Seroprevalence of Helicobacter pylori infection in patients with non-ulcer dyspepsia in Zaria metropolis

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Abstract- Background of the study: Since *Helicobacter pylori* was first cultured by Warren and Marshall in 1983, much has been learned about its clinical aspects and its epidemiology. Knowledge of the epidemiology of this infection comes mainly from prevalence studies. In this research work, the prevalence of *Helicobacter pylori* infection was studied among patients with non-ulcer dyspepsia in the Out-Patients Department of four selected hospitals in Zaria, Kaduna State, to assess the risk factors associated with the infection. A total of two-hundred and fifty (250) blood samples were collected from consenting patients. Enzyme linked immunosorbent assay (ELISA) was used to test for the IgM and IgG antibodies to *Helicobacter pylori* in the patients' serum samples. Statistical package for social science (SPSS) version 21 was used to test for the associated risk factors for the infection. The result obtained showed an overall prevalence of 73.6% (184/250), and 39.2% (98/250) for *H. pylori* IgG and IgM antibodies respectively. There was a significant association between *H. pylori*-IgM seropositivity and Household crowding (χ^2=8.185, p=0.017), washing of hands with soap (χ^2=13.705, p=0.000), Educational status (χ^2=10.919, p=0.012) and Socioeconomic Status (χ^2=7.568, p=0.006). Only hand washing with soap showed a significant association with *H. pylori*-IgG seropositivity (χ^2=44.206, p=0.000). We concluded that the overall prevalence *H. pylori* infection among dyspeptic patients in this study strongly correlates with congested household crowding, poor hand hygiene, low level of education and socioeconomic status.

Index Terms- *Helicobacter pylori*, Non-ulcer dyspepsia, Enzyme Linked Immunosorbent Assay, Seroprevalence.

I. INTRODUCTION

Dyspepsia is generally defined by most clinicians as the presence of chronic or frequently recurring epigastric pain or discomfort which is believed to originate in the gastro-duodenal region. This may be associated with other upper gastrointestinal (GI) symptoms such as nausea, belching, vomiting, postprandial fullness, and early satiety (Al-Humayed *et al.,* 2010). Chronic dyspeptic symptoms can be continuous, intermittent (episodic), or recurrent (Ramin *et al.*, 2014).

Dyspepsia is a common problem in the general population that frequently induces visits to the primary care physician and many possible causes have been suggested for dyspepsia, such as; lifestyle factors, stress, altered visceral sensation, alterations in gastric acid secretion, peptic ulcer disease (PUD), drugs; especially non-steroidal anti-inflammatory drugs (NSAIDs), as well as *Helicobacter pylori* infection (Aziz *et al*., 2009).

Helicobacter pylori (*H. pylori*) is a Gram negative, micro-aerophilic, spiral-shaped, flagellated bacterium that inhabits the gastric mucosa of the human stomach with a strong affinity for gastric-type epithelium. The discovery of *H. pylori* by Warren and Marshall, in 1983 was a major breakthrough in the management of dyspepsia (Talley and Vakil, 2005). The association between *H. pylori* infection and dyspeptic symptoms has long been established with *H. pylori* infection having high population attributable risk for dyspepsia (Ugwuja and Ugwu, 2007). *H. Pylori* infection is a worldwide problem and human beings have been the preferred host, colonized for at least 50,000 years and probably throughout their evolution. The organism colonizes from childhood and persists throughout life if left untreated (Atherton and Blaser, 2009). More than half of the world's population in both developed and developing countries are infected with this organism (Czinn, 2005). An epidemiological survey by Cover and Blaser, (1995), reveals that *H. pylor* infection is significantly higher in developing countries where the prevalence rate ranges between 70% and 90%, as compared to 20-50% in developed countries making *H. pylori* probably one of the most common bacterial infections of humans. In Nigeria, various studies on *H. pylori* show prevalence rates between 73.0% and 94.5% among patients with dyspepsia (Holcombe *et al*., 1994; Ndububa *et al.*, 2001; Otegbayo *et al*., 2004).

