DOI: https://dx.doi.org/10.4314/gjpas.v25i2.3

GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES VOL. 25, 2019: 145-151
COPYRIGHT© BACHUDO SCIENCE CO. LTD PRINTED IN NIGERIA ISSN 1118-0579
www.globaljournalseries.com, Email: info@globaljournalseries.com

PREVALENCE OF HELICOBACTER PYLORI INFECTION AMONG DYSPEPSIA PATIENTS IN CALABAR.

KOOFFREH-ADA MBANG, OKONKWO UCHENNA, UGBONG EMMANUEL, ESSIEN ANIEKAN, CHUKWUDIKE EVARISTUS, EDOGIAWERIE DONALD, NGIM OGBU.

(Received 20 May 2019; Revision Accepted 14 June 2019)

ABSTRACT

Helicobacter pylori is an ubiquitous organism. It is estimated that more than 50% of the world's population is infected with the bacteria. The infection is typically acquired in infancy and has been associated with poor living conditions and low socio-economic status. Once helicobacter pylori is acquired, it commonly persists lifelong unless treated. This pathogen has been implicated as a major aetiologic agent in the pathogenesis of peptic ulcer disease and is an established carcinogen. The aim of this study was to determine the prevalence of helicobacter pylori infection among our dyspeptic patients. This was a retrospective study conducted from April 2014 to December 2018. A total of one hundred and fifteen (115) patients who had symptoms of dyspepsia were recruited within this period of time. The presence of helicobacter pylori was determined using urea breath test. The results showed that 42.6% of the patients were positive for helicobacter pylori, while 51.3% of patients had a negative result. A borderline result was seen in 6.1% of patients. The mean age of the studied population was 45.10 years (SD= 12.55), with most patients aged between 41-60 years. This study showed no sex predilection, with an equal sex distribution of the study participants. Reports from other parts of the country also found the prevalence of helicobacter pylori to be highest in individuals between the 4th and 5th decade of life. This study concluded that the prevalence of helicobacter pylori infection is relatively high among patients with dyspepsia in South South Nigeria.

KEYWORDS: Helicobacter pylori, dyspepsia, urea breath test, South South Nigeria.

INTRODUCTION

Robin Warren and Barry Marshall brought to the attention of the world the role of Helicobacter pylori (H.pylori) in the pathogenesis of peptic ulcer disease (PUD) over a decade ago (Peura et al, 2010). Since then, several studies have been done worldwide and even in Nigeria regarding this pathogen, however there is paucity of data regarding this infection in Calabar, Southern Nigeria. Helicobacter pylori is a resilient gram negative, micro-aerophilic bacillus which resides in the acidic milieu of the human stomach (Adeniyi et al, 2012).It has a unique spiral shape and multiple unipolar flagella which enables it to traverse the course of the mucous layer of the gastric epithelium, where it remains protected from the low gastric ph (Peura et al, 2010).Helicobacter pylori further controls the acidic environment of the stomach by producing copious amounts of urease, an enzyme that hydrolyses urea to alkaline ammonia and carbon

Kooffreh-Ada Mbang, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Okonkwo Uchenna, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Ugbong Emmanuel, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Essien Aniekan, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Chukwudike Evaristus, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Edogiawerie Donald, Department of Internal Medicine, University of Calabar Teaching Hospital, Nigeria.
Ngim Ogbu, Department of Surgery, University of Calabar Teaching Hospital, Nigeria.

