Arch. Bas. App. Med.12 (2024):41-45
www.archivesbamui.com
www.ojshostng.com/index.php/abam

Research Article

Prevalence of *Helicobacter pylori* Infection in Patients with Gastrointestinal symptoms using Urea Breath Test in Ilorin, North-central Nigeria

Bojuwoye M.O.[1], *Agede O.A.[1,2], Ilesanmi O.N.[1], Aiyedun O.S.[1], Aliyu A.M.[1], Arinde O.[1], Ojimi O.O.[1], Safiu K.I.[1]

[1]*Department of Medicine, University of Ilorin and University of Ilorin Teaching Hospital, Ilorin, Nigeria.*
[2]*Department of Pharmacology and Therapeutics, University of Ilorin, Ilorin, Nigeria*
Accepted: January 22, 2024

Abstract
Helicobacter pylori (*H. pylori*) infection has been linked with some gastrointestinal (GI) symptoms particularly dyspepsia. Urea breath test (UBT) is a simple non-invasive tool for the detection of this infection in humans. We, therefore, studied the prevalence of *H. pylori* infection among patients who were referred for UBT on account of GI symptoms in a tertiary health center in Nigeria. This was a retrospective study in which the biodata, indications and test results of patients who had UBT done over a period of 7 years (2012-2019) were retrieved from a dedicated register. The data was entered into a spreadsheet, cleaned and analyzed using the statistical software for social sciences (SPSS) version 22. Results were presented using frequency tables and charts. Associations between categorical variables were determined using the chi-square test and the level of significance set at $p<0.05$. Of the 251 patients with UBT results, 216 (86.1%) were on account of GI symptoms. The ages of the patients ranged from 10 to 77 years with a mean age (SD) of 40.0 (±14.2) years. There were more females 111 (51.4%) and the 31-40 years age group had the largest number of patients 57 (26.4%). Dyspepsia was the most common indication for UBT across the age groups ($p=0.001$). The frequency of *H. pylori* infection in our cohort was 64.4%. The highest frequency of the infection was observed among the 31-40 years age group ($p=0.072$) and among females (73/111; $p=0.905$). The association between *H. pylori* infection and the GI symptoms was not statistically significant ($p=0.748$). The prevalence of *H. pylori* infection among our study cohort is high. There was no significant association between *H. pylori* infection and the age group, gender and GI symptoms. The small sample size might be responsible for the lack of significant association.

Key Words: *Helicobacter pylori*, Prevalence, Urea Breath Test, Gastrointestinal, Nigeria

INTRODUCTION

Helicobacter pylori (*H. pylori*) is a ubiquitous, microaerophilic, urease producing, gram-negative bacillus (Wang *et al*., 2015). It affects more than 50% of the world's population and is one of the widely prevalent chronic bacterial infections (Li *et al*., 2023). The prevalence of *H. pylori* is variable between 19 and 88% and depends on various factors such as geographical location, patient's age, sanitation, and socioeconomic status (Li *et al*., 2023; Hooi *et al*., 2017). Patients often acquire *H. pylori* infections during childhood, and if untreated, persist throughout life (Hooi *et al*., 2017). The route of transmission is fecal–oral or oral–oral (Hooi *et al*., 2017).
H. pylori has a unique spiral shape and multiple unipolar flagella which enables it to move within the mucous layer of the gastric epithelium, where it remains protected from the low gastric pH and causes inflammation of the gastric mucosa (Haley *et al*., 2015). The bacterium is an established cause of gastroduodenal disorders such as chronic gastritis, peptic ulcer disease (PUD), gastric mucosa-associated lymphoid tissue (MALT) lymphoma, and stomach cancer; all of which often present with dyspepsia (Ford *et al*., 2020). Therefore, screening for and eradication of this bacterium are important components of prevention and management of these disorders. A meta-analysis of a Chinese population demonstrated that the infection rate of *H. pylori* in patients with HBV-related liver diseases had a positive relation with the increase of disease severity. In addition, the rate of *H. pylori* positivity in chronic HBV patients was 2.44-fold higher than that in healthy controls (Wang *et al*., 2016). *H. pylori* has also been implicated in the aetiology of some extra-gastrointestinal disorders such as iron deficiency anaemia, Vitamin B12 deficiency anaemia, immune thrombocytopenic purpura, preeclampsia, immunoglobulin A (IgA) nephropathy, membranous nephropathy, glaucoma, central serous chorioretinopathy, chronic spontaneous urticaria and psoriasis (Gravina *et al*., 2020; He *et al*., 2022).
Since the discovery of *H. pylori* in 1983, numerous detection methods for the presence of the bacterium have been developed. Each one of them has its advantages and disadvantages. These tests are broadly classified into non-invasive and invasive tests (Sabbagh *et al*., 2019). The former include 13C or 14C urea breath test, stool antigen test (SAT),