Studies have demonstrated that *H. pylori* infection plays a key role in the aetiology of various gastrointestinal diseases that were not previously believed to have a microbial cause (Rosenstock, 1997; Patric *et al.*, 1999). *H. pylori* infection may lead to acute gastritis (abdominal pain, nausea and vomiting) within two weeks of infection. Duodenal inflammation (duodenitis) also often occurs as well as duodenal ulcer. Long lasting *H. pylori* infection results in persistent inflammation which can lead to an inflammatory response of the stomach known as atrophic gastritis (type B), a recognized precursor of gastric ulcer disease and gastric cancer, which is the second most common cancer world-wide. Chronic infection also causes gastric mucosa-associated lymphoid tissue (MALT) lymphomas (Oluwasola, *et al.*, 2002). However, in some individuals, infection may not show any clinical symptoms, suggesting that the disease outcome may be influenced by the strain of *H. pylori* and its interaction with the host as well as genetic and environmental factors (Hunt *et al*., 2010). The aim of this study is to determine the prevalence of *H. pylori* infection in patients presenting with non-ulcer dyspepsia in selected hospital in Zaria, Kaduna State Nigeria.

II. Materials and Methods

2.1 Study Design and Population

The study was a hospital based cross sectional study which span through a period of six months. Data was collected from consenting patients presenting with symptoms of dyspepsia in the out-patient section of the selected hospitals during the period of the research work.

2.2 Study Area

This study was conducted in Zaria, Kaduna state. Zaria is situated at Latitude 11° 25″ North and Longitude 4° 27″ Northern Nigeria (The World Gazetteer, 2007). Four major hospitals within Zaria, were enrolled in this study; Major Ibrahim B. Abdullahi memorial hospital Zaria- former Limi, Hajiya Gambo Suwaba Hospital Kofan Gaya Zaria, Salama Hospital and Ahmadu Bello University health services (UHS- University Health Services sick bay).

2.3 Ethical Approval

Ethical approval was obtained from the ethical committee of the Kaduna State Ministry of Health (Ref No: MOH/ADM/744/VOL. 1) and also from the ethical committee of the selected hospitals before sample collection.

2.4 Recruitment Inclusion and Exclusion Criteria

Inclusion criteria for the study involved consenting patients with mainly dyspeptic symptoms (persistent or recurrent abdominal pain) and with other associated gastrointestinal complaints such as nausea, vomiting, anorexia, early satiety etc. Patients who do not give their consent and/or are already on proton pump inhibitors or on *H. pylori* eradication therapies were excluded from the research work.

2.5 Collection of Data

Before enrollment, informed consent of the participants were sought and obtained. Questionnaire on socio-demographic features and characteristics of the epigastric pain and symptoms were administered. Subjects were asked about their age sex, their level of education, occupation, accommodation and toilet facility which were used to classify their socioeconomic status into two groups of high and low. The sex, age and socioeconomic level of subjects were considered in order to determine risk factors for infection. Subjects were also asked about their sleeping arrangement (i.e. number of people in the room) and their drinking water sources. This was to determine the possible source of infection and/or transmission

2.6 Sample collection and processing

Five milliliters (5mls) of venous blood was drawn from each patient aseptically by venipuncture and dispensed into two sterile labeled anticoagulant free containers, for the detection of *H. pylori* antibodies; Immunoglobulin M and Immunoglobulin G. Followed by centrifugation at 1500 rpm for 10 minutes to separate the serum. The sera samples were then transferred into sterile properly labeled screw capped vials and stored at -20^{o}C until required for analysis.

2.7 Assay for *Helicobacter pylori* Antibodies (using ELISA Technique)

According to the manufacturers of the test kits, the assay for the *Helicobacter pylori* antibodies in all the patients' sera samples was by the principle and technique of Enzyme-Linked Immunosorbent Assay (ELISA) by (Diagnostic Automation, inc., Calabasa USA)

In this test the microtitre wells are coated with purified and in activated *H. pylori* antigens. Controls and diluted patient's serum are incubated in the wells. The *H. pylori* specific antibodies, if present, bind to the solid phase antigens. After incubation and washing, all unbound antibodies are washed off. The wells are treated with conjugate, composed of anti-human monoclonal antibodies labeled with peroxidase, Horse Radish Peroxidase (HRP). After a second incubation and washing step the unbound HRP conjugate is washed off. The wells are incubated with the enzyme substrate Tetramethylbenzidine (TMB), the bound enzyme generate colour. Acidic stopping solution is then added and the intensity of the colour is determine by spectrophotometer wavelength absorbance measurement at 450nm. The absorbance measured is directly proportional to the concentration of anti-*H. pylori* antibodies present in the serum samples.