dioxide (Peura et al 2010, Ferwana et al 2015). The production of urease is the principle behind the urea breath test and rapid urea biopsy tests for the detection of H.pylori infection (Peura et al 2010, Ferwana et al 2015). Helicobacter pylori infection is prevalent worldwide involving more than half of the world populace (Peura et al 2010, Hunt et al 2010).The prevalence rate is influenced by age, geographic, ethnic, and socioeconomic factors (Hunt et al 2010).). Recent trends suggest a decrease in the incidence of H.pylori in the Western world, but an increasing prevalence in developing countries (Jemikalajah et al 2014). Worldwide prevalence figures reveals varied reports, in the United States for instance, the prevalence rate is 30 to 40%, while higher figures (70 to 90%) have been reported in South American and African studies (Adeniyi et al, 2012, Hunt et al 2010). In West Iran, Sheikhan et al found the overall prevalence rate of H.pylori infection to be 43%, this was lower than figures seen in other developing countries (Sheikan et al, 2011). The earlier concept of an 'African enigma' regarding the low prevalence of H. pylori infection and its complications (peptic ulcer and gastric cancer) in Africa has been debunked with current reports revealing a prevalence that is comparable with data in developing countries (Agha et al, 2005). One reason given for this trend, is the improved diagnosis of the infection (whilst investigating PUD) through histologic specimens obtained from upper gastrointestinal endoscopy (Agha et al, 2005).

A report in Ghana, found that 74.8% of patients with dyspeptic symptoms had H.pylori infection (Archampong et al, 2015).Similarly, Ndububa et al in South West Nigeria, reported a prevalence of 73% among dyspeptic patients (Ndububa et al, 2001). Both studies used campylobacter-like organism (CLO)-urease test on gastric specimens at upper gastrointestinal endoscopy (Archampong et al 2015,Ndububa et al, 2001).Whereas, in Keffi, North Central Nigeria, Ishaleku et al reported a relatively lower sero-prevalence rate of 54.0% among University undergraduates (Ishaleku et al 2010). While reports in South-east Nigeria and South - south Nigeria revealed lower sero-prevalence rates of 25% and 12.7% respectively (Ahaneku et al 2010, Jemikalajah et al 2014). These Nigerian studies showed a steady decline in H. pylori prevalence over the past decade. Socioeconomic differences among the populations studied may be contributory to the variations in H.pylori prevalence. Poor sanitary methods, lack of potable water as well as overcrowding and poor dietary habits have been linked to the transmission of H.pylori usually through the oral–oral or faeco–oral routes (Peura et al, 2010). Childhood infections are reported to be common globally especially in developing countries (Peura et al 2010, Jemikalajah et al2014). Helicobacter pylori infection is a major public health concern and has been implicated in the pathogenesis of gastric and duodenal ulcer as well as gastric mucosa–associated lymphoid tissue (MALT) lymphoma, and adenocarcinoma (Peura et al, 2010). Host genetics, bacterial traits and environmental features have been proven to influence the clinical outcome of the infection(Peura et al, 2010).The infection has a high morbidity but low mortality rate and a 'cure' can be achieved with an appropriate antibiotic regimen (Malaty et al 2007). Currently the diagnosis of H.pylori can be through invasive and non-invasive techniques, including endoscopy with biopsy, serology for immunoglobulin titres, stool antigen test and UBT (Ferwana et al).The sensitivity of serology is quite high (90% to 100%) but its specificity is variable (76% to 96%), especially in areas where the prevalence of H. pylori is low. Therefore, in places where infection is less common (most areas of the United States), the negative predictive value of serology is high (Peura et al, 2010). Conversely, the positive predictive value is poor, suggesting most often positive results are actually falsely positive especially in areas were the infection is prevalent (Peura et al, 2010).Hence, the diagnosis is best confirmed with another method such as a stool antigen or UBT before commencing treatment (Peura et al, 2010).Stool antigen test or UBT is the preferred non -invasive test for the preliminary diagnosis of active H. Pylori infection (Hunt et al, 2010). Both investigations have a comparable sensitivity (88% to 95%) and specificity rate (95%)(Hunt et al, 2010).Endoscopic biopsy of gastric tissue is preferred in patients undergoing a diagnostic endoscopy who are found to have a pathology such as an ulcer or for those requiring endoscopy to follow-up a gastric ulcer or suspected MALT lymphoma. The reported sensitivity of rapid urease tests is 90% to 95% (Hunt et al, 2010).

MATERIALS AND METHOD

Study location

The University of Calabar Teaching Hospital (UCTH) is a tertiary health institution located at Calabar the state capital of Cross River State. It is a main reference centre in the state and also neighbouring states like Akwa Ibom, Abia and Benue.

