



Potential Risk Factors and Prevalence of Infection of *Helicobacter pylori* in Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author FOO designed the study, wrote the protocol and the first draft. Author QR managed the experimental processes. Author PAA analysed the study and managed the literature search, while author SAB processed and obtained ethical approval. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Potential risk factors and prevalence associated with *Helicobacter pylori* (*H. pylori*) infection in apparently healthy children in Nigeria were studied.

Study Design: To investigate the current potential risk factors associated with recent prevalence of *H. pylori* in apparently healthy children in Nigeria.

Place and Duration of Study: The study was conducted in two Local Government Areas, Alimosho and Ajeromi, of Lagos State, Nigeria between March and September 2014.

Methodology: Seroprevalence status of 185 asymptomatic children made up of 93 males and 92 females, aged between 2-16 years were selected by randomized stratified sampling with descriptive questionnaire. Serum immunoglobulin G *H. pylori* antibody of the individual subjects was determined using *DiaSpot H. pylori* kit while fecal samples of same group were analysed for

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HpSAg using immunoassay test kit of *Helicobacter pylori* Stool Antigen (HpSAg).

Results: Of 185 children tested for *H. pylori* antigen, 134 (68.7%) and 51(26.2%) were classified as seropositive and fecal HpSA positive respectively. Highest rate of 40.0% and 34.6% of the children weighing between 21 and 40 kg were positive while 29.2% and 32.5% children of parents that were traders were positive to serum *H. pylori* antigen and fecal HpSA respectively. Only 12.4% and 14.1% children from artisan parents were positive but different age group have no association with the infectivity or prevalence of fecal *H. pylori* antigen (OR=0.67, CI=0.142-0.152). Significant higher percentage of seropositivity of 59.0% and fecal positivity of 55.7% was recorded among children from 5-8 people in a room ($p>0.05$), while Households with regular potable water supply have lower *H. pylori* seropositivity and fecal positivity of 11.9% and 7.6% compared with households that *sometimes* have water supply. The Households that *never had water* supply had highest number of seropositivity of 40.0% and 18.4%, respectively. *Sewage nearness to kitchen* indicates 30.8% and 28.7% *H. pylori* seropositive and fecal positivity rate among children.

Conclusion: Paediatric *H. pylori* prevalence is highly associated with water borne infection and poor sanitary practices. There is need for achievable interventions and improvement in environmental sanitation.

Keywords: Seroprevalence; asymptomatic infection; children; *Helicobacter pylori*; stool antigen.

1. INTRODUCTION

Helicobacter pylori is a Gram-negative helix shaped bacterium thought capable of penetrating the mucoid lining of the stomach [1]. It is linked to the development of chronic gastritis, gastric ulcers, duodenal ulcers, and stomach mucosal atrophy [2]. Moreover, *Helicobacter pylorus* is well recognized to have been acquired early in life and is most prevalent in developing countries with lower standard of hygiene compared with developed countries [3].

H. pylori is contagious, although the exact route of transmission is not known [4]. *H. pylori* may be transmitted orally by means of faecal matter through the ingestion of waste-tainted water [5]. Many of the reported factors for *H. pylori* infection include poor hygiene, deficient sanitation and crowded living conditions [6]. However, the roles of many other factors associated have not been elucidated. While prevalence of *H. pylori* has been documented among hospital patients by several authors [7,8] and asymptomatic patients that present with some form of gastro-intestinal ailments [9], few information is available on the prevalence of this pathogen among apparently healthy children and a thorough knowledge of risk factors that predispose to infection among apparently healthy population in Nigeria is scanty.

The aim of the current study was to determine the prevalence of *Helicobacter pylori* in two Local Government Areas of Lagos State of Nigeria and to assess the risk factors for *Helicobacter pylori* involving data on sex, age, maternal

educational level, Household populations i.e. number of members of household that sleep in a room and availability of potable water for Household use.

2. MATERIALS AND METHODS

2.1 Study Population

One hundred and eighty five asymptomatic children aged between 2 and 16 years attending nursery, primary and junior secondary schools were enrolled in this study. Written informed consent was obtained from all the parents of the children thereafter assent of the children was obtained before sample collection. Additional assent forms were issued to the children or their parents after they had been educated on the study.