**Author for Correspondence:* Tel: +2348035887600 E-mail: *agede.oa@unilorin.edu.ng*

serology, and molecular methods whereas the latter include endoscopy and gastric biopsy followed by either rapid urease test (RUT) or histology or culture, or molecular methods on biopsy samples (Sabbagh *et al*., 2019).

Urea breath test (UBT) has been in use for about 30 years, it remains the most popular, and accurate, non-invasive test for the diagnosis of *H. pylori* infection (Wang *et al*., 2015). This test can detect the infection indirectly by measuring the activity of bacterial urease produced by *H. pylori* in the stomach (Kalali *et al*., 2015). The test exploits the hydrolysis of orally administered urea by the *H. pylori*. An isotopically (13C or 14C) labeled urea is hydrolyzed into ammonia and carbon dioxide, which diffuses directly into the blood and excreted out through the lungs. The released carbon dioxide can be measured (Wang *et al*., 2015; Kalali *et al*., 2015).

The prevalence rate of *H. pylori* infection among patients with dyspepsia in our study site was previously studied more than a decade ago using histology of gastric mucosa biopsies. The patients were recruited over a period of 8 months in the year 2012 and the prevalence was 47.3% (Bojuwoye *et al*., 2016). The prevalence of *H. pylori* infection can change over a period of time in the same geographical location and the yield differ with method of diagnosis used. In the absence of alarm symptoms, an invasive test such as histology of gastric mucosa biopsies is not the recommended diagnostic method in most guidelines. We, therefore, sought to determine the prevalence of *H. pylori* infection among the patients who had UBT done in our hospital on account of dyspepsia and other GI related symptoms.

MATERIALS AND METHODS

Study site and setting: The study was conducted at the University of Ilorin Teaching Hospital, a 750-bedded federal government-owned hospital, located in Ilorin metropolis, the capital city of Kwara state in the North-central geopolitical zone of Nigeria. The study facility offers specialist medical, surgical, emergency, delivery, pediatric and immunization services. The hospital is the only tertiary health facility in the state and referrals for UBT are received from the clinical departments in the hospital, other hospitals in the state and neighboring states (such as Ekiti, Osun, Oyo, Kogi and Niger states).

Ethical considerations: Ethical approval was obtained from the Ethics and Research Committee of the University of Ilorin Teaching Hospital, Ilorin, Kwara State with approval number: ERC PAN/2021/10/1004. The study complied with all ethical protocols as contained in the Helsinki declaration.

Study design and population: This was a retrospective study involving the review of a dedicated register for UBT conducted in University of Ilorin Teaching Hospital, Ilorin, Nigeria over a seven-year period (March 2012- February 2019). The study population consisted of all patients who had UBT done irrespective of their age or sex. The information retrieved from the register included the age and sex of the patients, date the test was conducted, indications, and the results. The results were either reported as positive, negative or indeterminate.

Data collection: The study site kept a hard copy dedicated register which contained the following information: Patient's name, age, folder number, address, sex and date in which the urea breath test was conducted, indications for the UBT and test results.

Urea breath test: The brand of the UBT equipment and accessories were Heliprobe®Analyzer, HeliCap™ –14C-urea capsules and Breath Card™. The patient swallows the urea capsule with 30ml of water. After 10 minutes, he or she 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 colour 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. The result is interpreted as follows: 0 indicates negative, 1 indicates indeterminate while 2 indicates a positive result.

Data analysis: The statistical software for social sciences (SPSS) version 22 was used to conduct the analysis after the data was entered into a spreadsheet. Results were presented using frequency tables and charts. Associations between categorical variables were determined using the chi-square test and the level of significance set at $p < 0.05$.

RESULTS

We had access to the data of 251 patients who underwent UBT during the study period. The commonest indication for UBT was dyspepsia 188 (74.9%) followed by abdominal pain 18 (7.2%); other indications are as shown in table 1.