III. Results

A total of 250 blood samples were collected from patients with dyspeptic like symptoms in four selected hospitals within Zaria metropolis, Kaduna State: Major Ibrahim B. Abdullahi memorial hospital Zaria, Ahmadu Bello University health services (UHS- University Health Services sick bay), Salama Hospital and Hajiya Gambo Suwaba Hospital Kofan Gaya Zaria.

Of the 250 sera samples screened, 84 (33.6%), 184 (73.6%), positive for *H. pylori* Immunoglobulin M (IgM), Immunoglobulin G (IgG) respectively. Sixty three (25.2%) tested positive to both IgG and IgM and forty five (45) tested negative to both (Figure 1).

The results obtained from this study were analyzed in relation to gender (Table 1). Eighty four (84) were males and 166 were females. The observed incidence (IgM) and prevalence (IgG) rate were higher in female 36.1% (60/166), 77.1% (128/166) when compared to the male 28.6% (24/84), 66.7(56/84) patients respectively. However, the difference observed with respect to prevalence of *H. pylori* infection and gender, was not statistically significant (IgM: χ^2= 1.434**,** p=0.231), (IgG: χ^2=1.130, p=0.077).

Also shown on table 1 is the analysis of data obtained with respect to age distribution. The subjects were grouped into five different age groups with class size of ten. A total of 38, 82, 69, 45 and 61 patients fall within the age group 21-30, 31-40, 41-50, 51-60 and those above 60 years respectively. The results obtained in relation to age showed that age 21-30 years had the highest (44.7%) *H. pylori*-IgM prevalence rate, while the peak prevalence for *H. pylori*-IgG (84.4%) was recorded among patients within age group 51-60 years. The differences observed were not statistically significant (IgM: χ^2= 3.838**,** p=0.428), (IgG: χ^2=8.627, p=0.071).

Table 2 presents the analysis of results obtained in this study in relation to some demographic factors. No statistically significant association was observed between family type and the prevalence of *H. pylori* infection (p>0.05). However, higher

prevalence of 36.0% (63/175) and 73.7% (129/175) for *H. pylori* IgM and *H. pylori* IgG were recorded among patients from polygamous family.

In relation to type of residence, a higher prevalence rate of 73.9% (102/112) for *H. pylori*-IgG was recorded among those living in flat apartment, while those who reside in a single room apartment had the highest prevalence of 35.5% (49/138) for *H. pylori* IgM. The observed differences were not statistically significant (p>0.05).

With respect to number of people staying in a room (Household crowding), those who shared room with more than two people had the highest rate of 41.7% (55/132) and 75.0% (99/132) for *H. pylori* IgM and *H. pylori* IgG respectively. Prevalence of IgM antibody for *H. pylori* infection was significantly associated with the level of household crowding (χ^2=8.185, p=0.017), whereas that of *H. pylori*-IgG was not statistically significant (p>0.05).

Though there was no significant association (p>0.05) between prevalence of *H. pylori*-IgG in relation to patients' level of education, Occupation and socioeconomic status. However, the prevalence of *H. pylori*-IgM antibody was significantly associated with patients' level of education (χ^2=10.919, p=0.012) and Socioeconomic Status (χ^2=7.568, p=0.006), with the highest prevalence rate recorded among patients with non-formal type of education 53.5% (23/43), those who are unemployed 39.5% (15/38) and 38.7% (70/181) observed among those who fall within the low socioeconomic group

The prevalence of *Helicobacter pylori* infection with respect to toilet system type, Washing of hands with soap after using the toilet, and source of drinking water were also subjected to statistical analysis. The highest *H. pylori* prevalence rate of 88.2%, 89.1% and 74.0% was recorded among patients; who defaecate on open field, washed their hands only with water without soap and those who use bore-hole as their source of drinking water respectively. The differences observed were not statistically significant except for washing of hand with soap which was highly significant (χ^2=44.206, p=0.000).