Study design and data collection This study was a retrospective study involving patients with dyspeptic symptoms who presented to the Medical Outpatient Department of the University of Calabar Teaching Hospital for UBT screening. Data was retrieved from patient's records from April 2014 to December 2018.

A total of one hundred and fifteen (115) patients were investigated within this period of time. Demographic information such as age, sex, occupation, educational status, state of origin were obtained. In addition, history of smoking of cigarettes and number of siblings was also gathered.

Sample collection

The Heliprobe analyser with serial number 1919 (manufacturer: KIBION AB, SE-751 05 Uppsala Sweden) was used for the detection of gastro duodenal H.pylori infection. The results are obtained on-site with a diagnosis being made within 20 minutes.

Patients were instructed to come fasting for the test, they were to swallow the Helicap capsule with 50mls of water. The Helicap capsule contains 14C- labelled urea, which disintegrates rapidly in the stomach and 14C-urea is dissolved. In the presence of H.pylori, the 14C-urea is metabolized to carbon dioxide and ammonia by the enzyme urease produced by H.pylori. The available 14C isotopes, now in the form of $14C0_2$, diffuses into the blood to be transported to the lungs , where it is exhaled in the breath to be captured during sampling using the breath card. In the absence of H.pylori, the administered urea is absorbed in the gastrointestinal tract and subsequently voided. Results were expressed as; Heliprobe 0= patient not infected, Heliprobe 2= patient infected and Heliprobe 1 = borderline. The sensitivity and specificity of the Heliprobe analyser are 95% and 100% respectively.

Statistical analysis

Analysis of data was done using the Statistical Package for Social Sciences version 18 (PASW statistics 18). Quantitative data was expressed as mean and standard deviation (SD). Categorical variables were compared using the Chi-square tests to establish association with H.pylori. A p-value of 0.05 or less was considered statistically significant.

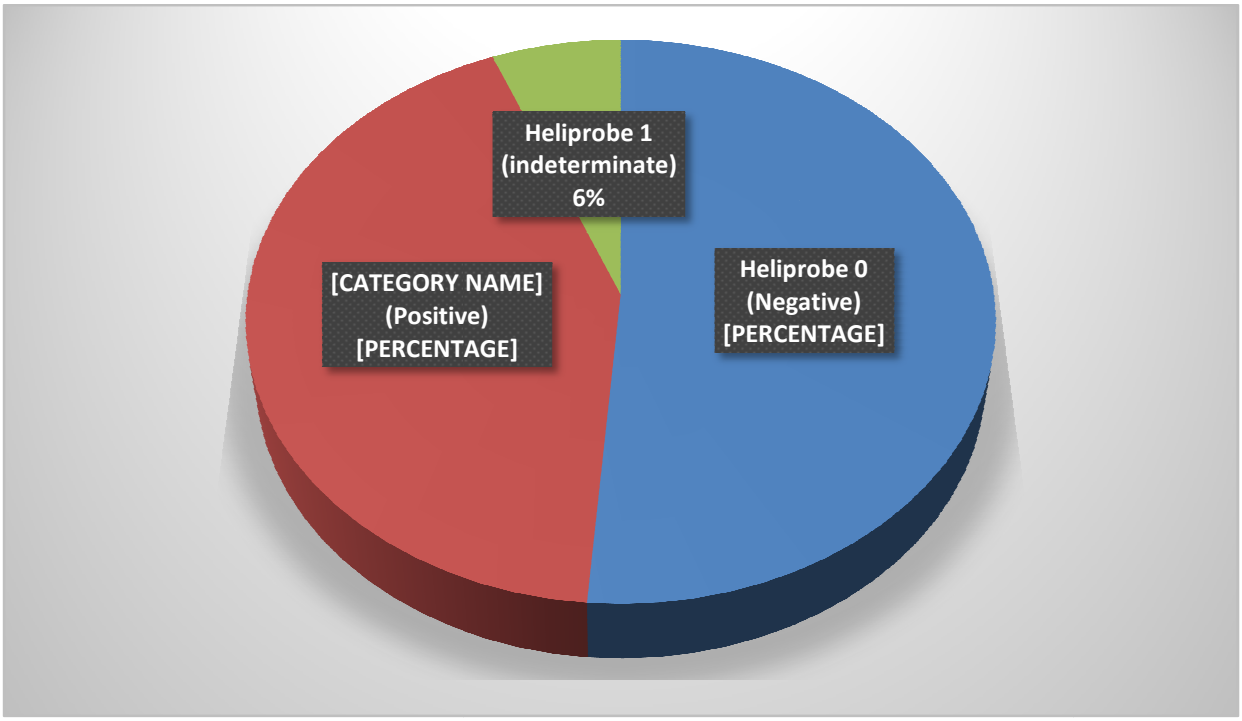
Results A total of 115 individuals were tested for H.pylori infection, comprising patients with dyspeptic symptoms (belching, bloating, epigastric pain, retrosternal burn and flatulence). A comparable number of males (58, 50.4%) and females (57, 49.6%) were investigated, with the mean age of patients being 45.10 years (SD=12.55) and the age ranging between 18 to 77 years. Most patients had an average of three to four siblings (53, 46.1%). The mean number of siblings was 4.37 (SD=2.28), with the range being 0 to 13.Forty nine (42.6%) patients tested positive for H.pylori (heliprobe 2), while 59 (51.3%) and 7 (6.1%) had negative (heliprobe 0) and borderline (heliprobe 1) results respectively (see figure 1). Most patients (23, 42.6%) who tested positive for H.pylori infection were aged between 41 to 60 years, however this finding was not statistically significant (p> 0.005). It was also observed that most patients (35, 38.9%) that came from Southern Nigeria (Cross River State, Akwa Ibom State, Rivers State, etc) had H.pylori infection, however this was not statistically significant (p>0.005). Majority of patients (34, 41.0%) with H.pylori had tertiary level of education, though this finding was not statistically significant (p> 0.005), see table 1.