Table 1:
Spectrum of indications for urea breath test and their association with *H. pylori* infection

Indications	Urea breath test results			Total (%)	X^2 (ρ value)
	Positive	Negative	Indeterminate		
Dyspepsia	119	67	2	188 (74.9)	15.627 (0.901)
Abdominal pain	13	5	0	18 (7.2)	
Post *H. pylori* treatment test	7	9	0	16 (6.4)	
Chronic urticaria	13	3	0	16 (6.4)	
Gastroesophageal reflux disease	6	1	0	7 (2.8)	
Gastrointestinal bleeding	1	2	0	3 (1.2)	
Chronic prurigo	1	0	0	1 (0.4)	
Acute glomerulonephritis	1	0	0	1 (0.4)	
Chronic glomerulonephritis	0	1	0	1 (0.4)	

Total	161	88	2	251 (100.0)

X^2: Pearson Chi-square

The number of patients with gastrointestinal symptoms was 216 with ages ranging from 10 to 77 years and a mean age of 40 (±14.2) years. There were more females 111 (51.4%) and the 31-40 years age group constituted the largest number of patients 57 (26.4%). Dyspepsia was the most common indication for UBT across the age groups (p=0.001). Of the 16 patients who had post-*H. pylori* eradication test, 9 patients had negative results, which means 56.3% of them were successfully treated for *H. pylori*. The prevalence rate of *H. pylori* infection in our cohort was 64.3% and 63.3% among the subset with dyspepsia and gastrointestinal symptoms respectively. The highest prevalence was observed among the 31-40 years age group (p=0.072). (Table 2).

Table 2:
Association between *H. pylori* infection and the age groups among patients with gastrointestinal symptoms (N=216)

Age groups	Urea breath test results			Total	X^2 (p value)
	Positive	Negative	Indeterminate		
≤ 20	15	5	0	20	
21-30	27	9	0	36	
31-40	37	20	0	57	
41-50	35	17	1	53	19.751 (0.072)
51-60	18	18	0	36	
61-70	5	3	1	9	
71-80	2	3	0	5	
Total	139	75	2	216	

X^2: Pearson Chi-Square

Table 3:
Association between *H. pylori* infection and the gastrointestinal symptoms

Indications	Urea breath test results			Total	Percentage (positive tests)	X^2 (p value)
	Positive	Negative	Indeterminate			
Dyspepsia	119	67	2	188	63.3	
Gastroesophageal reflux disease	6	1	0	7	85.7	3.468 (0.748)
Gastrointestinal bleeding	1	2	0	3	33.3	
Abdominal pain	13	5	0	18	72.2	
Total	139	75	2	216	64.3	

X^2: Pearson Chi-Square

There was an observed increase in the frequency of *H. pylori* detection from the age groups of ≤ 20 years to the 31–40, thereafter a decline in older age groups. *H. pylori* infection was more common among females (73/111; p=0.905). (Figure 1).

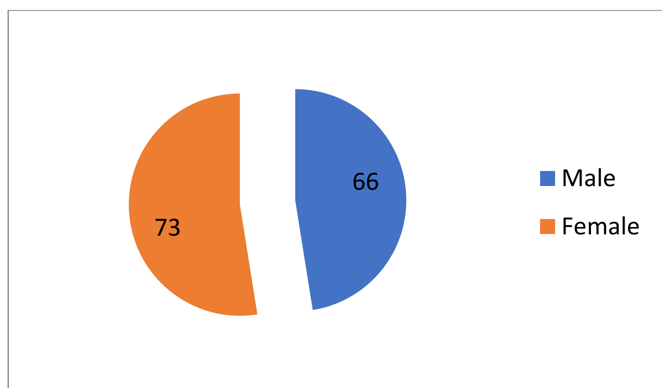

Figure 1:
Gender distribution of *H. pylori* infection in the study population.

frequency of *H. pylori* detection among our study cohort (p=0.148). (Figure 2).

