Review Article
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Risk factors with *Helicobacter pylori* infection prevalence among children and adult symptomatic patients attending Ad-Lucem Obobogo hospital in the health district of Efoulan, Yaounde-Cameroon

Abstract

Background: The burden of *Helicobacter pylori* infection (HPI) remains very high in sub Saharan Africa (SSA) with varying levels of prevalence among children and adults reported in different regions of the continent like Cameroon. The study was conducted to determine the prevalence of *Helicobacter pilory* (*H. pilory*) and to identify risk factors among symptomatic patients attending Ad-Lucem Obobogo Hospital.

Methods: From January 18th, to March 22nd, 2021, we conducted a cross-sectional study among 142 gastritis symptomatic patients (children and adults) aged between 10 to 81years old attending Ad-Lucem Obobogo Hospital in Yaounde, Cameroon. Data were collected using well-structured questionnaire containing general characteristics of study participants and risk factors. Blood and fresh stool samples were performed for the presence of *H. pylori* antibody in sera, antigen in stool using qualitative rapid diagnostic tests (RDTs). The data were performed using Epi-info version 7 with P< 0.05 considered statistically significant.

Results: The mean age was 36.42years old (standard deviation: ±14.85) and the females were more represented with 61.97% (88/142). Overall, the rate of IgG antibodies and stool antigen were detected in 66.90% (95/142), and 29.58% (42/142), respectively. The antigen prevalence (31.48% versus 28.41%) Odds Ratio (OR) =0.9 (0.46-2.05), P=0.84 and antibodies (75.92% versus 61.36%), OR=2 (0.93-4.23), P=0.07 were more detected in males than the females respectively. The antigen had the highest prevalence within range age (40-54) years (P=0.41) and antibody had the highest prevalence within range age ≥55years old (P=0.45). The multivariate analysis shows that, the risk factors such as education level and source of cooking water were statistically associated with HPI (P=0.02).

Conclusion: This result shows the high prevalence of HPI among patients attending Ad-Lucem Obobogo Hospital in Yaounde. The risk factors such as education level and source of cooking water were significantly associated for this infection.

Keywords: *H. pylori* infection, prevalence, risk factors, symptomatic patients, Obobogo hospital

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Abbreviations: ELISA, enzyme linked immunosorbent assay; HPI, *Helicobacter pylori* infection; IQR, interquartile range; ITP, idiopathic thrombocytopenic purpura; SSA, sub Saharan Africa; MALT, mucosa-associated lymphoid tissue; NPV, negative predictive value; OR, odds ratio; PCR, polymerase chain reaction; PPV, positive predictive value; RDT, rapid diagnostic tests; vs, versus

Introduction

HPI is one of the foremost bacterium infections worldwide, particularly in SSA countries with more than half (50%) world population infected.[1] The prevalence of *H. pylori* varies geographically with a higher prevalence occurring in the developing countries than western world.[2] Latest statistic recorded an increase prevalence of *H. pylori* in Africa (79.1%) and Asia (54.7%) compared to 37.1% in Northern America and 24.4% in Oceania.[3] Of note, *H. pilory* is a micro-aerophilic Gram-negative rod bacterium that parasitizes the gastric mucous layer and the epithelial lining of the stomach, it is also a Class I carcinogen and the major bacterium that colonizes the stomach mostly during childhood.[2,4] This bacterium is known to cause common chronic bacterial infections with about 10% of infected individuals develop overt clinical disease while 90% remain subclinical and the infection can persist throughout life if untreated.[1,5] Furthermore, initial infection with this microorganism is usually silent but symptoms and pathologic changes occur later in life. So, the clinical conditions and pathologic changes associated with *H. pylori* infection include gastritis, gastric and duodenal ulcers, gastric cancers, adenocarcinoma of distal stomach, mucosa-associated lymphoid tissue (MALT), lymphoma, iron deficiency anaemia and idiopathic thrombocytopenic purpura (ITP).[2,4,6,7]

The routes of transmission of *H. pylori* have not been clearly identified. Meanwhile, transmissions from person-to-person and through tubes or endoscopes have been reported by several authors in the world. Water consumption contaminated with faeces and fecal-ora transmissions are considered as predisposing factors for HPI.[8,9] Also, some risk factors such as poor housing, poor sanitation, lack of safe drinking water, source of drinking water, age, gender, genetic predisposition, ethnicity, educational level, lack of salary, the geographic variations, stress and number of person in room have been associated to high prevalence of HPI in developing countries.[10–13]