Table 1

Variable	Heliprobe 0 N= 59 Frequency (%)	Heliprobe 2 (N= 49) Frequency (%)	Heliprobe 1 (N= 7) Frequency (%)	Chi-square tests	p-value
Age (years)					
18-40	25 (51.0)	21 (42.9)	3 (6.1)	0.630*	1.000
41-60	28 (51.9)	23 (42.6)	3 (5.6)		
>60	6 (50.0)	5 (41.7)	1 (8.3)		
Sex					
Male	30 (51.7)	24 (41.4)	4 (6.9)	0.238*	1.000
Female	29 (50.9)	25 (43.9)	3 (5.3)		
Occupation					
Civil servant	22 (51.2)	17 (39.5)	4 (9.3)	9.002*	0.502*
Public servant	11 (35.5)	18 (58.1)	2 (6.5)		
Trading/Business	17 (58.6)	11 (37.9)	1 (3.4)		
Unemployed	2 (66.7)	1 (33.3)	0 (0)		
Student	3 (60.0)	2 (40.0)	0 (0)		
Healthcare worker	4 (100.0)	0 (0)	0 (0)		
Marital status					
Married	51 (51.5)	41 (41.4)	7 (7.1)	2.971*	0.722
Single	8 (53.3)	7 (46.7)	0 (0)		
Widowed	0 (0)	1 (100.0)	0 (0)		
Education					
Primary	6 (75.0)	2 (25.0)	0 (0)	3.988*	0.651
Secondary	9 (45.0)	11 (55.0)	0 (0)		
Tertiary	42 (50.6)	34 (41.0)	7 (8.4)		
Informal	2 (50.0)	2 (50.0)	0 (0)		
Place of Origin					
Southern Nigeria	50 (55.6)	35 (38.9)	5 (5.6)	9.008*	0.121
Eastern Nigeria	6 (40.0)	9 (60.0)	0 (0)		
Western Nigeria	2 (33.3)	2 (33.3)	2 (33.3)		
Northern Nigeria	1 (25.0)	3 (75.0)	0 (0)		
No. of Siblings					
0	1 (50.0)	1 (50.0)	0 (0)	4.046*	0.707
1-2	9 (56.3)	5 (31.5)	2 (12.5)		
3-4	29 (54.7)	21(39.6)	3 (5.7)		
>4	20 (45.5)	22 (50.0)	2 (4.5)		
Cigarette smoking					
No	59 (51.8)	48 (42.1)	7 (6.1)	2.367*	0.487
Yes	0 (0)	1 (100.0)	0		