2.2 Exclusion Criteria

Children who underwent partial or complete gastro-rectomy, those who had complaints of stomach pain of any sort or degree and those who were treated with any antibiotics, in the previous 2-3 weeks were excluded from the study.

2.3 Questionnaires

The children or the parents of the participants were educated on the questionnaires. Information on age, sex, weight, maternal level of education, size of family, occupation of parents, nature of household, eating habits (buying food

from food hawkers or vendors), availability of water in the household.

2.4 Serology

3.0 ml of venous blood was collected into plain tubes (Celtech, Germany) and allowed to clot by standing the samples at room temperature, 30°C, for 10 minutes. Clear non-haemolysed serum sample was obtained by spinning the tubes at 2000 rpm for 5 minutes using the table centrifuge (Boehringer, USA).

Each serum (about 400 µl/sample) was transferred into a new tube and stored at 5°C till use. The *DiaSpot H. pylori* kit (Indonesia) was allowed to attain 30°C (room temperature) before being used for the analysis according to the manufacturer's manual (*One step H. pylori Test Device [Serum/Plasma] Package*). The kit is a qualitative immunoassay membrane strip for the detection of *H. pylori* Immunoglobulin G antibodies in serum. Briefly, 3.0 drops of serum sample were transferred to the specimen well of test device carefully, to avoid trapping air bubble in the specimen well. Appearance of a single red line indicates a negative result while double lines indicate positive sample.

2.5 Detection of *H. pylori* Stool Antigen (HpSA)

2.0 grams of faeces was collected in a 5.0 ml sterile collection bottle (manufactured by Celtech, China). Immediately after collection, faecal samples were analysed for HpSA following the procedure stated on the kit's manual. Briefly, 0.5 gm of faecal sample was transferred into HP Sample Collection Tube containing 1.5 ml sample buffer and shaken vigorously to produce a homogenous suspension. 2.0 drops of the suspension were transferred into designated wells on the cassette and allowed to stand for 15.0 mins after which it was read and the results were interpreted.

2.6 Data Analysis

The significance of *H. pylori* fecal antigen and serum antibody positivity was determined by Chi square while its association with demographic factors were determined by its Odd ratio (OR) and confidence interval (CI) taken p value <0.05 using SPSS 16 software.

3. RESULTS AND DISCUSSION

In this study, the overall prevalence of *H. pylori* among healthy children in two Local Government Areas in Lagos State, Nigeria, show prevalence rate of 68.7% and 26.2% as seropositive and fecal HpSA positive respectively (Fig. 1). The seropositive rate recorded in this study is similar to overall prevalence of 63.6% *H. pylori* infection rate in apparently healthy children in Lagos, Nigeria reported by Senbanjo et al. [7] and also 69% reported among pediatric age group in Northern part of Nigeria [10,11]. This increasing rate of seropositive *H. pylori* could largely be attributed to poor hygiene, socio-cultural factors and self-medication by the parents. As maternal immunity before age 5 years waned, subclinical infection might confer some level of immunity thereafter while serodiagnosis would detect early *H. pylori* infection and would increase detection rate of HpSAG among apparently healthy children. The role of copro-antibodies in the shedding of HpSAG will need to be further investigated.

It was amazing to record highest rate of 40.0% and 34.6% of the children weighing between 21 and 40 kg to be positive to serum *H. pylori* antigen and fecal HpSA respectively but not significant ($p=0.051$), Table 1. The rate of acquisition of *H. pylori* differs greatly within and among populations of children which is greatly influenced by the rate of acquisition and transmission of the organism. Although, previous investigations have shown the importance of age, sex and poor household living conditions in childhood acquisition of *H. pylori* infection (OR=0.67, CI=0.142-0.156).