In the laboratory, several methods such as invasive (endoscopy and biopsy using modalities like culture, histology, polymerase chain reaction and rapid urease test) and non-invasive (fecal antigen

testing, and serology) were performed for the detection of this global infection.[14] For the non-invasive method, the stool test demonstrates the presence of antigens and active infection of bacterium while serology detects antibodies to *H. pylori* and serology must be carried out with Enzyme Linked Immunosorbent Assay (ELISA) kits (IgG) whose performance is greater than 90%[15,16] However, serologic tests are limited by false positivity because of cross-reactions.[17]

In Cameroon, the prevalence of *H. pilory* varies place to place from patients using the invasive techniques. Several studies reported *H. pylori* prevalence of 72% (67/93) from biopsies samples with evidence of gastritis [18] and 92.2% from gastric biopsies of patients with gastroduodenal pathologies.[19] Moreover the prevalence of *H. pylori* was recently detected in Yaoundé using polymerase chain reaction (PCR).[20] Meanwhile, there is a paucity of information on the prevalence of *H. pylori* and risk factors among symptomatic patients in Cameroon using non-invasive techniques such as fecal antigen testing, and serology. The survey conducted by Agbor et al.[21] in west Cameroon reported a prevalence of HPI of 43.4% (217/500) for serology and 47.4% for stool antigen test. Therefore it is important to conduct a new investigation to determine the prevalence of *H. pillory* and to identify some risk factors with this global infection from patients using non-invasive techniques such as serum antibody and stool antigen.

Materials and methods

Study site and population

This cross-sectional study was conducted among 142 patients attending Ad-Lucem Obobogo Hospital in Yaoundé, Cameroon from January, 18th to March, 22nd 2021. Ad-Lucem Obobogo Hospital is located in Efoulan Health District, Centre region of Cameroon. In the current study, the participants were recruited consecutively by interview face to face after obtained written informed consent from adult and parental or guardian for children (inclusion criteria: aged ≥10years old and consent to participate). The data were collected using a well-structured questionnaire including demographic details and risk factors such as gender, age, region, marital status, education level, family income, households people, source of drinking water, source of cooking water, frequency of hand washing and toilet location.

Specimen collection

Four milliliters (4ml) of total blood were collected aseptically from each study participant by venipuncture and transferred into a sterile vacutainer dry container previously labeled. The blood sample was centrifuged at 1.500 rpm for five minutes. The serum was obtained, separated and stored at -20°c until handled. Immediately after the blood sample collected, a clean and sterile stool sample container previously labeled was given to each study participant to provide fresh stool samples within one hour.

H. pylori testing

For the two specimen collected, a lateral flow immunochromatographic assay for the qualitative detection of *Helicobacter pylori* antibodies in serum or plasma and antigen in human fecal specimen (Qingdao Hightop Biotech Co., Ltd, China) was used.

Detection of *H. pylori* antibodies in sera

H. pylori antibodies were detected in sera using Qingdao Hightop Biotech, China, according to the manufacturer's instructions. It is the lateral flow chromatographic immunoassay based on sandwich method for the qualitative detection of *H. pilory* antibody. The test utilizes antibodies including an anti-human antibody and rabbit anti-*H. pylori* antibody on the nitrocellulose membrane with colloidal gold marked *H. pylori* antigen. The test results were observed within 15-20 minutes. For the reactive or positive result, two distinct red lines appear (one line should be in the control zone and another should be test zone). The non-reactive or negative result shows the appearance of one red line in control zone and no appearance of red line in test zone.

Detection of *H. pylori* antigens in stool

H. pylori antigens were detected in stool using Qingdao Hightop Biotech, China, according to the manufacturer's instructions. It is the lateral flow chromatographic immunoassay based on sandwich method for the qualitative detection of *H. pilory* antigen. The test results were observed within 15-20minutes. For the reactive or positive result, two distinct red lines appear (one line should be in the control zone and another should be test zone). The non-reactive or negative result shows the appearance of one red line in control zone and no appearance of red line in test zone.

Ethical considerations and participation

Before this survey started, ethical clearance was issued from the ethic committee of the Centre Region (Reference Number: CE 1918 N°/CRERSHC/2020 of 29 December 2020). Administrative authorizations were also obtained from the Regional Delegation of Public Health for the Centre Region and the Chief Medical Doctor of Ad-Lucem Obobogo hospital. Samples were collected only from participant who gave their consent to participate. The confidentiality was secured by a unique code attributed to each study participant. Any participant positive for *H. pylori* was follow up by the physician.