***Fisher's exact test was used where counts are less than 5 in any cell.**

Figure 1



DISCUSSION

A total of one hundred and fifteen (115) individuals with dyspeptic symptoms were investigated in this retrospective study. Forty nine (42.6%) of these patients tested positive for H.pylori infection, while 59 (51.3%) were negative. The prevalence rate shown in our study is lower than the average global prevalence rate (50%) and most African reviews (Adeniyi et al 2012, Archampong et al, 2015, Ndububa et al, 2001).Reports from Western (Ibadan), North central (Keffi) and Eastern (Enugu) Nigeria had prevalence rates way above the average global prevalence rate (Adeniyi et al 2012, Ishaleku et al 2010, Ezugwu et al 2014).However, the prevalence rate found in our study was higher than reports found in the Southern part of the country (Ahaneku et al 2010, Jemikalajah et al 2014). The relatively lower prevalence of H.pylori infection reported in our study and in other parts of Southern Nigeria, when compared to other regions of the country may suggest a decline in the disease trend in the region. The disparity in prevalence rates in the various parts of the country may largely be linked to the socioeconomic status of dyspeptic patients in the region. This could be associated with improved hygiene standards and wide spread use of antibiotics (Jemikalajah et al 2014). Furthermore, gradual urbanization with better access to healthcare facilities and potable water could be another reason for this observation, as may be deduced from our study. A low socioeconomic status has been reported to promote the transmission of H.pylori prevalence and it has been speculated that the spread of the infection may be associated with domestic overcrowding, high housing density as well as sharing of beds especially in developing countries (Oling et al 2015, Whitaker et al 1993, Ozbey et al 2017 and Den Hoed et al 2011). Bello and his colleagues, in their review showed that the lower social class had a significant association with H.pylori (Bello et al, 2018). They proposed that Individuals from the lower socioeconomic class were more likely to be linked with poor education, including poor health education and a more likelihood of living in an environment that predisposes to faecal contamination of food and water (Bello et al, 2018). On the contrary our study found the prevalence of H.pylori to be higher in patients with tertiary level of education, these category of individuals tend to fall under the high or middle social class demographic (civil and public servant), however no statistical significant association was seen. It could be assumed that these well-educated group of individuals had a better health seeking attitude regarding their dyspeptic symptoms than those in the lower socioeconomic class (who could probably be more at risk). The mean age of patients in this study was 45.10 years (SD=12.55), with most patients who