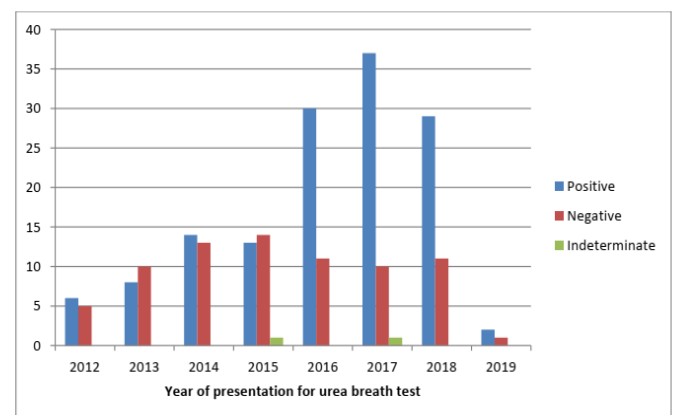

Figure 2:
Annual trend of the frequency of *H. pylori* infection in the study population

The association between *H. pylori* infection and the GI symptoms was not statistically significant (p=0.748) as shown in table 3. There was no significant difference in the annual

DISCUSSION

Urea breath test (UBT) has been referred to as the most accurate non-invasive method, the best test for epidemiological studies and for assessing the eradication of *H. pylori* after treatment (Liao *et al*., 2023; Perets *et al*., 2019). In Nigeria, fewer studies have used UBT to determine the prevalence of *H. pylori* compared to other methods such as histology, RUT, culture, serology and SAT. The latest prevalence rate of *H. pylori* infection among patients with dyspepsia who underwent oesophagogastroduodenoscopy (OGD) in UITH, Ilorin in 2012 was 47.3% (Bojuwoye *et al*., 2016). Seven years later, the prevalence of *H. pylori* infection from our study was 63.3%, which could be due to the differences in the methods of diagnosis (histology versus UBT), study period and patient selection (patients aged < 18 years were excluded in the earlier study). Similar to the previous study, there were more females in the study population and the females still predominate with regard to *H. pylori* infection.

The prevalence of 63.3% obtained in our study is similar to the prevalence of 69.6% reported using UBT in Abuja - the Country's capital which is located in the same region with our study center - Duduyemi *et al*., 2014). However, it is higher than the prevalence of 52.2% from Ogun state but lower than the 76.0% from Ekiti state which are both in the southwestern region of the country (Jemilohun *et al*., 2019; Solomon *et al*., 2015). It is higher than the prevalence rates of 42.6% and 49.5% reported using UBT in 2019 and 2023 respectively at the University of Calabar Teaching Hospital (UCTH) in Calabar, the capital of Cross River State (Mbang *et al*., 2019; Itam-Eyo *et al*., 2023). It is also higher than the prevalence rates of 39.8% and 49.2% that were observed at two different health facilities in Port-Harcourt, Rivers State (Ayodele *et al*., 2018; Egboh *et al*., 2022). In a multicenter study of patients with dyspepsia recruited from tertiary teaching hospitals, three in the South-West and one in the South-South regions of Nigeria, *H. pylori* infection was reported in about half of the patients (Smith *et al*., 2019). The age group 52-71 years had the highest frequency of the infection which contrasts with the 31-40 years in our study. However, in another multicenter study of 347 patients with dyspepsia from six tertiary hospitals in Nigeria, a similar age group of 31-40 had the highest frequency of *H. pylori* infection though the overall prevalence was lower (37.5%) (Smith *et al*., 2018). There is paucity of data from the northern region of the country with available data limited to the north-central region. The prevalence of *H. pylori* infection among dyspeptics using UBT is averagely ≥ 50% in the north-central and south-western regions whereas it is ≤ 50% in the south-southern region. These studies are all hospital based, hence may not be a true reflection of the prevalence in the general population.

In Benin Republic, one of the countries in West Africa, a lower prevalence of 34.7% among 150 dyspeptic patients was observed with UBT (Kpossou *et al*., 2019). Prevalence rates of 28.4%, 51.2% and 56.0% were obtained from Thailand, Iraq and Turkey respectively (Shoosanglertwijit *et al*., 2020; Mohammed *et al*., 2017; Bayraktar *et al*., 2021). The differences in the sample selection, sample sizes, geographical location and period of study may account for the different rates obtained in these studies. There was no significant association between the age group and the prevalence of *H. pylori* infection in our study and this is similar to what was observed in previous studies (Jemilohun *et al*., 2019; Mbang *et al*., 2019).

The eradication rate of 56.3% observed in our study is low when compared to the 87.2% and 92.6% obtained by Onyekwere *et al*., 2014 and Shoosanglertwijit *et al*., 2021 respectively. This may be explained by the small sample size in our study.

There were more females with *H. pylori* infection in our study though this was not statistically significant. This finding, which is similar to those of other studies (Jemilohun *et al*., 2019; Mbang *et al*., 2019; Ayodele *et al*., 2018; Mohammed *et al*., 2017), may be due more women presenting to the hospital as a result of their better healthcare seeking behaviour. There was also no significant association between the gastrointestinal symptoms and the prevalence of *H. pylori* infection in our study and this again may due to the small sample size. A similar finding was observed among patients with gastrointestinal symptoms in Iran (Nakhaei Moghaddam, 2010).