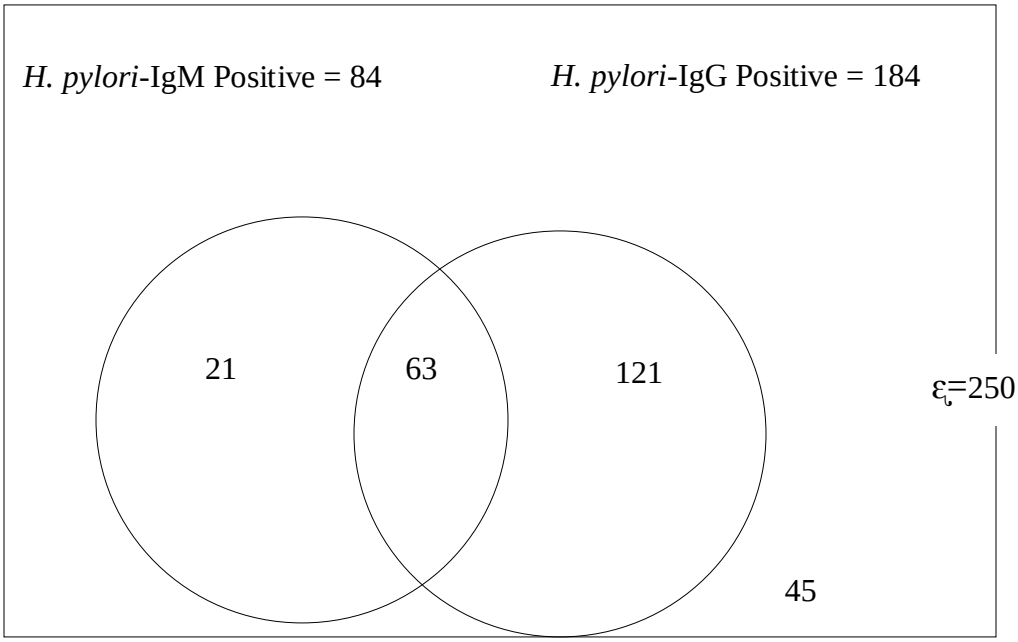

Figure 1: Vein Diagram Showing Prevalence of *H. pylori*-IgG and IgM Antibodies Among dyspeptic patients in Zaria metropolis.

Table 1: Seroprevalence of *H. pylori* IgM and IgG in relation to gender and age among dyspeptic patients attending selected hospitals in Zaria, Kaduna State Nigeria.

Variable	No Examined	Immunoglobulin M No Positive (%)	χ^2	p-Value	Immunoglobulin G No Positive (%)	χ^2	p-Value
Gender							
Male	84	24 (28.6)	**1.434**	**0.231**	56 (66.7)	**1.130**	**0.077**
Female	166	60 (36.1)			128 (77.1)		
Age (Years)							

21-30	38	17 (44.7)	**3.838**	**0.428**	22 (57.9)	**8.627**	**0.071**
31-40	82	27 (32.9)			59 (72.0)		
41-50	69	23 (33.3)			54 (78.3)		
51-60	45	14 (31.1)			38 (84.4)		
>60	16	3 (18.8)			11 (68.8)		
Total	**250**	**84 (33.6)**			**184 (73.6)**		

Key: No=Number, **(%)** =Percentage, χ^2=Chi-square, ($p<0.05$) * = Significant association Exist

Table 2: Seroprevalence of *H. pylori* infection among dyspeptic patients in relation to some socio-demographic factors.

