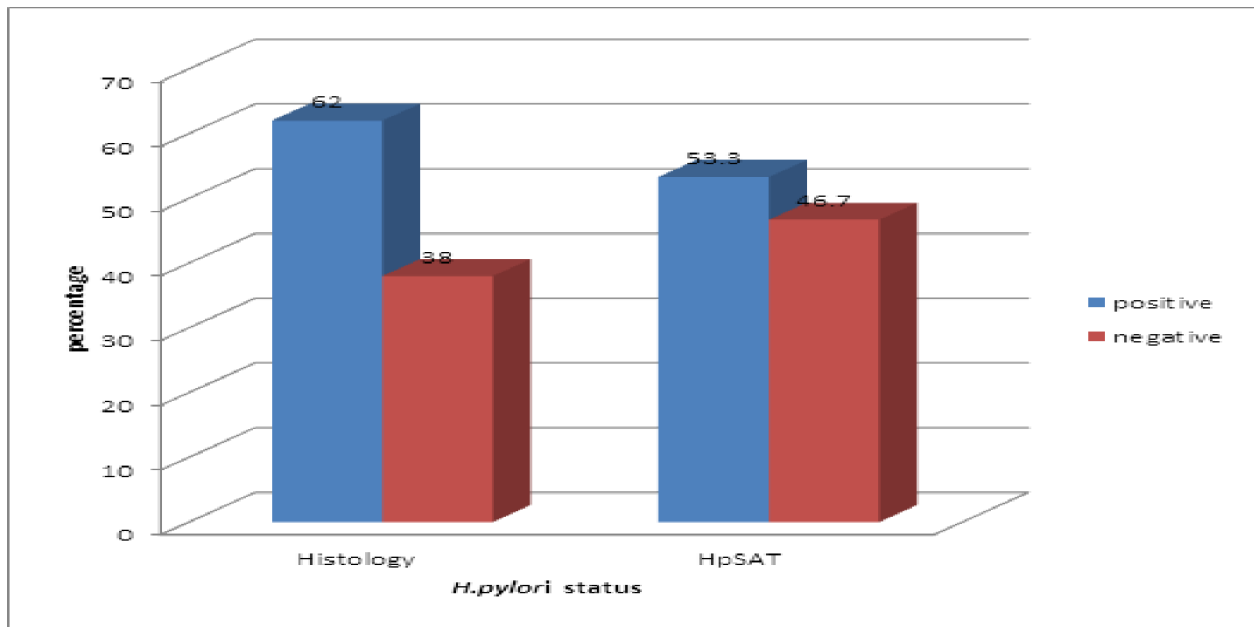
Risk factors		Frequency(N=150)n(%)	χ^2	df	p-value
NSAIDs	Yes	21(14)	77.76	1	0.000
	No	129(86)			
Smoking	Yes	6(4)	126.96	1	0.000
	No	144(96)			
Alcohol	Yes	14(9.3)	99.227	1	0.000
	No	136(90.7)			
Steroids	Yes	2(1.3)	142.107	1	0.000
	No	148(98.7)			
CCB	Yes	13(8.7)	102.507	1	0.000
	No	137(91.3)			
DM	Yes	2(1.3)	142.107	1	0.000
	No	148(98.7)			
Herbal mixtures	Yes	53(35.3)	12.907	1	0.000
	No	97(64.7)			
FHOD	Yes	41(27.3)	58.680	2	0.000
	No	92(61.4)			
	Don't know	17(11.3)			

*p-value < 0.05 is statistically significant

NSAIDs = Non-Steroidal Anti-Inflammatory Drugs; CCB = Calcium Channel Blockers; FHOD = Family History of Dyspepsia; DM = Diabetes Mellitus; df = degree of freedom.

per day for more than 5 years while those that smoked cigarette, 4(2.7%), consumed between 1 - 5 pack years of cigarette as at the time of this study.

of *H. pylori* was highest amongst the age group 20-39 years using histology (p > 0.05). (Table 3) With respect to gender, 64% of males and 61% of females



HpSAT = *H. pylori* Stool Antigen Test; P-value = 0.0000.