Statistical analysis

The data collected were registered in a Microsoft Excel sheet version 2016 and transported to the analysis software Epi info™ version 7. The Chi2 test was used to compare the results of the different categories and to measure the associations between the dependent and independent variables. The probability was statistically significant for all values of $P<0.05$.

Results

General characteristics of study participants

Out of one hundred and forty two (142) participants was included in this study. The general characteristics showed that females were more represented with 61.97% (88/142) versus (vs.) 38.03% (54/142) for the males. The mean age was 36.42years old (standard deviation: ±14.85) ranging from 10 to 81 years old and the age group of 25-39years was more represented with 42.96% (61/142). The majority of study participants came from Centre region, South region with 52.82% (75/142), 44.37% (63/142) were single and 54.23% (77/142) were in secondary school (Table 1). Among 142 study participants enrolled, 29.58% (42/142) and 66.90% (95/142) were tested positive for stool and IgG antibodies respectively (Figure 1).

Table 1 shows that the stool antigen was detected in both gender (28.41% for females vs. 31.48% for males, P=0.84). In the same vein, IgG antibodies were also found in both gender with 61.36% (54/88) and 75.92% (41/54) respectively for females and males (P=0.07). According to the age, *H. pylori* antigen was more found in age group of 40 to 54years with 37.14% (13/35). Meanwhile, the antibodies

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were more detected in age of 55 years and above with 76.47% (13/17). Regarding the education level, *H. pylori* antigen (50.00%, 1/2) and the antibodies (100%, 2/2) were more detected in participants with no formal education.

Table 1 Prevalence of *H. pylori* infection and characteristics of study participants

Factors	Total number of participants (%)	Detection of *H. pylori*			
		Stool antigen Reactive (%)	P-value	IgG antibodies in sera Reactive (%)	P-value
Gender					
Females	88 (61.97)	25 (28.41)	0.84	54 (61.36)	0.07
Males	54 (38.03)	17 (31.48)		41 (75.92)	
Age group (years)					
10 – 24	29 (20.42)	7 (24.14)	0.41	15 (51.72)	0.45
25 – 39	61 (42.96)	17 (27.87)		44 (72.13)	
40 – 54	35 (24.65)	13 (37.14)		23 (65.71)	
55-	17 (8.45)	5 (29.41)		13 (76.47)	
Region					
Centre, South	75 (52.82)	23 (30.66)	0.14	51 (68.00)	0.88
Littoral	7 (4.93)	0 (0.00)		3 (42.86)	
North	4 (2.82)	0 (0.00)		3 (75.00)	
West, South-west, North-west	56 (39.43)	19 (33.92)		38 (67.85)	
Marital status					
Single	63 (44.37)	18 (28.57)	0.32	38 (60.32)	0.06
Married	53 (37.32)	19 (35.85)		40 (75.47)	
Divorced	4 (2.82)	2 (50.00)		4 (100.00)	
Window (er)	20 (14.08)	3 (15.00)		13 (65.00)	
No answer	2 (1.41)	0 (0.00)		0 (0.00)	
Education level					
No formal education	2 (1.41)	1 (50.00)	0.10	2 (100.00)	***0.02***
Primary school	15 (10.56)	1 (6.67)		6 (40.00)	
Secondary school	77 (54.23)	27 (35.06)		54 (70.13)	
Post-secondary school	39 (27.46)	12 (30.77)		30 (76.92)	
No answer	9 (6.34)	1 (11.11)		3 (33.33)	
Family income					
Per month	47 (33.10)	12 (25.53)	0.78	32 (68.09)	0.62
Per week	65 (45.77)	21 (32.31)		41 (63.08)	
No answer	30 (21.13)	9 (30.00)		22 (73.33)	
Family size					
<5 people/room	49 (34.51)	12 (24.49)	0.58	30 (61.22)	0.53
6 to 10 people/room	73 (51.41)	23 (31.51)		52 (71.23)	
>10 people/room	20 (14.08)	7 (35.00)		13 (65.00)	

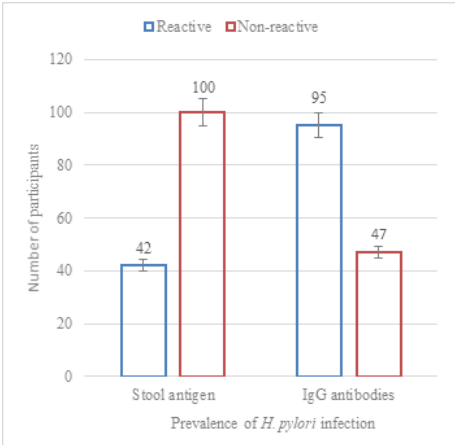

Figure 1 Prevalence of *H. pylori* infection in study population

Prevalence of *H. pylori* infection and risk factors

Table 2 shows that, source of cooking water was the risk factors associated to *H. pylori* infection detected in stool (P=0.02). In this study, no association was found between source of drinking water, drinking water conservation, frequency of hand-washing, Latrine location and *H. pylori* (P>0.05).