Increasing positivity rate of 29.2% and 32.5% to *H. pylori* serum and fecal HpSA among children of parents that were traders being higher than 12.4% and 14.1% from artisan parents (i.e low or poorly skilled class) suggest a dreadful trend of *H. pylori* infectivity due to poor socio-economic status of many parents. In Nigeria, poverty has actually enhanced level of transmission due to malnutrition, poor hygiene and unaffordable health care. It is evident that mothers occupation of positive children have significant association with the infectivity or prevalence of *H. pylori* among the children (OR= 0.53, CI=0.152-0.87, $p=0.037$). This is similar to reports from other part of the globe indicating association of low socio-economic factors with prevalence of *H. pylori* infection in Asia [11], South America [12],

Africa [13] and Nigeria [7]. Higher rate of *H. pylori* colonization were more recorded among children of low socioeconomic class compared with those of high socioeconomic class. This further reflects the poor standards of living conditions of low socioeconomic children which is characterized with malnutrition, diarrhea, gastritis and other intestinal infections [14], which could predispose them to *H. pylori* infection [14,15].

A household of three in a Nigerian standard-sized room is considered the norm. Household that are crowded with 5-8 people show significant higher percentage of seropositivity of 59.0% and fecal positivity of 55.7% ($p>0.05$), compared with the households that are not overcrowded. This confirms the works of several authors that overcrowding facilitates transmission of *H. pylori* [9,10]. The prevalence tended to be higher if there were younger children and more family-members in a household. Some other studies have reported household crowding as risk factor for *H. pylori* infection among children [16,17] while bed sharing among different people was a strong and independent risk factor for *H. pylori* prevalence due to overcrowding.

In spite of overpopulation experienced in various household in Nigeria, availability of water for household use remains a long term problem in many Nigeria communities. This usually determines the level of personal and household

hygiene which is very important factor to be considered in the prevalence of *H. pylori*. Households with regular potable water supply have lower *H. pylori* seropositivity and fecal positivity of 11.9% and 7.6% compared with households that *sometimes* have water supply. The Households that *never had water* supply had significant highest number of seropositivity of 40.0% and 18.4% respectively ($p=0.013$). According to Nurgalieva et al. [18], adverse effect of the poor source of drinking water consistently predispose many children to high frequency of *H. pylori* infection while non-availability of water is a marker of household hygienic practices. The prevalence of *H. pylori* could have been reduced in these two study areas assuming they consistently boiled water before drinking and for domestic uses but this is uncommon practice in this locality. Due to unavailability of suitable water in this environment, many resorted to the use of river water as alternative source. It is evident that drinking river water had highest risk of *H. pylori* infection due to contamination from various sources.

Refuse and excreta disposal in these areas, is another factor to be considered. It was observed that *Sewage nearness to kitchen* indicates 30.8% and 28.7% *H. pylori* seropositivity and fecal positivity rate among children whose kitchens were closed to the sewage disposal system (Table 1).