Fig. 1: Prevalence of *H. pylori* using Histology

Helicobacter pylori was detected on histology of the gastric mucosa in 93 (62%) of the 150 patients studied. HpSAT test was positive in 80 patients (53.3%), p < 0.05. (Fig.1). The prevalence

tested positive to *H. pylori* on histology while 59% and 49% of males and females respectively were positive on HpSAT. However, there was no statistically significant difference in the rates

Table 3. Prevalence of *H. pylori* according to socio-demography

Variables	N(150)	Histology n (%+ve)	HpSAT n (%+ve)	p-value
<i>Age groups(yrs)</i>				
<20	3	2(66.7%)	2(66.7%)	0.083
20 - 39	51	34(66.7%)	30(58.8%)	0.000
40 - 59	67	39(58.2%)	32(47.8%)	0.000
60 - 79	29	18(62.1%)	16(55.2%)	0.002
<i>Gender</i>				
Male	61	39(64%)	36(59%)	0.000
Female	89	54(61%)	44(49%)	0.000
<i>Occupation</i>				
Civil servants	38	22(58%)	15(39%)	0.000
Farmers	13	4(30.7%)	4(30.7%)	0.048
Artisans	12	9(75%)	8(66.7%)	0.028
Traders	26	21(80.7%)	18(69%)	0.001
Business	14	8(57%)	9(64%)	0.036
Retired	16	10(62.5%)	9(56%)	0.000
Unemployed	31	19(61%)	17(55%)	0.000

Table 4. *H. pylori* diagnostic test evaluation for HpSAT

HpSAT	Histology		Total
	Positive	Negative	
Positive	74(a)	6(c)	80(a + c)
Negative	19(b)	51(d)	70(b + d)
Total	93(a + b)	57(c + d)	150(a+b+c+d)

a = True positive (TP); *b* = False negative (FN); *c* = False positive (FP); *d* = True negative(TN)

CI = Confidence Interval.

Sensitivity = $74/93 \times 100\% = 79.6\%$ (95% CI = 73.15% to 86.05%)

Specificity = $51/57 \times 100\% = 89.5\%$ (95% CI = 84.59% to 94%)

Positive Likelihood Ratio (LR+) [sensitivity/(100 - specificity)] = 7.58 (95% CI = 3.34 to 11.82)

Negative Likelihood Ratio (LR-) [(100 - sensitivity)/specificity] = 0.228(95%CI= -0.54 to 0.99)

*The HpSAT kit Manufacturer's sensitivity and specificity were both reported as 100% compared with a combination of Rapid urease test (RUT) and Urea breath test(UBT) used as gold standard of diagnosis.

according to gender using both histology and HpSAT (p-value > 0.05). The *H. pylori* infection rates were highest amongst traders and artisans (80.7% and 75% respectively) on histology and (69% and 66.7% respectively) on HpSAT.

The relationship between *H. pylori* status and some risk factors for dyspepsia showed that the rates were higher amongst those who took alcohol and smoked tobacco product; 71.4% and 83.3% on histology and 57.1% and 66.7% on HpSAT respectively.

A vast majority of those who presented with a history of haematemesis tested positive to *H. pylori*; moreso on histology (80%) as compared with HpSAT (60%). The sensitivity and specificity of HpSAT

were 79.6% and 89.5% respectively. The likelihood diagnostic evaluation showed that HpSAT has about 8-fold [Positive likelihood ratio (LR+) = 7.58] increase in the chance of detecting *H. pylori* infection when the test is positive in a patient. In the same vein, there was about 23% [Negative likelihood ratio (LR-) = 0.228] chance of the presence of *H. pylori* infection in a patient when the test is negative (Table 4).

The precision level for HpSAT to detect truly positive *H. pylori* infection was as high as 92.5% while that for detecting truly negative *H. pylori* infection was 72.9% using histology as the gold standard. (Table 5) The diagnostic accuracy for HpSAT is 83.3%. (Table 5) It has a high diagnostic

Table 5. Other Diagnostic Evaluation Tests For HpSAT

HpSAT	Histology		Total
	Positive	Negative	
Positive	74(a)	6(c)	80(a + c)
Negative	19(b)	51(d)	70(b + d)
Total	93(a + b)	57(c + d)	150(a+b+c+d)

a = True positive (TP); b = False negative (FN); c = False positive (FP); d = True negative (TN)

CI = Confidence Interval.