CONCLUSION

Our study shows that the prevalence of *H. pylori* infection among dyspeptics in our center remains high and the rate is similar to rates obtained in similar studies from the north-central region of the country. There was no significant association between *H. pylori* infection and the age group, gender and GI symptoms. The small sample size might be responsible for the lack of significant association.h.

Acknowledgements

We appreciate the Management and staff of Gastroenterology unit of University of Ilorin Teaching Hospital, Ilorin.

.

REFERENCES

Ayodele, M.B., Aaron, U.U., Oluwatayo, G.A., Wariso, K.T. 2018. Prevalence of *Helicobacter pylori* infection among suspected peptic ulcer patients in Port Harcourt, South-South, Nigeria. *Gazette of Medicine*. 6(1):602-8.

Bayraktar, M., Dabak, R. 2021. Screening of *Helicobacter pylori* in patients with dyspeptic complaints with the urea breath test and its usability in family medicine. *Turkish Journal of Family Medicine and Primary Care.* 15(4):763-768.

Bojuwoye, M. O., Olokoba, A. B., Ibrahim, O. O. K., Ogunlaja, O. A, and Bojuwoye, B. J. 2016. Relationship between *Helicobacter pylori* infection and endoscopic findings among patients with dyspepsia in North Central, Nigeria. *Sud J Med Sc*. 11(4): 167-174.

Duduyemi, B. M., Ojo, B.A., Olaomi, O. O, Atiba, A. S. 2014. Histopathological pattern of endoscopic gastric biopsy in a district hospital in Nigeria: a review of 118 consecutive cases. *Am J Med Biol Res*. 2(3):83-6.

Egboh, S.C., Ihekwaba, A. 2022. Prevalence and possible risk factors of *H. pylori* among uninvestigated dyspeptic patients in Port-Harcourt. *East Afr. Med. J*. 99(5):40-8.

Ford, A. C., Marwaha, A., Sood, R., Moayyedi, P. 2020. Global prevalence of, and risk factors for, uninvestigated dyspepsia: a meta-analysis. *Gut*. 69(9): 1445-1451.

Gravina, A. G., Priadko, K., Ciamarra, P., Granata, L., Facchiano, A., Miranda, A., Dallio, M., Federico, A., Romano, M. 2020. Extra-Gastric Manifestations of *Helicobacter pylori* Infection. *J. Clin. Med.* 9(12):3887-95.

Haley, K. P., Gaddy, J. A. 2015. *Helicobacter pylori*: Genomic Insight into the Host-Pathogen Interaction. *Int J Genomics*. 10:69-75.

He, J., Liu, Y., Ouyang, Q., Li, R., Li, J., Chen, W., Hu, W., He, L., Bao, Q., Li, P., and Hu, C. 2022. *Helicobacter pylori* and unignorable extragastric diseases: Mechanism and implications. *Front. Microbiol*. 13: 27-34.

Hooi, J. K. Y., Lai, W. Y., Ng, W.K., Suen, M. M. Y., Underwood, F. E., Tanyingoh, D. 2017. Global Prevalence of *Helicobacter pylori* Infection: Systematic Review and Meta-Analysis. *Gastroenterology*. 153(2): 420-429.

Itam-Eyo, A.E., Kooffreh-Ada, M., Chukwudike, E., Okonkwo, U., Ngim, O., Udoh, U., Ikobah, J. 2023. Spectrum of endoscopic findings in patients with *Helicobacter pylori* infection in a Nigerian tertiary institution. *Niger. J. Gastroenterol. Hepatol*. 15(2):27-32.

Jemilohun, A.C., Ajani, M.A., Ngubor, T. D. 2019. *Helicobacter pylori* prevalence by urea breath test in a Southwestern Nigerian population. *J Gastroenterol Hepatol Res*. 8(1):2819-22.

Kpossou, A.R., Kouwakanou, H.B., Ahouada, C., Vignon, R.K., Sokpon, C.N., Zoundjiekpon, V., Kodjoh, N., Séhonou, J. 2021. *Helicobacter pylori* infection: prevalence and associated factors in a study population undergoing Carbon-14 urea breath test. *Pan Afr Med J*. 40:266-266.