tested positive for H.pylori aged between 41-60 years. This was comparable with reports from other parts of the country which found the prevalence of H.pylori to be highest between the 4th and 5th decade of life (Ezugwu et al 2014, Jemilohum et al 2011).The prevalence of H. pylori has been reported to increase with age, with the prevalence climbing up to 50% in those 60 years or older (Adeniyi et al, 2012).This increased prevalence of infection with age was initially thought to be due toon-going acquisition throughout adult life(Peura et al, 2010). However, in developing countries new adult infection and reinfection are infrequent (Peura et al, 2010). Rather this observation reflects possible childhood infection among this age group (Jemikalajah et al, 2014).A comparable number of males (58, 50.4%) and females (57, 49.6%) were studied in this report, with no sex predilection observed. This finding was also seen in a Kano report, where there was no significant differences in prevalence among both genders (Kumurya et al 2015).This was contrary to other reports in the country which found a higher prevalence of H.pylori infection in their female patients (Jemikalajah et al, 2014, Omosor et al 2015, Olokoba et al 2013, Samson et al 2018). Whereas, Bello et al found a male preponderance for H.pylori infection among their patient's (Bello et al, 2018).The lack of sex predilection for H.pylori infection in both sexes in our study could be as a result of a common risk of acquiring the infection in both genders. Helicobacter pylori infection was also found to be more prevalent in our patients who had either 3 to 4 siblings or more than 4 siblings, however there was no significant association. The number of siblings has been linked with an increased risk of acquiring H.pylori (Peura et al, 2010, Ozbey et al, 2017). This finding suggests that our patients who had a higher number of siblings may have acquired H.pylori in childhood. The number of siblings may essentially be measuring crowded living conditions, sharing of beds as well as house density during the childhood of our patients. This may give a glimpse of the socioeconomic status of our patients during their childhood. This report showed a relatively lower overall prevalence of H.pylori when compared with local and global studies. The higher trend of H.pylori infection in the 4th and 5th decade of life in this study, is in keeping with most reports and is reflective of the 'birth cohort effect' of H,pylori, which describes the increasing prevalence of the infection with age (Lim et al 2013, Mhaskar et al 2013). Though a low socioeconomic status has been linked with an increased prevalence of H.pylori especially in developing countries (Mhaskar et al 2013). The finding of our patients being from a higher socioeconomic status does not preclude possible childhood acquisition of the disease from crowded living conditions or sharing beds as a result of having a higher number of siblings. Other factors such as cigarette smoking has been reported to exacerbate the outcome of H.pylori infection (Zhu et al, 2014). However, this review, showed no association with cigarette smoking probably due to the fact that only one person in our study acknowledged this habit. This study was limited by the relatively small study population (this could account for the lack of statistical association with established risk factors for the acquisition of H,pylori). A community based study may address this concern.

REFERENCES

Adeniyi B. A, Otegbayo J. A, Lawal T. O, Oluwasola A. O, Odaibo G. N, Okolo C. et al . 2012. Prevalence of Helicobacter pylori infection among dyspepsia patients in Ibadan, South West Nigeria. African Journal of Microbiology Research 6(14): 3399-3402.

Agha A, Graham D. Y. 2005. Evidence-based examination of the African enigma in relation to Helicobacter pylori infection. Scandinavian Journal of Gastroenterology 40: 523-529.

Ahaneku G, Nwosu M. N, Okonkwo U. C. 2010. Tropical Journal of Medical Research.14 (1)

Archampong T. N, Asmah R. H, Wiredu E. K, Gyasi R. K, Nkrumah K. N, Rajakumar K. 2015. Epidemiology of Helicobacter pylori infection in dyspeptic Ghanaian patients. Pan African Medical Journal 20:178.

Bello AK, Umar AB, Borodo MM. 2018. Prevalence and risk factors for Helicobacter pylori infection in gastroduodenal diseases in Kano, Nigeria. Afr J Med Health Sci17: 41-6.

Den Hoed C. M, Vila A. J, Holster II, Perez-Perez G. I, Blaser M. J, De Jongste J. C, Kuipers E. J. 2011. Helicobacter Pylori and the Birth Cohort Effect: Evidence for Stabilized Colonization Rates in Childhood. NIH Public Access 16(5): 405–409.

Ezugwu RI, Chukwubike C. 2014.Epidemiology of Helicobacter pylori infection among dyspepsia patients in South-East, Nigeria. IOSR Journal of Pharmacy and Biological Sciences 9 (6):53-56.

Ferwana M, Abdulmajeed I, Alhajiahmed A, Madani W, Firwana B, Hasan R, Altayar O et al. 2015.

Accuracy of urea breath test in Helicobacter pylori infection: Meta-analysis. World J Gastroenterol 21(4): 1305-1314.

Hunt R. H, Xiao S. D, Megraud F, Leon-Barua R, Bazzoli F, Van der Merwe S et al. 2010. Helicobacter pyloriin developing countries. World Gastroenterology Organisation Global Guidelines.

Ishaleku D, Ihiabe H. A. 2010. Sero-prevalence of Helicobacter pylori infection among students of a Nigerian University. Asian Pacific Journal of Tropical Medicine584-585.