Positive Predictive Value (PPV) = 74/80 × 100% = 92.5% (95% CI = 88.28% to 96.72%)

Negative Predictive Value (NPV) = 51/70 × 100% = 72.9% (95% CI = 65.79% to 80.01%)

Diagnostic Accuracy (DA) = (74+51)/150 × 100% = 83.3% (95% CI=77.33% to 89.27%)

Diagnostic Odds Ratio (DOR) = (TP/FN)/(FP/TN) = (74/19)/(6/51)=33.1(95%CI=25.7 to 40.63)

Odds Ratio (LR+/LR-) of 33.1, HpSAT has a very high positive likelihood compared with negative likelihood when applied in the diagnosis of *H. pylori* infection. (Table 5)

Discussion

In this study comparing the usefulness of HpSAT with histology, the mean age of the study subjects was comparable with that by Syam *et al* [15] in

Table 6. *H. pylori* status in the various endoscopic findings

Endoscopic Findings	Freq (N=150) n(%)	n (% +ve) (Histology)	% +ve (HpSAT)	(Histology vs HpSAT) p-value
Normal Finding	47(31.3)	29(61.7)	20(42.6)	0.000*
Antral Gastritis	51(34)	36(70.6)	23(45.1)	0.000*
Gastroduodenitis	18(12)	16(88.9)	15(83.3)	0.314
Gastric Erosion	14(9.3)	10(71.4)	8(57.1)	0.580
Duodenal ulcer	18(12)	14(80.0)	13(75.0)	0.032*
Erosive GERD	24(16)	12(50.0)	7(29.0)	0.193
Gastric ulcer	6(4)	5(83.3)	3(50.0)	1.000
Gastric mucosal thinning	34(22.6)	18(52.9)	15(44.1)	0.000*
PHG with Oesophageal varices	3(2)	2(66.7)	2(66.7)	0.333
Hiatus hernia	11(7.3)	5(45.5)	3(27.3)	0.015*

P-value < 0.05 is statistically significant; * = statistically significant

PHG = Portal Hypertensive Gastropathy

% positive on Histology = Percentage of patients positive for *H. pylori* on Histology

% positive on HpSAT = Percentage of patients positive for *H. pylori* on HpSAT

At endoscopy, *H. pylori* positivity was 88.9%, 83.3% and 80% of patients with gastroduodenitis, gastric ulcer and duodenal ulcer using histology while 83%, 50% and 75% of those with gastroduodenitis, gastric ulcer and duodenal ulcer respectively were positive using HpSAT (Table 6). The Receiver operating characteristic (ROC) curve and the area under the curve (AUROC) for HpSAT was 0.827. (Figure 2).

Indonesia and that by Jemilohun *et al* [16] in Nigeria. These studies, however, had small sample sizes of 63 and 86 respectively. The mean ages in these studies probably reflect the population of patients who usually seek health care in our health facilities as well as the mean age of individuals with dyspepsia in the population.

The gender distribution of predominantly female of 59.3% is also similar to the work done by Jemilohun *et al* [16] where they also found female

