RESEARCH ARTICLE

SEROPREVALENCE AND RISK FACTORS FOR *HELICOBACTER PYLORI* INFECTION AMONG SCHOOL STUDENTS IN SANA'A CITY, YEMEN

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ABSTRACT

Background and Objectives: *Helicobacter pylori* is the most common bacterial infection affecting more than 50% of the population globally, especially in developing countries, while data on its prevalence in Yemen is still limited. Therefore, the current study aimed to estimate the seroprevalence and risk factors of *H. pylori* among school students in Sana'a city, Yemen.

Methods: A cross-sectional study was conducted in primary and secondary schools in Sana'a during the period from October to December 2021 in which two hundred and ninety-three (293) school students aged 11-21 years were enrolled in this study and tested for *H. pylori* in blood specimens by using a cassette Rapid antibody test. Associated risk factors were collected through a designed questionnaire.

Result: Overall, *H. pylori* antibody was positive in 82/293(27.99%) students. The higher rate of seroprevalence of *H. pylori* antibodies was reported among male students (29.25%; *P*>0.05), age group of 16-21 years (33.69%; *P*<0.05), and secondary students in schools (31.66%; *P*<0.05). Also, the highest rate of *H. pylori* infection was positive among students who drank untreated water (32.61%), consuming of unwashed vegetables (28.71%) and fruits (30.51%), not been infected previously (28.45%), one of their family infected (28.98%), sometimes eating out of home (32.47%), and non-use antibiotics (29.12%) and there was non-statistical significant difference (*P*>0.05). In addition, there were no significant relationships between seropositivity of *H. pylori* and clinical signs and symptoms as well as antibiotic use. Finally, most of the students with blood group (O) had *H. pylori* antibodies (*P* >0.05).

Conclusion: It can be concluded that the increasing rate of *H. pylori* among school students will become a real serious health problem if it is not monitored. Therefore, an effective educational health program is important for the prevention and control of *H. pylori* infection among school students.

Keywords: *Helicobacter pylori*, Seroprevalence, Students, School, Sana'a, Yemen.

INTRODUCTION

Helicobacter pylori (*H. pylori*) is the commonest bacterium widespread in the world that infects more than 50% of individuals and over 80% of individuals infected with this bacterium are asymptomatic[1]. *H. pylori* causes long-term inflammation of the mucous membrane of the stomach representing gastric and duodenal ulcers which progress to develop into gastric cancer if untreated[2,3,4]. Also, it is accountable for iron deficiency anemia, decreasing blood platelet count, fetal deformity, and fetal growth retardation in pregnant women[5]. The acquisition of *H. pylori* infection rises often during childhood that could be referred to as outdoor activities and exposure to potential external sources[6]. Seroepidemiologic reports have revealed that over 50% and 90% of adults in developed and developing countries, respectively, are positive for serum antibodies against *H. pylori*[7]. The route of *H. pylori* transmission is via person-to-person and fecal-oral routes. Also, the overcrowding conditions, inadequate personal hygienic practices, low socioeconomic conditions, lack of waste treatment system, and use of contaminated water are the most factors that contribute to the increasing prevalence of bacterial infection in developing countries[8-13]. In developing countries, school students are at higher risk of *H. pylori* infection due to the mentioned factors.

Numerous studies documented the frequency of *H. pylori* infection among school students in several countries. In Nigeria, Mynepalli *et al.*,[14] found 59% of participating school students had *H. pylori* infection. Also, it was found that 23.6% of examined school students were positive for *H. pylori* infection in Poland[15]. In Yemen, the seroprevalence of *H. pylori* antibodies among children was 9%. The prevalence according to age varied from 0% in children under 2 years to 12.5% in age group 9-10 years. In addition there was a correlation between the amounts of positive antibodies and increasing age. The prevalence rate of *H. pylori* antibodies was also significantly associated with the practice of drinking water from reused plastic jerry cans, with poor mouth hygiene and with co-infection by intestinal parasites[6], but no study has been reported so far among schoolchildren. Therefore, the current study aimed to detect *H. pylori* infection among school students in Sana'a city, Yemen.

MATERIALS AND METHODS

Study area and period
This study is a cross-sectional study carried out at primary and secondary schools in Al-Meaen and Al-Thourah districts during the period from October to December 2021.

Sample size
Two hundred and ninety-three (293) blood specimens were randomly sampled from school students aged between 11-21 years old who attending the primary and secondary schools in Sana'a city.

Data collection
The required data were collected from enrolled school students by using a structured questionnaire. The data that included in the questionnaire such as gender, age, study level, parents' educational status, family size, source of drinking water, consumption of raw vegetables and fruits, hand washing after defecation, infected previously, one of your family infected, and eating food out home were interviewed. Also, the clinical signs and symptoms such as heartburn, nausea, regurgitation, heartburn and regurgitation, abdominal pain, and weight loss as well as antibiotics used were obtained. The questionnaire was constructed in Arabic and translated into English. The students have voluntarily participated into this study. The age group was divided into a group that included; children (11-15 years) and adolescents (16-21 years).