		Immunoglobulin M			Immunoglobulin G		
Demographic Factors	**No Examined**	**No Positive (%)**	**χ^2**	**p-Value**	**No Positive (%)**	**χ^2**	**p-Value**
Family Type							
Monogamous	75	21 (28.0)	**1.506**	**0.220**	55 (73.3)	**0.004**	**0.950**
Polygamous	175	63 (36.0)			129 (73.7)		
Type of Residence							
Flat	112	35 (31.3)	**0.502**	**0.479**	102 (73.9)	**0.016**	**0.901**
Single Room	138	49 (35.5)			82 (73.2)		
Household Crowding							
1 person	30	7 (23.3)	**8.185**	**0.017***	22 (73.3)	0.317	0.853
2 people	88	22 (25.0)			63 (71.6)		
2 and above	132	55 (41.7)			99 (75.0)		
Educational Status							
Primary	81	25 (30.9)	**10.919**	**0.012***	65 (80.2)	**3.801**	**0.284**
Secondary	91	29 (31.9)			67 (73.6)		
Tertiary	35	7 (20.0)			23 (65.7)		
Non-formal	43	23 (53.5)			29 (67.4)		
Occupation							
House-wife	51	12 (23.5)	**3.142**	**0.370**	39 (76.5)	**1.771**	**0.621**
Self-employed	107	38 (35.5)			80 (74.8)		
Civil-servant	54	19 (35.2)			36 (66.7)		
Unemployed	38	15 (39.5)			27 (76.3)		
Socioeconomic Status							
High	69	14 (20.3)	**7.568**	**0.006***	49 (71.0)	**0.328**	**0.567**
Low	181	70 (38.7)			135 (74.6)		
Total	**250**	**84 (33.6)**			**184 (73.6)**		

Key: No=Number, **(%)** =Percentage, χ^2=Chi-square, ($p<0.05$) * = Significant association Exist

Table 3: Seroprevalence of *H. pylori* infection among dyspeptic patients in relation to some possible risk factors

		Immunoglobulin M			Immunoglobulin G		
Factors	**No Examined**	**No Positive (%)**	**χ^2**	**p-Value**	**No Positive (%)**	**χ^2**	**p-Value**
Toilet Type							
Water-closet	151	48 (31.8)	**3.089**	**0.213**	110 (72.8)	**2.033**	**0.362**
Pit-latrine	82	27 (32.9)			59 (72.0)		
Open-field	17	9 (52.9)			15 (88.2)		

Washing of hand with soap							
Yes	103	21 (20.4)	**13.705**	**0.000***	53 (51.5)	44.206	**0.000***
No	147	63 (42.9)			131 (89.1)		
Source of Drinking Water							
Tap Water	6	2 (33.3)	**0.107**	**0.948**	4 (66.7)	**0.156**	**0.925**
Bore-hole	77	27 (35.1)			57 (74.0)		
Well Water	167	55 (32.9)			123 (73.7)		
Total	**250**	**84 (33.6)**			**184 (73.6)**		

Key: No=Number, **(%)** =Percentage, χ^2=Chi-square, ($p<0.05$) * = Significant association Exist

IV. Discussion

In this study, the overall prevalence of IgG and IgM was determined, and the risk factors associated with *H. pylori* infection in dyspeptic patients attending some selected hospitals in Zaria, Kaduna State, Nigeria was examined. To the best of our knowledge, there are limited published data in this part of the country, in this regard.

This study recorded an overall prevalence of 73.6% (n=184) for *Helicobacter pylori* Immunoglobulin G (IgG) antibody among the study population. This is lower than 80.4% reported by Nwodo *et al*. (2009) in a similar study conducted in some parts of Kaduna State nearly ten years ago, and far lower than prevalence of 93.6% which was reported by Olokoba *et al.* (2013) in Maiduguri, North-eastern Nigeria, 94.5% by Otegbayo *et al.* (2004) in Ibadan, South-west Nigeria. Nevertheless, this prevalence is consistent with findings of Ndububa *et al.* (2001), who reported a prevalence of 73% in Ile-ife, South-west Nigeria, 73.9% in Pakistan (Farhat *et al.,* 2013) and reports of findings from other African countries which have consistently shown a high prevalence of *H. pylori* infection such as; Ghana (74.8%), Kenya (71%) and Ethiopia (72.9%) (Shmuely *et al.,* 2003; Tadesse *et al.,* 2013; Archampong *et al.,* 2014). In these countries it has been reported that *H. pylori* infection may be present in about 70-100% of dyspeptic patients (Baako and Darko, 1996; Ben-Ammar *et al.,* 2003; Asrat *et al*., 2004). Detection of specific IgG antibody to *Helicobacter pylori* has been shown to be very accurate for the diagnosis of *H. pylori* infections (Ho and Marshall, 2000). However, *H. pylori*-IgG antibody titre, may remain high and detectable indefinitely, even after eradication of *H. pylori* (Alem *et al.,* 2002). Hence, detection of IgG to *H. pylori* may not differentiate between current and past infections. Testing sera for anti-*H. pylori* immunoglobulin M (IgM) on the other hand, may provide data confirming recent or active infection (Alem *et al.,* 2002).