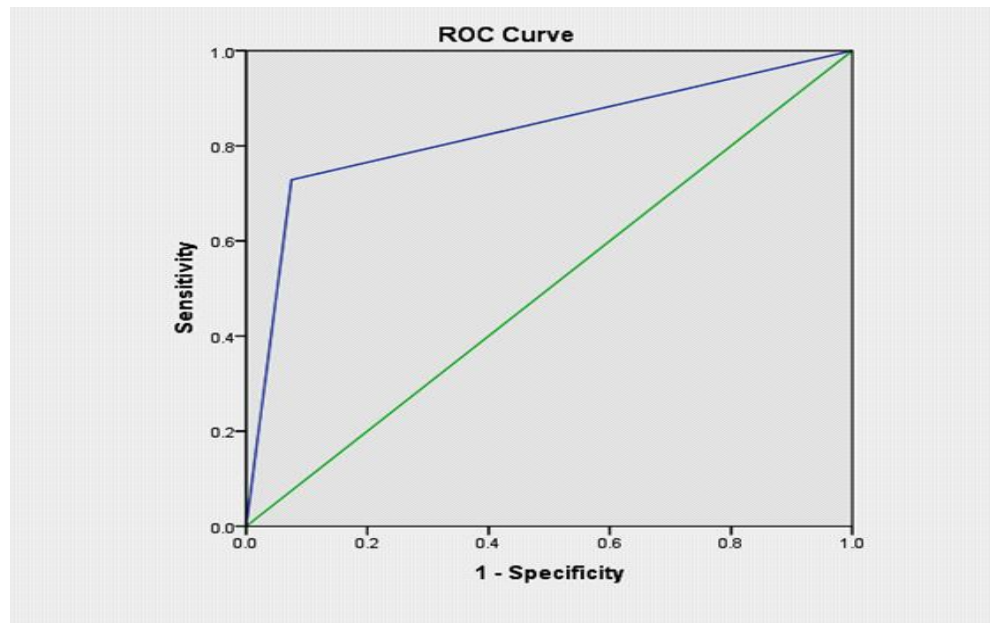


Fig. 2: Area Under The Receiver Operating Characteristic (AUROC) Curve of HpSAT

_____ HpSAT ROC Area: 0.827
 _____ Reference line

The interpretation of AUROC is as follows; a value of:-

0.9 – 1.0 is excellent; **0.8 – 0.9** is very good; **0.7 – 0.8** is good; **0.6 – 0.7** is sufficient; **0.5 – 0.6** is bad; **< 0.5** means the test is not useful.

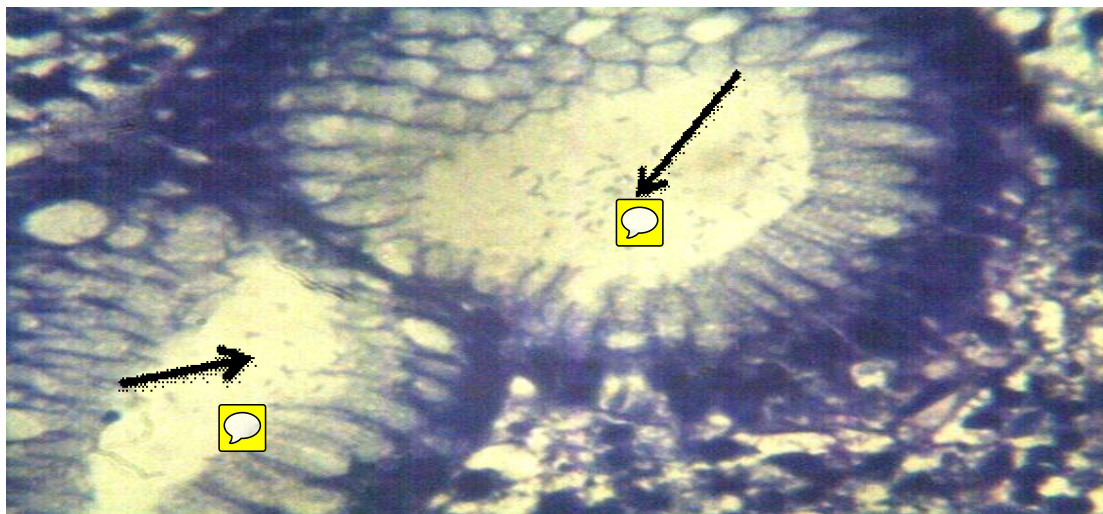


Fig. 3: Histology slide of a study patient (Giemsa Stain $\times 40$) showing *H. Pylori* (Thick Arrows)

preponderance of 54.7%. In another study by Aje *et al* [9] in south-west, Nigeria, they also reported a slight female preponderance of (20 males vs; 26 females). The female predominance in these studies among dyspeptic patients may be due to the fact that females have lower threshold for pain as was also opined by Aje *et al* [9] they may also be more conscious of issues of health than males and it is also possible that psychosomatic and emotional disorders are likely more common in females, than males hence the female preponderance.

In this study, the majority of participants were civil servants, followed by students/the unemployed and traders. About fifty-percent of them had up to a secondary school education and 30% had post-secondary education. This pattern is similar to another study by Hameed *et al* [4] in Lagos, Nigeria, where the participants consisted of traders/business men and women, students, and civil servants. They also found that approximately half of their respondents had post-secondary education, while 38.2% had up to secondary education only.

Majority of our patients were civil servants and had up to secondary education. This could be a reflection of information on health issues and consequently on health seeking behaviour. Health seeking behaviour is a reflection of educational background.