Inclusion and exclusion criteria
The students who signed informed consent and delivered blood specimens were included. In contrast, the students who refused to full the questionnaire and sign the informed consent were excluded.

Specimen's collection and examination
About five mL of blood specimens were sampled from each student by venipuncture and transferred into a clean tube containing no anticoagulant. The detection of *H. pylori* antibody was performed by using the rapid test of ACON *H. pylori* Ab Test Cassette (ACON Laboratories, Inc, USA). One drop of whole blood was placed cassette test. Also, the blood group was assessed for each student.

Ethical statement
The ethical declaration of the this work was permitted by the Ethics Committee of the Gulf University For Science and Technology, Yemen and authorized by the Education office that belong to Sana'a capital of Yemen. Additional, the consent form that signed by the participants or investigator teams was obtained.

Statistical analysis
The data were statistically analyzed using SPSS program (SPSS version 18.0). A significant difference between the variables was determined by *P*-value (<0.05) that was considered statistically significant.

RESULTS

Participated characteristics
In present result, 53.54% of the study participants were female students and 62.8% are between 16-21 years old. And (67.9%) of participants were studying in high school. (35.49%) of students' parents hold a high school certificate.

Table 1: Socio-demographic of schoolchildren participating in a study.

Variables		Examined No. (%)	Variables		Examined No. (%)
Gender	Male	137(46.76)	Consumption of raw vegetables	Yes	101(34.47)
	Female	156(53.24)		No	192(65.53)
Age (in years)	11-15	109(37.20)	Consumption of raw fruits	Yes	118(40.27)
	16-21	184(62.80)		No	175(59.73)
Study level	Primary	94(32.1)	Hand washing after defecation	Water and soap	238(81.23)
	Secondary	199(67.9)		Water only	55(18.77)
Parents' educational status	Illiterate	51(17.41)	Infected previously	Yes	54(18.43)
	Primary	49(16.72)		No	239(81.57)
	Secondary	104(35.49)	One of your family infected	Yes	138(47.1)
	Graduate	89(30.38)		No	155(52.9)
Family size	3-7	148(50.51)	Eating food out home	Always	111(37.88)
	8-12	106(36.18)		Sometimes	77(26.28)
	13-16	39(13.31)		Rare	105(35.84)
Source of drinking water	Treated water	247(84.3)	Antibiotics used	Yes	87(29.69)
	Not treated	46(15.7)		No	206(70.31)

Table 2: Clinical signs and symptoms characterization.

Variables		No. examined (%)
Heartburn	Yes	142 (48.46)
	No	151(51.54)
Nausea	Yes	133(45.39)
	No	160(54.61)
Regurgitation	Yes	90(30.72)
	No	203(69.28)
Heartburn and regurgitation	Yes	134(45.73)
	No	159(54.27)
Abdominal pain	Yes	141(48.12)
	No	152(51.88)
Weight loss	Yes	98(33.45)
	No	195(66.55)

Also, 50.51% are living with family sizes between 3-7 individuals and drinking treated water (84.3%) as well as consuming unwashed vegetables (65.53%) and fruits (59.73%). In addition, 81.23% are washing their hands after defecation and didn't infect previously (81.57%). And no one of their family infected (52.9%), always eating food out home, and didn't use antibiotics (70.31%) as summarized in Table (1). Table 2 shows that most of the specimens were collected the students did not suffer from clinical signs and symptoms such as heartburn, nausea, regurgitation, heartburn and regurgitation, abdominal pain, and weight loss.

Seroprevalence of *H. pylori* antibodies
The present result showed that the sero-prevalence of *H. pylori* antibody was 82(27.99%) reported among participating students. While 211(72.01%) specimens were negative for *H. pylori* antibody (Figure 1).
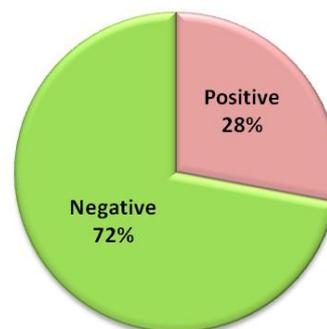
Figure 1: Seroprevalence of *H. pylori* antibody.

Seroprevalence of *H. pylori* and its associated risk factors
The existing finding revealed that male students had a higher rate (29.25%) of *H. pylori* antibodies than females with a statistically non-significant difference (P=0.221). The result according to the age, the age group of 16-21 years had the highest *H. pylori* anti-bodies with 33.69% when compared to age group of 11-15 years with 18.34% with a statistically significant difference (P=0.031).