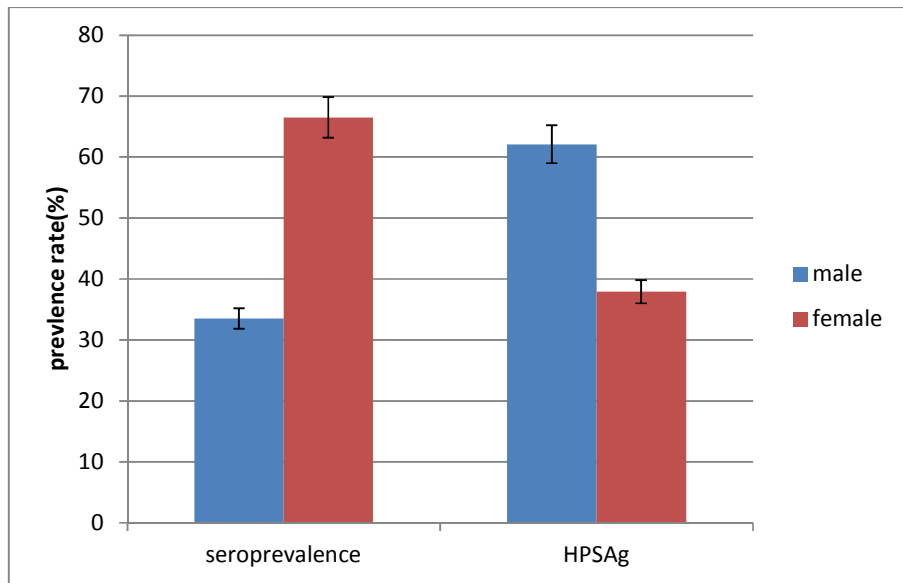


Fig. 1. Seroprevalence and fecal HPSAg rate among different sex

Table 1. Demographic status of the recruited subjects examined for *H. pylori* serum IgG and fecal antigen (HpSA)

Variables	Serology								Stool antigen	
	Total number of subjects recruited=185								OR (95% CI)	P value
	Positive (n=134)		Negative (n=51)		Positive (n=134)		Negative (n=51)			
	N	%	n	%	n	%	n	%		
Weight										
0-20	47	25.4	17	9.2	35	18.9	18	9.7	0.60 (0.132-0.157)	0.051
21-40	74	40.0	30	16.2	64	34.6	30	16.2		
41-6-	13	7.0	3	1.6	14	7.6	3	1.6		
60-above	0	0.0	1	0.5	21	11.4	0	0.0		
Mothers occupation										
Artisan	23	12.4	12	6.5	26	14.1	10	5.4	0.53 (0.152-0.87)	0.037
Civil servant	33	17.9	10	5.4	26	14.1	20	10.8		
Trader	54	29.2	25	13.5	60	32.5	15	8.1		
Unemployed	24	13.0	6	3.2	22	11.9	6			
Age										
0-10	95	51.4	34	18.4	93	50.3	31	16.8	0.67 (0.142-0.156)	0.67
11-20	39	21.1	17	9.2	41	22.2	20	10.8		
21-above	0	0.0	0	0.0	0	0.0	0			
Household population										
0-4	20	10.8	6	3.2	24	13.0	7	3.8	0.47 (0.112-0.116)	0.045
5-8	109	59.0	42	22.7	103	55.7	43	23.3		
9-above	5	2.7	2	1.1	7	3.8	1	0.5		
Availability of water										
Never	74	40.0	31	16.8	34	18.4	19	10.3	0.0 (0.10-0.015)	0.013
Always	22	11.9	6	3.2	14	7.6	13	7.0		
Sometimes	39	21.1	13	7.0	86	46.5	19	10.3		
Sewage Nearnesto Kitchen to soakaway										
Far	79	42.7	33	17.9	74	40.0	34	18.4	0.37 (0.102-0.126)	0.051
Close	57	30.8	20	10.8	53	28.7	17	9.2		

Key: n=number of subject tested, %=percentage of the subject tested, OR= odd ratio; CI=confidence interval

This is a very threatening situation and call for immediate practical intervention to prevent outbreak of paediatric *H. pylori* infection in this community. Although indoor toilet facilities are not common in these study areas while feces of infants are visibly disposed in the environment or dumping sites near many homes which are readily accessible to animals, flies, rodents, birds and children [19,20]. These are risk factors needed to be considered for *H. pylori* acquisition [18]. These findings are consistent with mode of transmission of *H. pylori* which can be directly transmitted from person-to-person interaction or with animals while indirect transmission requires

routes such as air, food, contaminated water, flies and animals [21].

4. CONCLUSION

Prevalence of *H. pylori* among children in these areas could well be transmitted through water borne or related to poor sanitary practices. Therefore, there is urgent need to provide health awareness and achievable interventions to prevent increasing rate of *H. pylori* and provide improvement in environmental sanitation, household hygienic practices and proper waste disposal.

CONSENT

The Authors declared that informed assents and consent were obtained personally from all individual subjects involved in this study and any interested subject that met the criteria of the study. They were informed of the benefit of the study and freedom to withdraw.

ETHICAL APPROVAL

Informed assent of the parents were obtained before commencement of the study while the Ethical Approval was obtained from the Ethical Committee of Lagos State University, College of Medicine, Ikeja, Lagos, Nigeria.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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