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Original Research Article

Seroprevalence and the factors associated with *Helicobacter pylori* infection among adolescent students in Tiko municipality, Southwest region of Cameroon

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ABSTRACT

Background: *Helicobacter pylori*, a gram-negative oncogenic coccobacillus, and micro-aerophilic bacterium requires environments containing oxygen at a low partial pressure. Although many carrier individuals are asymptomatic, long-term exposure to this bacterium can contribute to the pathogenesis and progression of peptic ulcers, chronic gastritis and stomach cancers in adulthood.
Method: A school based cross-sectional study was carried among 180 adolescents chosen conveniently. Descriptive and multivariate logistic regression analyses were performed to determine the factors associated with this infection.
Results: The 180 participants were aged 17.27 ± 1.48 years on average. Of these, blood sample from 96 (53.3%) tested positive for *H. pylori* antibodies. Three factors were significantly associated with this sero-prevalence. Compared to individuals consuming 3-4 meals daily, those taking only 1-2 meals per day had approximately 2.5 times higher odds of infection (aOR= 2.48, 95% CI 1.347-4.588, p = 0.004). Participants using a pit toilet system had higher odds of infection relative to those using a flushing system (aOR = 1.93, 95% CI 1.042-3.597, p = 0.037). Additionally, alcohol consumption was associated with higher odds of *H. pylori* infection (aOR = 1.98, 95% CI 1.083-3.636, p = 0.027).
Conclusion: *H. pylori* sero-prevalence was found to be high and associated with low dietary frequency, pit toilets use, and the consumption of alcohol. Hence, health interventions targeting nutrition, environmental sanitation, and behavioural change would contribute to reduce the risk of exposure of adolescent population to *H. pylori* infection.

Keywords: Sero-prevalence, *Helicobacter pylori*, Adolescents, Cameroon

INTRODUCTION

Helicobacter pylori is classified as a group one carcinogen, a gram-negative coccobacillus, and micro-aerophilic as they require environments containing oxygen at a partial pressure lower than that of atmospheric oxygen.[1] This bacterium has been linked to the pathogenesis and progression of gastrointestinal diseases such as peptic ulcers, chronic gastritis and stomach cancers, although many individuals with this organism remain without symptoms.[2] The association of *Helicobacter pylori* with gastric cancer and peptic ulcer disease plays a significant role in the global morbidity, mortality and health-care costs. Furthermore, inequalities in the socioeconomic status, such as reduced access to health care, sanitation and household crowding, still continue to sustain transmission cycles in endemic areas.[3-5] This bacterium is known to be higher in developing

countries due to conditions that favour the infection. The primary modes of transmission are known to be oral-oral and faecal-oral routes. The prevalence of this infection differs by geographic locations as well as the demographic characteristics of the population. However, this difference is due to environmental factors that facilitate the transmission and the spread of the infection within the population.[6] Studies have pointed out unpredictability in the prevalence rates for *H. pylori* infection and diseases associated with it. *H. pylori* infection is rare in developed communities, despite the burden of gastric cancer in some populations. This suggests that other factors beyond *H. pylori* infection play a crucial role in the progression of gastric cancer, such as, alcohol consumption, diet and smoking.[7] Previous studies in this area have focused only on adults and symptomatic patients of gastrointestinal issues. As a result, data is lacking on the prevalence of *H. pylori* infection among adolescent groups. This shows a significant gap and the need for targeted research among adolescents who may be silent carriers and reservoirs of transmission.[8] Data is therefore needed for early intervention and better management of the infection before it becomes chronic. This study therefore, sought to determine the seroprevalence and the factors associated with *H. pylori* infection among adolescent students in Tiko municipality, Southwest region of Cameroon.

METHODS

Study design and settings

A school-based cross-sectional study was carried out in a Government Bilingual High School in Tiko, Southwest region of Cameroon, from February to April 2025.

Study population and selection criteria

Adolescent students age 15-20 years attending the Government Bilingual High School in Tiko who provided assent and whose parent /guardian signed consent to participate were eligible for the study. Those with a history of gastrointestinal disease other than gastritis, and those who had taken any antibiotics within the last thirty (30) days were excluded

Sampling

This study used a convenient sampling approach to recruit a total of 180 adolescents in a Government Bilingual High School in Tiko. The sample size was calculated using Cochran's formula.

$$n = \frac{Z^2 p(1-P)}{e^2}$$

*For a z value of 1.96 as the standard normal variate at the 95% confidence level, the error margin is 5% (e), and the prevalence is 23%.[9] A minimum sample size of 118 participants was required.