Table 3: Seroprevalence of *H. pylori* and according to associated risk factors.

Variables		Examined No. (%)	Infected No. (%)	*P* value
Gender	Male	137(46.76)	43(29.25)	0.221
	Female	156(53.24)	39(25)	
Age (in years)	11-15	109(37.20)	20(18.34)	0.031
	16-21	184(62.80)	62(33.69)	
Study level	Primary	94(32.1)	19(20.21)	0.042
	Secondary	199(67.9)	63(31.66)	
Parents' educational status	Illiterate	51(17.41)	11(21.57)	0.307
	Primary	49(16.72)	15(30.61)	
	Secondary	104(35.49)	28(26.92)	
	Graduate	89(30.38)	28(31.46)	
Family size	3-7	148(50.51)	45(30.40)	0.436
	8-12	106(36.18)	30(28.30)	
	13-16	39(13.31)	7(17.95)	
Source of drinking water	Treated water	247(84.3)	67(27.12)	0.449
	Not treated	46(15.7)	15(32.61)	
Consumption of raw vegetables	Yes	101(34.47)	29(28.71)	0.841
	No	192(65.53)	53(27.60)	
Consumption of raw fruits	Yes	118(40.27)	36(30.51)	0.431
	No	175(59.73)	46(26.28)	
Hand washing after defecation	Water and soap	238(81.23)	70(29.41)	0.260
	Water only	55(18.77)	12(21.82)	
Infected previously	Yes	54(18.43)	14(25.92)	0.710
	No	239(81.57)	68(28.45)	
One of your family infected	Yes	138(47.1)	40(28.98)	0.720
	No	155(52.9)	42(27.09)	
Eating food out home	Always	111(37.88)	35(31.53)	0.087
	Sometimes	77(26.28)	25(32.47)	
	Rare	105(35.84)	22(20.95)	
Antibiotics used	Yes	87(29.69)	22(25.28)	0.505
	No	206(70.31)	60(29.12)	

*Significant statistics at *p*-value <0.05.

Table 4: Clinical signs and symptoms associated with *H. pylori* infection.

Variables		No. examined (%)	Infected No. (%)	*P* value
Heartburn	Yes	142 (48.46)	35(24.65)	0.218
	No	151(51.54)	47(31.13)	
Nausea	Yes	133(45.39)	30(22.56)	0.059
	No	160(54.61)	52(32.5)	
Regurgitation	Yes	90(30.72)	21(23.33)	0.239
	No	203(69.28)	61(30.05)	
Heartburn and regurgitation	Yes	134(45.73)	32(23.88)	0.152
	No	159(54.27)	50(31.45)	
Abdominal pain	Yes	141(48.12)	39(27.66)	0.905
	No	152(51.88)	43(28.29)	
Weight loss	Yes	98(33.45)	29(29.59)	0.666
	No	195(66.55)	52(26.67)	

*Significant statistics at *p*-value <0.05.

Also, it was detected that students attending secondary schools (31.66%) and whose parents graduated from university (31.46%) were more infected by *H. pylori* bacterium. Regarding family size, these findings showed that a higher rate of *H. pylori* antibodies was recorded among a small number of family sizes (3-7) at 50.51% (Table 3). However, a higher rate of seroprevalence of *H. pylori* antibodies was recorded among students who drank untreated water (32.61%), consuming of unwashed vegetables (28.71%) and fruits (30.51%), washed their hands after defecation with water and soap (29.41%), not infected previously (28.45%), one of their family infected (28.98%), sometimes eating out of home (32.47%), and didn't use of antibiotics (29.12%) (Table 3). Table 4 shows that the seroprevalence of *H. pylori* antibodies was higher among students who did not suffer from heartburn (31.13%), nausea (32.5%), regurgitation (30.05%), heartburn and regurgitation (31.45%), and abdominal pain (28.29%) with non-statistical differences (*P* >0.05). In contrast, the student with weight loss had more prevalence rate of *H. pylori* antibodies at 29.59%.In the present result regarding the blood group, it was noticed that the higher rate of *H. pylori* antibodies was 30.43% recorded among students who had blood group (O) as listed in Table 5.

Table 5: Seroprevalence of *H. pylori* antibodies in relation to blood group.

Blood group	No. examined (%)	Infected No. (%)	*P* value
A	120	33(27.5)	
O	138	42(30.43)	0.287
B	29	6(20.69)	
AB	6	1(16.67)	

*Significant statistics at *p*-value <0.05.