The prevalence of *H. pylori* in this study was 62% on histology and 53.3% on faecal antigen test. A study carried out by Ndububa *et al* [17] in 2001, about 14yrs before now, in the same hospital reported a prevalence rate of 73% on histology. The drop in the prevalence rate perhaps reflects an increasing awareness and possible over-the-counter use of antibiotics and anti-ulcer drugs. Another reason could be that good hygiene as reflected in their educational background may also have impacted on their *H. pylori* infection rate. Nevertheless, the prevalence rate of 62% is still high. Prevalence rates similar to the findings in this study have also been reported in other parts of the world. Jemilohun *et al* [16] in 2011 in Ibadan, Southwest Nigeria, reported a prevalence rate of 64% from their study of 86 patients using histology and rapid urease test (RUT). Abo-Shadi *et al* [18] in 2013 reported a prevalence of 64.7% in a study of 68 patients using histology in Egypt. However, Olokoba *et al* [19] in 2013 reported *H. pylori* prevalence of 80% using histology from their study in the Northern Nigeria. Mustapha *et al* [20] in a prospective study carried out in the same North-Eastern Nigeria from 2003 to 2006 had reported a similar prevalence of 78.5% using the same histology. Tijani *et al* [21] in Kano, North-western Nigeria found a prevalence rate of 81% amongst patients studied using histology. Hameed *et al* [4] in Lagos using histology reported a prevalence rate of 41% for which the authors were of the opinion that inadequate biopsy samples due to the cost of processing samples may be a factor and also that the patients' ability to remember the details of antibiotics used over the previous six weeks might not be completely reliable and could have affected the results of the study. It thus seems that geographical variations and socio- demographics of the population studied and the socio-economic status of people possibly influences *H. pylori* prevalence. Bani-Hani *et al* [22] in their work in Jordan demonstrated that environmental factors such as barometric pressure and seasonal temperature variation and not necessarily genetic background played a role in the prevalence of *H. pylori* in different populations further strengthening this postulate.

In this study, the prevalence of *H. pylori* with HpSAT was 53.3% which is similar to that reported by Naji *et al* [23] in Yemen. Higher values were reported by Aje *et al* [9] and Smith *et al* [8]. The

difference in rates may have reflected the general prevalence of *H. pylori* infection in these regions of Nigeria and perhaps, the season of the study.

The sensitivity, specificity, diagnostic accuracy, positive predictive value and negative predictive value for HpSAT were 79.6%, 89.5%, 83.3%, 92.5%, and 72.9% respectively. Positive and Negative likelihood ratios (LR+ and LR-) were 7.58 and 0.228 respectively. This is similar to the report by Falaknazi *et al* [24]. Findings in this study also compare with, though, slightly lower than what was obtained by Asfeldt *et al* [25] in 2003 where they reported sensitivity and specificity of 98% and 94%, with positive and negative likelihood ratios of 16.7 and 0.02, respectively. Gisbert *et al* [26] in their systematic review of 22 studies reported pooled sensitivity, specificity, LR+, and LR- as; 95%, 97%, 24, and 0.07 respectively.

The rates of *H. pylori* infection using HpSAT in the various endoscopic findings like; normal stomach, antral gastritis, DU, GU and gastroduodenitis were similar to those obtained using histology. These findings are also similar to the works by Mohammed *et al* [27] and Syam *et al* [15].

The area under the receiver operating characteristic curve (AUROC) for HpSAT was 0.827 which according to Youden *et al* [28] implies that this test is very good compared to the gold standard used in this study which is histology. The value for the ROC is also similar to the work by Kazemi *et al* [29] with AUROC value of 0.897 and Farazi *et al* [30] with an AUROC value of 0.889.

Conclusion

This study has shown a clear relationship between *H. pylori* infection and occurrence of dyspepsia. There is still a high prevalence of *H. pylori* infection amongst patients with dyspepsia. *H. pylori* infection is highest amongst the young age group of 20-39years. The diagnostic accuracy tests for HpSAT shows that it is comparable to gastric histology in diagnosing *H. pylori* infection and may be used to complement the diagnosis of *H. pylori* where UBT is not available. However, histology remains a superior method of *H. pylori* diagnosis especially in the event of compelling indications for upper gastrointestinal endoscopy.

Limitation of the study

It is a hospital-based study and it therefore may not have captured the true prevalence of *H. pylori* in the community. Possibility of inadequate drug history as it may have been underestimated by the study participants

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