Association between stool antigen test results and serology detection of HPI

By comparing the results of stool antigen test to the serology results, it was found that, this test showed sensitivity of 100.0%, specificity of 47.0%, Positive Predictive Value (PPV) of 44.21%, Negative Predictive Value (NPV) of 100.0%, and accuracy of 62.68%. The results appear strong association between stool antigen test and IgG antibodies in sera in study (P=0.0000) (Table 3).

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Table 2 Prevalence of *H. pylori* infection and risk factors

Factors	Total number of participants (%)	Detection of H. pylori			
		Stool antigen Reactive (%)	P-value	IgG antibodies in sera Reactive (%)	P-value
Source of drinking water					
Fountain	9 (6.34)	3 (33.33)	0.18	6 (66.67)	0.86
Mineral water	31 (21.83)	6 (19.35)		22 (70.97)	
Well fitted out	32 (22.53)	9 (21.43)		21 (65.63)	
River	7 (4.93)	2 (28.57)		6 (85.71)	
Tapwater	52 (36.62)	15 (2.,85)		32 (61.54)	
Source	11 (7.75)	7 (63.64)		8 (72.73)	
Source of cooking water					
Fountain	11 (7.75)	4 (36.36)	0.02	8 (72.73)	0.65
Well fitted out	33 (23.24)	9 (27.27)		22 (66.67)	
Well non fitted out	8 (5.63)	3 (37.50)		5 (62.50)	
River	8 (5.63)	3 (37.50)		7 (87.50)	
Tapwater	71 (50.0)	15 (21.13)		44 (61.97)	
Source	11 (7.75)	8 (72.73)		9 (81.82)	
Drinking water conservation					
Can	17 (11.97)	4 (23.53)	0.35	14 (82.35)	0.27
Can, closed bucket	35 (24.65)	13 (37.14)		26 (74.29)	
Plastic bottle	36 (25.35)	8 (22.22)		23 (63.89)	
Closed bucket	49 (34.51)	14 (28.57)		28 (57.14)	
Closed bucket, bottle	5 (3.52)	3 (60.00)		4 (80.00)	
Frequency of hand-washing					
After defecation	3 (2.11)	1 (33.33)	0.13	1 (33.33)	0.77
After defecation and after work	1 (0.70)	1 (100.00)		1 (100.00)	
After meals	2 (1.41)	2 (100.00)		2 (100.00)	
Before And after meals, and after defecation	19 (13.38)	7 (36.84)		13 (68.42)	
Before And after meals, after defecation and after work	13 (9.15)	3 (23.08)		10 (76.92)	
Before meals	8 (5.63)	3 (37.50)		7 (87.50)	
Before meals and after defecation	81 (57.04)	21 (25.93)		51 (62.96)	
Before meals, after defecation and after work	6 (4.23)	0 (0.00)		4 (66.67)	
No answer	9 (6.34)	4 (44.44)		6 (66.67)	
Latrine location					
Hut out of the house	54 (38.03)	21 (38.89)	0.19	39 (72.22)	0.56
Open air latrine	5 (3.52)	2 (40.00)		4 (80.00)	
Indoor latrine	77 (54.23)	18 (23.38)		49 (63.64)	
No answer	6 (4.23)	1 (16.67)		3 (50.00)	

Table 3 Detection of *H. pylori* infection in study participants by both tests

Stool antigen test				
IgG antibodies in sera	**Reactive (%)**	**Non-reactive (%)**	**Total (%)**	**P-value**
Reactive (%)	42 (44.21)	53 (55.79)	95 (66.90)	0.0000
Non-reactive (%)	0 (0.00)	47 (100.0)	47 (33.10)	
Total (%)	42 (29.58)	100 (70.42)	142 (100.0)	

Stool antigen test considered as gold standard

Discussion

The current survey was conducted to investigate the HPI prevalence among symptomatic patients attending Ad-Lucem Obobogo hospital and to identify risk factors with this global infection. So, a total of 142 participants was recruited in the study and the females were more represented with 61.97% (88/142) vs. 38.03% (54/142) for the males. This high presence of females reflect the socio-demographic population in Cameroon stipulating that the females were more

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represented.[22] Despite the small sample size, several studies conducted in SSA show the large representation of the females than the males.[21,23]