DISCUSSION

The current study showed that the overall positive prevalence of *H. pylori* antibodies was 27.99% among school students. This is consistent with studies reporting the prevalence of *H. pylori* antibodies among schoolchildren in the city of Makkah, Saudi Arabia (27.4%)[16], as well as in southwestern Uganda (24.3 %)[17], and in Gruziadz, Poland (23.6%)[15]. However, the lower rate of *H. pylori* antibodies was recorded in the Sana'a city (9%)[6], in Taiwan (15.1%)[18], and in East of Sudan (21.8%)[19]. In contrast, the higher rate was reported in Yemen at 43.9% in Sana'a[20], 68% in Hodeidah[21], 75.8% in Dhamar[22], and 55.8% in Iraq[23]. This result found that male students had a higher rate of *H. pylori* antibodies than females and were not statistically significant (*P*=0.221). This finding is similar to a report by Abbas *et al*.,[19]. In contrast, this finding is not constant with several reports that showed that female students had a higher rate of *H. pylori* infection[21,22]. These findings indicate that the higher rate was found among male students might be referred to activities performed outdoor which make them more exposed to potential external sources

of *H. pylori* through eating contaminated foods due to fast food retailers or street vendors with inadequate hygienic practices. The present work indicated a high rate of *H. pylori* antibodies in the age groups of 16-21 years with insignificant differences (*P*=0.031). In similar study was conducted in Hadhramout, Yemen by Bin-Hameed and Barajash[9] who noticed the older age group had a higher rate of *H. pylori* antibodies. Also, Mehata *et al*.,[24] revealed that the highest rate of *H. pylori* infection was reported among age group 15-19 years old. In the present finding, it was found that the students with secondary school education level were more positive for *H. pylori* antibodies and significant association. A study by Bin-Hameed and Barajash[9] revealed that the participated students educated at primary and high schools account for the majority of the positive results for *H. pylori* and there were non-statistical significant difference.

This work found that students whose parents graduated from the university were more infected by *H. pylori* bacterium and this is in agreement with the study by Mynepalli *et al*.,[14]. The high rate of *H. pylori* prevalence indicates that the education level did not influence the decrease in the transmission of pathogenic microorganisms in Yemen. Also, some

reports mentioned that most individuals educated at the university level may lack awareness of the way pathogens are spread and transmitted[25,26]. With respect to family size, in current result findings revealed that the small-sized families number of family sizes (3-7 persons) were shown to have higher *H. pylori* antibodies with a non-statistical difference. This result is different than most of the reports carried out in different countries that proved that a large family size is more acceptable for the acquisition of *H. pylori* infection but didn't play an important role in *H. pylori* transmission between family individuals[27,28].

The highest rate of *H. pylori* antibodies in the present study was observed among students who drank untreated water, consuming of unwashed vegetables and fruits, and washed their hands after defecation with water and soap, and there was no statistically significant difference. The results of this study are supported by Abebaw *et al.*,[28] and Mynepalli *et al.*,[14].

Yemen is a developing country where more than 90% of households lack the use of a safe water supply. They depend on obtaining water from surface rivers and water tanks which are available to everyone and more potentially contaminated by pathogenic micro-organisms[29,30]. Consumption of raw vegetables plays an important role in transmitting pathogenic micro-organisms in Yemen[31-33]. Most students who were positive for *H. pylori* antibodies in exiting work was not infected previously and one of their family infected as well as sometimes eating out of home and didn't use antibiotics with non-statistical significant differences. These results are consents with several reports conducted in different countries[21,22,27].

Some reports documented that the antibiotics used were observed to be a significant risk factor for *H. pylori* infection[34,35]. *H. pylori* resistance to antibiotics is an increasing trend due to the overuse and mis-treatment worldwide of antibiotics, especially in developing countries, for the treatment of other infections[36-40] and resulting in falling success rates of *H. pylori* eradication and treatment[41-44]. The sero-prevalence of *H. pylori* antibodies was higher among students who did not suffer from clinical signs and symptoms with non-significant differences and this result is similar to some studies[9,15,43]. *H. pylori* infection in many children may be asymptomatic throughout life[45,46]. According to the blood group, the present result revealed that a higher rate of *H. pylori* antibodies was reported among students possessing blood group (O) with non-statistically significant differences. In similar, Al-Kadassy *et al.*,[21] found that the higher prevalence of *H. pylori* antibodies was among students with blood group (O) and non-significant differences.

LIMITATIONS

The limitations of the present work are represented in the sample size collected from some schools due to limited resources and equipment as a result of the economic circumstances in Yemen. In addition, the lack of advancing diagnostic techniques capable of accurate diagnosis and expensive commercial kits.

CONCLUSION

The higher seroprevalence of *H. pylori* antibodies among school students is considered a threat to the health of the population in the future if it is not controlled. So, applying of health awareness program among school students that will be enhancing their hygienic practices as well as improve the water and sanitation system might decrease the risk of prevalence of *H. pylori* bacterium among schoolchildren in Yemen.

CONFLICT OF INTEREST

The author declares that this article's content has no conflict of interest.

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