Kalali, B., Formichella, L., Gerhard, M. 2015. Diagnosis of *Helicobacter pylori*: changes towards the future. *Diseases*. 3(3): 122–135.

Liao, E. C., Yu, C. H., Lai, J. H., Lin, C. C., Chen, C. J., Chang, W. H. 2023. A pilot study of non-invasive diagnostic tools to detect *Helicobacter pylori* infection and peptic ulcer disease. *Sci Rep*. 13: 22-28.

Li, Y., Choi, H., Leung, K., Jiang, F., Graham, D. Y., Leung, W. K. 2023. Global prevalence of *Helicobacter pylori* infection between 1980 and 2022: a systematic review and meta-analysis. Lancet Gastroenterol. *Hepatol*. 8(6): 553-564.

Mbang, K.A., Uchenna, O., Emmanuel, U., Aniekan, E., Evaristus, C., Donald, E., Ogbu, N. 2019. Prevalence of *Helicobacter pylori* infection among dyspepsia patients in Calabar. *Global J. Pure Appl. Sci*. 25(2):145-51.

Mohammed, M.O., Bayz, H.H., Maarouf, F.B. 2017. Clinical, endoscopic and urea breath test among dyspeptic patients referred to Kurdistan center for gastroenterology and hepatology in sulaimani. Kurd. *J. Appl. Res*. 2(2):89-95.

Nakhaei Moghaddam, M. 2010. Prevalence of *Helicobacter pylori* infection in patients with digestive complaints using urea breath test in mashhad, northeast Iran. *J Res Health Sci.* 10(2):77-80.

Onyekwere, C.A., Odiagah, J.N., Igetei, R., Emanuel, A.O., Ekere, F., Smith, S. 2014. Rabeprazole, clarithromycin, and amoxicillin *Helicobacter pylori* eradication therapy: report of an efficacy study. *World J Gastroenterol*. 20(13):3615-9.

Perets, T. T., Gingold-Belfer, R., Leibovitzh, H., Itskoviz, D., Schmilovitz-Weiss, H., Snir, Y. 2019. Optimization of 13 C-urea breath test threshold levels for the detection of *Helicobacter pylori* infection in a national referral laboratory. *J Clin Lab Anal*. 33:674-80.

Sabbagh, P., Mohammadnia-Afrouzi, M., Javanian, M., Babazadeh, A., Koppolu, V., Vasigala, V. R. 2019. Diagnostic methods for *Helicobacter pylori* infection: ideals, options, and limitations. *Eur J Clin Microbiol Infect Dis.* 38(1):55-66.

Shoosanglertwijit, R., Kamrat, N., Werawatganon, D., Chatsuwan, T., Chaithongrat, S., Rerknimitr, R. 2020. Real-world data of *Helicobacter pylori* prevalence eradication regimens and antibiotic resistance in Thailand, 2013-2018. JGH Open. 4:49-53.

Smith, S.I., Jolaiya, T., Onyekwere, C., Fowora, M., Ugiagbe, R., Agbo, I. 2019. Prevalence of *Helicobacter pylori* infection among dyspeptic patients with and without type 2 diabetes mellitus in Nigeria. *Minerva Gastroenterol Dietol.* 65(1):36-41.

Smith, S., Jolaiya, T., Fowora, M., Palamides, P., Ngoka, F., Bamidele, M. 2018. Clinical and Socio- Demographic Risk Factors for Acquisition of *Helicobacter pylori* Infection in Nigeria. *Asian Pac J Cancer Prev*. 19(7):1851-1857.

Solomon, O., Ajayi, A., Adegun, P., Gabriel, O., Afolabi, O., Solomon, O. 2015. Effectiveness of triple therapy regimens in the eradication of *Helicobacter pylori* in patients with Uninvestigated Dyspepsia in Ekiti State, Nigeria. *Br J Med Med Res.* 6(3):278-85.

Wang, J., Chen, R. C., Zheng, Y. X, Zhao, S. S, Li, N., Zhou, R. R. 2016. *Helicobacter pylori* infection may increase the risk of progression of chronic hepatitis B disease among the Chinese population: a meta-analysis. *Int. J. Infect. Dis.* 50:30–37.

Wang, Y. K., Kuo, F. C., Liu, C. J., Wu, M. C., Shih, H. Y., Wang, S. S. 2015. Diagnosis of *Helicobacter pylori* infection: Current options and developments. *World J Gastroenterol*. 21(40): 11221-35.