On examining the *H. pylori* IgM status of sera samples collected from dyspeptic patients in this study, an overall incidence rate (IgM) of 39.2% (n=98) was recorded among the study population. The observed incidence was higher than 22.2% reported by Nwodo *et al*., (2009) but lower than 43% reported by Montazer-Saheb *et al*. (2011) in Iran. The failures of the remaining 152 (60.8%) patients with dyspeptic complain to show seropositivity to *H. pylori*-IgM, suggests that, their blood samples might have been obtained after the acute IgM seroconversion (Perez-Perez *et al*., 1998). An IgM response to *H. pylori* has been seen by day 18 of acquisition, but IgG and IgA sero-conversions occur together after 60 days, at which time IgM titers must have decline (Dobbs *et al*., 2000). Due to the nature of *H. pylori* infection, the initial infection by this organism may not necessarily be symptomatic and is not clearly different from those of an upset stomach; hence, most people delay their visit to the primary care physician hoping that the symptoms will resolve. Unfortunately, Spontaneous elimination of the infection is rare, and the infection remains active indefinitely unless it is treated with antimicrobials (Miranda *et al*., 2010).

Symptoms of dyspepsia in 45 (18.0%) patients whose samples showed no evidence of *H. pylori* infection, based on the assays employed in this study, may not be ascribed to infection with the bacterium, hence, the involvement of other aetiological factors that were out of the scope of this present study. This has been reported in earlier study by Ugwuja *et al.* (2009).

In relation to gender, we observed a higher *H. pylori* prevalence and incidence rates; (77.1%) and (36.1%) in female than (66.7%) and (28.6%) in males for both IgG and IgM antibodies respectively. Though, there were more females (n=166) than males (n=84) in this study. The female predominance observed in this study agrees with the findings of a similar study in Iran, conducted by Montazer-Saheb *et al*. (2011). This could be a reflection of the greater consciousness of the female gender in the issue of their health and their ready presentation in the hospital when compared, to the males, or it may be a matter of chance that more female patients visited for management of dyspepsia during the study period of this research. The analysis of results between gender and *H. pylori* prevalence rate, was not statistically significant ($p>0.05$) as seen in Table 1. The lack of significant sex difference in patients presenting with dyspepsia and *H. pylori* infection in this study is consistent with earlier reports (Otegbayo *et al.,* 2004;Shaib and El-Serag, 2004; Montazer-Saheb *et al*., 2011).

The prevalence of *H. pylori* IgG seropositivity among dyspeptic patients as observed in this study, increased markedly with age, being maximum (84.4%) at age group 51-60 years. After which, there was a decrease (68.8%) among those above 60 years of age as shown in Table 4.6. This agrees with findings of Baako and Darko (1996) who reported that the fifth decade of age was the peak of infection among dyspeptic patients in Ghana. However, the peak of *H. pylori* IgM seropositivity rate (44.7%) was noted among those within 21-30 years of age and a steady decrease was observed thereafter. This can be explained by the fact that younger people are at higher risk of *H. pylori* infection, although symptoms may not be significant in most individuals until later in Adulthood (Malaty *et al.,* 2002; Rowland *et al.,* 2006). The test of association between age and the rate of *H.*

pylori IgG and IgM seropositivity revealed, no significant association (p>0.05).

The results of the test of analysis between *H. pylori* prevalence and Family type, type of residence, household crowding (number of person per room), type of convenience (toilet) used, showed no significant association (P>0.05), except for the incidence rate (*H. pylori*-IgM) and household crowding. However, higher *H. pylori* incidence rate was recorded among patients who were from a polygamous family (36.0%), those who leave in single room apartment (35.5%) and those who shared room with more than two people (41%). Most Nigerians are members of extended family and often living in crowded conditions, especially in early childhood. This encourages some unhygienic conditions, which can promote intra-familial transmission regarding the risk of acquiring *H. pylori* infection. Close contact in families where carriers of *H. pylori* are already present can markedly increase the risk of oral-oral, gastro-oral or faecal-oral transmission, through inadvertently spreading infected saliva, vomitus or having poor personal hygiene (Goodman, 2000; Rothenbacher *et al.,* 2002; Rocha, 2003). Lack of association between infection and toilet system in this study implies that water-closet, pit-latrine as well as open field could constitute transmission route in equal rate if proper personal and environmental hygiene were not applied. Toilet facilities are important tools integrated in gastrointestinal health in general populations. When not properly cleaned in a routine and periodic manner, it can serve as a major source of microbial transmission and act as a hidden source of infection (Vernon *et al.,* 2005; Livinov *et al.,* 2010).