Specimen collection and processing

Approximately 25 µl of capillary whole blood was collected aseptically by finger prick using sterile single-use lancets after disinfection of the puncture site with 70% alcohol from adolescents with the approval of their parents. The blood was immediately transferred into the specimen well of an *H. pylori* antibody rapid test cassette, followed by the addition of two drops (approximately 70 µl) of assay buffer. The presence of anti-*Helicobacter pylori* antibodies was determined using a lateral flow immunochromatographic rapid test based on the double-antigen sandwich principle. During migration by capillary action, anti-*H. pylori antibodies*, if present in the specimen, bound to recombinant *H. pylori* antigen conjugates and were subsequently captured by immobilized *H. pylori* antigens on the test membrane, producing a visible colored line in the test region. An internal procedural control was provided with a coloured line in the control region, which verified the correct chromatographic migration and the amount of the specimen. The manufacturer's instructions were followed for interpreting test results after 15 minutes and test results were not read beyond 20 minutes. Samples that had both control and test lines were interpreted as positive for *H. pylori* antibodies, and those that had only the control line were interpreted as negative. Tests which did not show a visible control line were considered to be Invalid and re-tested on a fresh test cassette. Quality assurance procedures involved checking storage conditions, lot numbers and expiry dates of the reagents prior to testing, and the inclusion of positive and negative control materials to ensure the performance of the assays.

Data management and analysis

The data were entered into Microsoft Excel 2015 and cleaned. The cleaned data were then analysed using the Statistical Package for Social Sciences (SPSS version 26), with descriptive statistics presented as frequencies and percentages. A chi-square test was used to test associations, and logistic regression analysis was used to identify predictors of H. pylori infection. A chi square test of independence was conducted, and variables with p values ≤0.2 were considered significant for the multivariate model to avoid confounding variables. A multivariate logistic regression model was performed and $p < 0.05$ was used to determine the final predictors. Odds ratio (OR) estimates and confidence intervals (95% CI) with p values <0.05 were considered to be statistically significant.

RESULTS

Socio-demographic characteristics of the study participants

Among the 180 participants, most were within the age range 15–17 years (104, 57.8%),

with a mean age of 17.27±1.48 years. Most were females (92, 51.1%). The predominant religion was Christianity (146, 81.1%), and the most frequently reported parent monthly income bracket was 10,000–50,000 (82, 45.6%) (Table 1).

Table 1: Socio-demographic characteristics of the study participants.

Variables	Category	Frequency (n=180)	Percentage (%)
Age category (years)	15-17	104	57.8
	18-20	76	43.2
Sex	Female	92	51.1
	Male	88	48.9
Religion	Christian	146	81.1
	Islam	34	18.9
Parent monthly income	10000-50000	82	45.6
	60000-100000	44	24.4
	100000-200000	36	20
	>200000	18	10

Prevalence of H. pylori

Out of the 180 participants that were sampled and tested, 96(53.3%) were positive for *H. pylori* infection (Figure 1).

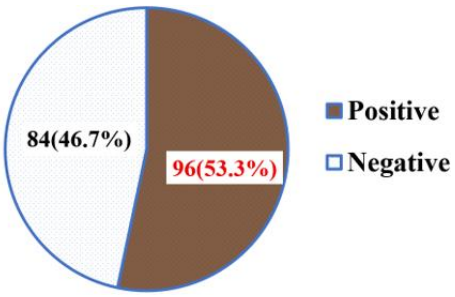

Figure 1: Seroprevalence of *H. pylori* infection.

Distribution of risk factors of H. pylori Infection among adolescents

Regarding potential risk factors for *H. pylori* infection, the majority of participants reported consuming 3-4 meals daily (92, 52.1%). The most common source of drinking water was Cam-water (66, 36.7%), and most households used a flushing toilet system (98, 54.4%). More than half of the participants reported drinking water without boiling or filtering (100, 55.6%), while the majority practiced hand hygiene (115, 63.8%).

Alcohol consumption was reported by just over half of the participants (92, 51.1%), whereas smoking was uncommon (14, 7.8%). The majority of meals consumed were home-cooked (112, 62.2%) (Table 2).

Table 2: Descriptive analysis of risk factors of *H. pylori* infection among adolescents.