Jemikalajah D. J, Okogun GRA. 2014. Health point prevalence of helicobacter pylori in Central Hospital Warri, Nigeria. African Journal of Cellular Pathology 3:57-60.

Jemilohun A. C, Otegbayo J. A, Ola S. O, Oluwasola O. A, Akere A. 2011. Prevalence of helicobacter pylori among Nigerian patients with dyspepsia in Ibadan. Pan African Medical Journal 6:18.

Kumurya S. A. Serological Detection of Helicobacter pylori Antibodies in Patients Suffering from Gastric Symptoms in Kano, Nigeria. 2015. American Journal of Health Research3(6): 352-355.

Lim SH, Kwon J. W, Kim N, Kim G. H, Kang J. M, Park of M. J, et al. 2013. Prevalence and risk factors Helicobacter pylori infection in Korea: Nationwide multicentre study over 13 years. BMC Gastroenterology 13:104.

Malaty HM. 2007. Epidemiology of Helicobacter pylori infection. Best Pract Res Clin Gastroenterol. 21(2): 205-14.

Mhaskar RS, Ricardo I, Azliyati A, Laxminarayan R, Amol B, Santosh W. 2013. Assessment of Risk Factors of Helicobacter Pylori Infection and Peptic Ulcer Disease. J Glob Infect Dis. 5(2): 60–67.

Ndububa D. A, Agbakwuru A. E, Adebayo R. A , Olasode B. J, Olaomi O. O, Adeosun O. A et al. Upper gastrointestinal findings and incidence of Helicobacter pylori infection among Nigerian patients with dyspepsia. 2001. West Afr J Med. 20 (2): 140-5.

Oling M, Odongo J, Kituuka O, Galukande M. 2015. Prevalence of Helicobacter pyloriin dyspeptic patients at a tertiary hospital in a low resource setting. BMC Res Notes8:256.

Olokoba Ab, Gashau W, Bwala S, Adamu A, Salawu Fk. 2013. Helicobacter Pylori Infection in Nigerians with Dyspepsia. Ghana Medical Journal 47 (2).

Omosor K. I, Omosor O. H, Ibeh I. N, Adejumo B. G, Abdulkadir U. I, Dimkpa U. Sero-prevalenceof Helicobacter pylori Infection and risk factors among asymptomatic subjects inDelta State, Nigeria. 2017. Advances in Microbiology 7; 641-652.

Ozbey G, Hanafiah A. 2017. Epidemiology, Diagnosis, and Risk Factors of Helicobacterpylori Infection in Children. Euroasian J Hepato-Gastroenterol 7(1):34-39.

Peura D A, Crowe S E. 2010. Helicobacter pylori. In: Feldman M, Friedman LS, Brandt LJ (Editors) Sleisenger and Fordtran's Gastrointestinal and Liver Disease; Pathophysiology, Diagnosis, Management, Vol. II, Saunders Elsevier. pp 833- 839.

Samson E. S, Okeleke O. J, Richard A. Y, Gideon F. T, Olutoyosi A. L., Damilola O. 2018. Screening for Helicobacter Pylori Infection among Undergraduate Students of a Tertiary Institution using serum Antibody and Stool Antigen Detection Methods. Biomed J Sci and Tech Res. 3 (2).

Sheikhan A, Ataherian S Delfan M, Ebrahimzadeh F and Pournia Y. Prevalence and risk factors of H. pylori infection among health centre referrals in Khorramabad (West Iran). 2011. Asian Journal of Epidemiology 4 (1): 1-8.

Whitaker C.J, Dubiel A. J, Galpin O.P. 1993. Social and geographical risk factors in Helicobacter pylori infection. Epidemiol. Infect 111: 63-70.

Zhu Y, Zhou X, Wu J, Su J, Zhang G. 2014. Risk Factors and Prevalence of Helicobacter pylori Infection in Persistent High Incidence Area of Gastric Carcinoma in Yangzhong City. Gastroenterology Research and Practice Volume 2014.