This study established a significant relationship between the prevalence of *H. pylori* infection and washing of hands with soap after using the toilet (p<0.05). A higher prevalence (89.1%) was recorded among the majority (147) of the patients who admitted washing their hands just after visiting the toilet, only with water, meanwhile, those who use soap always, had a lower prevalence (51.5%) as compared to those who used water only. This suggests that effective hand washing remain the one of the most effective and least expensive major method of preventing transmission of this infection.

We observed no significant association between the infection rate of *H. pylori* and source of drinking water as a risk factor in this study. However, patients who said they drank borehole water had the highest incidence (35.1%) and prevalence rate of 74.0% and the least incidence (33.3%) and prevalence (66.7%) was observed among those who drank tap water. This suggests a possible contamination of borehole water sources with sewage perhaps, boreholes are being situated close to septic tanks. Zaria like any other semi-urban cities in Nigeria is faced with acute shortage of portable water especially in the dry season making people to resort to boreholes, well water and other sources of water supply for drinking and other domestic activities.

A significant association (p<0.05) was observed between the level of education attained among the dyspeptic patients and the incidence (IgM) of *H. pylori* infection. The highest incidence rate of 53.5% was recorded among those with non-formal type of education while those with tertiary form of education recorded the least incidence 20.0%. The highest incidence rate observed among patients with non-formal type of education could be attributed to less awareness concerning the mode of transmission, pathogenesis and role of the *H. pylori* as an etiological factor of dyspepsia, low socioeconomic status and poor personal hygiene. Poor personal hygiene has been shown to enhance the acquisition and the spread of the bacteria (Woodward, 2000; Ugwuja, 2007). However, studies have shown that educated people are more concern with their personal and environmental hygiene and awareness of this infection. The seroprevalence rates of anti-*H. pylori* (IgG) that was recorded among the various educational levels was not statistically significant, however, the highest (80.2%) prevalence rate was recorded among those with primary level of education.

Occupation among the study population was also assessed to examine its relationship with *H. pylori* infection as a possible risk factor. The difference observed was not statistically significant (p>0.05). Nevertheless, patients who were housewives had the highest prevalence rate (76.5%) and the highest incidence rate (39.5%) was recorded among those who were unemployed.

In the case of socioeconomic status and the *H. pylori* infection rate, patients were divided into two groups (high and low socioeconomic class) based on a scale of combined factors, such as type of residence, household crowding, highest level of education attained and occupation rather than on a single factor. Although there was no significant difference (p>0.05) in the prevalence of *Helicobacter pylori* infection and socioeconomic status, however, infection was slightly higher (74.6%) in the lower socio-economic class than in the higher class (71.0%). The lack of association in this study may be due to the fact that most individuals have been already infected in childhood irrespective of their present socioeconomic status. This is in agreement with report of Nwodo *et al.* (2009). However, the difference observed between the two socioeconomic groups and the incidence of *H. pylori* infection was statistically significant (p<0.05) with lower class having a higher incidence rate of 38.7%. The spread of infection among the lower socioeconomic group must have been facilitated by less favorable living conditions and poor environmental hygiene. This agrees with the report of Veldhuyzen *et al.* (1995).

V. Conclusion

In conclusion, the observed prevalence rates in this study revealed that *H. pylori* infection is highly endemic in the study area; lack of proper sanitation and of basic hygiene, overcrowding, level of education as well as low socioeconomic status all played a role in the overall prevalence of *Helicobacter pylori* infection in this study. This further suggests that, the epidemiological situation of this bacterium in the study area still requires effective public health interventions.

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