Variables	Category	Frequency (n=180)	Percentage (%)
Frequency of daily meals	1 - 2	88	48.9
	3 - 4	92	52.1
Source of water	Borehole	44	24.4
	Tap water	66	36.7
	Mineral water	30	16.7
	Stream	40	22.2
Type of toilet system	Flushing system	98	54.4
	Pit toilet	82	45.6
Drinking water without boiling/ filtering	No	80	44.4
	Yes	100	55.6
Frequency of hand hygiene	No	47	26.2
	Sometimes	18	10
	Yes	115	63.8
Alcohol consumption	No	88	48.9
	Yes	92	51.1
Smoking	No	166	92.2
	Yes	14	7.8
Meals mostly eaten	Home-cooked food	112	62.2
	Street food	33	18.4
	Mixed	35	19.4

Factors associated with H. pylori infection

A chi-square test for independence identified four factors significantly associated with *H. pylori* infection. Sex (χ^2=4.290, p=0.038), frequency of daily meals (χ^2=5.900, p=0.015), drinking water without boiling or filtering (χ^2=16.060, p<0.001), and alcohol consumption (χ^2=5.340, p=0.021) each demonstrated a statistically significant relationship. Using a cutoff p value of <0.2 type of toilet system and frequency of hand hygiene was considered significant for the multivariate analysis (Table 3). In the multivariate logistic regression model. Compared to individuals consuming 3-4 meals daily, those taking only 1-2 meals per day had approximately 2.5 times higher odds of infection (aOR=2.48, 95% CI 1.347-4.588, p=0.004). Participants using a pit toilet system had higher odds of infection relative to those using a flushing system (aOR=1.93, 95% CI 1.042–3.597, p=0.037). Additionally, alcohol consumption was associated with higher odds (aOR=1.98, 95% CI 1.083–3.636, p=0.027) of *H. pylori* infection compared to those who does not consume (Table 4).

Table 3: Factors associated with *H. pylori* infection.

Variables	Category	Negative N (%)	Positive N (%)	x^2	P value
Age category (in years)	15-17	54 (54.9)	50 (50.0)	0.490	0.484
	18-20	42 (44.4)	34 (50.0)		
Sex	Female	56 (60.9)	36 (39.1)	4.290	0.038
	Male	40 (45.5)	48 (54.5)		
Religion	Christian	81 (55.0)	65 (45.0)	0.320	0.572
	Islam	16 (47.1)	18 (52.9)		
Parent monthly income (XAF)	10000–50000	46 (56.1)	36 (43.9)	1.690	0.639
	60000–100000	25 (56.8)	19 (43.2)		
	100000–200000	16 (44.4)	20 (55.6)		
	>200000	9 (50.0)	9 (50.0)		
Frequency of daily meals	1–2	28 (31.8)	60 (68.2)	5.900	0.015
	3–4	62 (67.4)	30 (32.6)		
Source of water	Borehole	24 (54.5)	20 (45.5)	1.210	0.749
	Tap water	38 (57.6)	28 (42.4)		
	Mineral water	14 (46.7)	16 (53.3)		
	Stream	20 (50.0)	20 (50.0)		
Type of toilet system	Flushing system	46 (46.9)	52 (53.1)	3.540	0.061
	Pit toilet	50 (61.0)	32 (39.0)		
Meals mostly eaten	Home-cooked food	59 (52.7)	53 (47.3)	2.120	0.347
	Street food	22 (62.9)	13 (37.1)		
	Mixed	15 (45.5)	18 (54.5)		
Drinking water without boiling/ filtering	No	56 (70.0)	24 (30.0)	16.060	<0.001
	Yes	40 (40.0)	60 (60.0)		
Frequency of hand hygiene	No	30 (63.8)	17 (36.2)	3.930	0.141
	Sometimes	11 (61.1)	7 (38.9)		
	Yes	55 (47.8)	60 (52.2)		
Smoking	No	90 (54.2)	76 (45.8)	0.670	0.413
	Yes	6 (42.9)	8 (57.1)		
Alcohol consumption	No	50 (62.5)	30 (37.5)	5.340	0.021
	Yes	46 (46.0)	54 (54.0)		

Table 4: Multivariate analysis of the factors associated with *H. pylori* infection.

Variables	Category	aOR	95% CI		P value
			Lower	Upper	
Sex	Male	2.14	0.182	2.901	0.212
	Female	1	.	.	.
Frequency of daily meals	1–2	2.48	1.347	4.588	0.004
	3–4	1	.	.	.
Type of toilet system	Pit toilet	1.93	1.042	3.597	0.037
	Flushing system	1	.	.	.

Continued.

Variables	Category	aOR	Lower	Upper	P value
Drinking water without boiling/filtering	Yes	1.38	0.754	2.529	0.296
	No	1	.	.	.
Frequency of hand hygiene	Yes	1.41	0.632	3.153	0.399
	Sometimes	1.08	0.382	3.086	0.877
	No	1	.	.	.
Alcohol consumption	Yes	1.98	1.083	3.636	0.027
	No	1	.	.	.