The rate of antibodies anti-*H. pilory* (IgG) was 66.90% (95/142). In comparaison to other studies conducted in Cameroon, this result is higher than that found by Agbor et al.[21] and similar to that found by Laure Brigitte et al.[24] who reported a HPI seroprevalence of 43.4% (217/500) and 64.39% (132/205) respectively. This higher seroprevalence can be explained by the fact that, many people suspected of having gastritis or peptic ulcer disease do not carry the HPI and have been in contact with the bacteria. The rate of antibodies was more detected in participants with no educational level (100%; 2/2) with a statistically significant difference (P=0.02). Our results are in agreement with many studies carried out in Cameroon stipulating that the educational level is a key element of sensitazation and communication for behavior change.[22] So, the lack of information, knowledge, attitude and practices can predispose population to infection. This rate of antibodies (75.92% vs. 61.36%), OR=2 (0.93-4.23), P=0.07 were more detected in males than the females respectively. Despite the fact that the result is not statistically significant, it appear that the males have a high chance of 2 times to be infected by *H. pylori*.

The antigen prevalence was 29.58% (42/142). Despite the methods used to detect the bacteria, HPI prevalence remains high in SSA and varies different regions.[12,25] So, in Cameroon like the majority of countries located in SSA, several studies reported a high prevalence of HPI.[8,19–21,24] There was no statistically signifcant difference in the antigen prevalence results between males and females (P=0.84). Meanwhile, This antigen prevalence was higher in males (31.48%; 17/54) than the females (28.41%; 25/88). This finding is in comparaison with other studies conducted in Cameroon, which reported higher prevalence of HPI among males.[20,24] Meanwhile, the study of Agbor et al. and Kpossou et al. found a similar HPI prevalence in both gender.[21,23] These differences observed could be explain by the sample size and the study population. Furthermore, these differences may be due to improvement in the socioeconomic and hygiene conditions of the population over time according to.[21] The antigen had the highest prevalence within range age (40-54) years with 37.14% (13/35) and antibody had the highest prevalence within range age 55years old and over with 13/17 (76.47%) without statically significant (P>0.05). Meanwhile, this antigen prevalence was more observed in participant with no formal education (50%; 1/2). The study of Agbor et al shows a high antigen prevalence of 53.2%, antibody of 42.34% in the study population aged > 50years and the prevalence of the infection decreased with increasing level of education with highest (80%, 20/25) prevalence among those with no level of education (P<0.05). The difference observed could by be explain by the study population. Futhermore, this may imply a lack of knowledge, attitude, and practices, which predisposes them more to infection as they aged. Moreover, this may reflect infection acquired in childhood and borne throughout life.[12,25]

There was no statistically signifcant diference between HPI prevalence results and risk factors such as family income and family size. Several studies have been published on risk factors for infection, but the findings have been conflicting. Generally, the infection has been shown to be higher among those with low socioeconomic and hygiene state.[26] So, previous studies show the statistically significant difference between HPI prevalence and the source of income.[20,27] The difference observed can be explained by the sample size, the study population and the methods used to detect the *H. pylori*. Moreover, the poverty is considered as a factor of high prevalence of infectious diseases.

The antigen prevalence was statistically associated with source of cooking water (P=0.02). This could reflect the presence of *H. pylori* in water from all sources, and even in the environment in general, especially since even hand washing at any time and especially before, after the meal. Several studies show the relation between HPI prevalence and risk factors such as source of cooking or drinking water.[28]

Study limitations

In the current study, the principal limitation is the Rapid Diagnostic Tests (RDTs) used to detect the present of *H. pylori* in stool and serum. In the first hand, the reagents used were designed for the qualitative screening test. Therefore, the concentration of *H. pylori* cannot be determined by this qualitative test. In the other hand, serologic tests are limited by false positivity because of cross-reactions.[17] In addition, the people recruited in this study were consulting for signs and symptoms of chronic gastritis. Therefore, the spatiotemporal results of this study cannot be generalized to represent the prevalence and risk factors of *H. pylori* in the general population of Cameroon. Then the study need to be performed in the other health district using an invasive method such as Rapid Urease Test (RUT) and histology.

Conclusion

The present study was performed to investigate prevalence and associated risk factors of *H. pylori* infection among gastritis symptoms patients attending Ad-Lucem Obobogo Hospital. The result of this study reveals a high prevalence of HPI using the non-invasive techniques (serology and stool antigen). This prevalence was more represented in male. The risk factors such as education level and source of cooking water were associated to infection.

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Competing interest

The author declare that they have no competing interests.

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