DISCUSSION

The results of this study revealed that 53.3% adolescent students in Tiko municipality were positive for *H. pylori* infection. Multivariate logistic regression analysis revealed, Frequency of daily meals, Type of toilet system and Alcohol consumption as significant predictors of *H. pylori* infection.

Prevalence of H. pylori infection

This study seroprevalence of 53.3% for *Helicobacter pylori* infection is similar to a study carried out by Ndip and colleagues in the Southwest region of Cameroon who documented a stool antigen prevalence of 52.3%.[10] Though the test used in both studies were different, the similarities between reported values maybe be due to socio-economical, geographical and environmental conditions within this region, which includes early exposure to the organism, poor hygiene and sanitation, household crowding.[10] The prevalence observed in our study was similar to another study conducted in the Northwest region of Cameroon with a seroprevalence of 51.5% among dyspeptic patients, but higher than the value of 47% we reported recently using stool-based antigen detection amongst patients with suspected gastritis at a neighbourhood, the Buea Regional hospital.[3] Although this study involved symptomatic patients who are older in age than the adolescent in our present study, the similar prevalence shows that *H. pylori* infection is still a problem in different populations in Cameroon.[11] Conversely, our study seroprevalence was lower than that of Mabeku and colleagues in Yaounde who had a prevalence of 64.4%. this difference may be due to the variations in the diagnostic approaches and the study population.[12] An African comprehensive review of the epidemiology of *H. pylori* infection reported that the prevalence exceeds 50% and may even increase up to 70-90% in different populations, showing a persistence in socio-economic inequalities, poor hygiene, household overcrowding and the lack of access to safe drinking water.[13] The prevalence in this present study is higher than estimate findings from some developed countries in North America and Europe, where prevalence among adolescent population is estimated to be generally below 30%. This lower prevalence is due to improved sanitation and hygiene, availability of portable water, improved housing conditions, smaller household size and higher educational levels.[14]

Factors associated with H. pylori infection

The multivariate logistic regression analysis revealed three factors associated with *H. pylori* infection. Adolescents who consumed one to two meals a day had higher odds of the infection than those who consumed three to four meals a day. The frequency of meals has not been extensively studied as a cause of *H. pylori* infection, but this result is biologically plausible and could be a result of underlying socioeconomic and nutritional susceptibility, not the direct impacts of meal frequency.15 Adolescents who consume fewer meals are more likely to come from food-insecure and financially constrained households, both of which are often associated with areas of overcrowding, lack of sanitation and poor hygienic practices, which promote the spread of *H. pylori* infection.[16] Similar studies in other developing countries have observed nutritional status and low socioeconomic conditions to being associated with and increase in *H. pylori* infection.[12]

Adolescents who used pit toilets had higher odds of the infection than those who used flushing toilets. This finding is in line with the known faecal-oral route of *H. pylori* transmission and highlights the need for environmental sanitation measures to prevent bacterial spread. Unmaintained pit latrines can increase the risk of environmental contamination due to contact with human faeces.[17] The observed association is in line with a previous study in Cameroon that reported a significant association between level of sanitation and *H. pylori* infection, which indicates that sanitation is still one of the key environmental factors associated with *H. pylori* infection.[18] In other African countries, a lack of adequate sanitation facilities and poor waste disposal systems have been consistently linked to increased *H. pylori* prevalence.[4]

Adolescents who consumed alcohol had higher odds of the infection than non-consumers. A similar meta-analysis study done by Du and colleagues also identified alcohol consumption as a factor associated with *H. pylori* infection.[19] This association can be explained by several mechanisms. Excessive alcohol intake may be associated with impaired gastric mucosal integrity, gastric immune response, and gastric microbiota, which may favour colonization and persistence of *H. pylori*.[18]

CONCLUSION

The findings from this study revealed a high seroprevalence of *H. pylori* infection among adolescent students in Tiko municipality, suggesting *H. pylori* infection is still a significant public health problem in this population. Several nutritional, environmental, and behavioural factors were identified as independent predictors of *H. pylori* seropositivity, such as reduced meal frequency, pit toilet systems, and alcohol intake, indicating that nutrition, environment, and behaviour play a role in the risk of infection. The findings highlight the importance of multi-sectoral public health interventions to improve sanitation, encourage health knowledge and behaviour change and also restrict alcohol consumption among adolescent populations. Additional long-term studies are recommended to better understand the transmission dynamics of *H. pylori*, and to inform evidence-based prevention and control efforts in Cameroon, using advanced diagnostic tools that are able to detect active *H. pylori* infection.

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