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RESEARCH ARTICLE

SEROPREVALENCE OF *HELICOBACTER PYLORI* AND HEPATITIS A VIRUS AMONG ORPHANAGE CHILDREN IN SANA'A, YEMEN

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Abstract

Background: The epidemiological association between *Helicobacter pylori* (*H. pylori*) and hepatitis A virus (HAV) has been evaluated by different groups with conflicting conclusions.
Aims: The aim of this study was to determine the prevalence of hepatitis A virus and *H. pylori* infection among children of an orphanage in Sana'a, and to identify the socio-demographic factors associated with their prevalence, both individually and simultaneously.
Methods: This is a cross-sectional study carried out among 200 orphaned children who lived at Ahmed's orphanage in Sana'a City, Yemen during the period from October 2022 to February 2023. The stool and blood specimens were collected and the required data were filled in pretested questionnaire. By using the immunochromatographic assay technique, the seropositivity of the HAV antibody was screened in blood plasma while the *H. pylori* antigen was detected in stool. The obtained results were analyzed using SPSS software.
Results: Out of 200 participants; 2(1%) were positive for anti-HAV and 63(31.5%) for *H. pylori* antigen. The HAV and *H. pylori* infections, respectively, were significantly higher in the group aged 10-12 and 13-15 years, attending a primary and preparatory school, living with 3-5 individuals/room, their family infected with hepatitis A and *H. pylori*, and received a blood transfusion. The high risk of hepatitis A infection was in children who their family was infected by HAV and received a blood transfusion while *H. pylori* was in subjects who had a history of hospitalizations and whose family infected by *H. pylori*.
Conclusion: The high number of children suffering from both *H. pylori* and HAV antibodies among orphans in Sana'a indicates a high prevalence rate in the community. It is possible that this high prevalence reflects a prevalence specific to this group or age, and this connection is real.
Keywords: *Helicobacter pylori* (*H. pylori*), Hepatitis A virus (HAV), Orphanage, Prevalence, Sana'a, Yemen.

INTRODUCTION

Helicobacter pylori (*H. pylori*) infection is currently recognized as a worldwide health problem and causes morbidity and mortality. Globally, *H. pylori* have infected about half of the total population (50%) and nearly one-third (32.3%) of all children, particularly in low-incoming nations[1-3]. *H. pylori* is the main cause of peptic ulcer disease which progress to develop into gastric cancer. The signs and symptoms associated with *H. pylori* infection are abdominal pain, nausea, belching, bloating, and sometimes vomiting. Also, the complication resulting from persistent infection can lead to iron deficiency anemia, decreasing blood platelet count, mental deficiency, birth defects, and fetal stunted growth in pregnant women[4-6].

Hepatitis A virus (HAV) is considered one of the endemic infectious diseases worldwide and is usually asymptomatic in younger children (<6 years) and symptomatic in older children and adults. It infects the liver and can range in severity from a mild illness to a severe illness. Internationally, it was estimated by the World Health Organization (WHO) that approximately 1.4 million new cases of HAV infection and about 100 thousand people die resulting from acute HAV infection are reported each year[7-9]. Some studies suggested their association between *H. pylori* and HAV in epidemiology, transmission routes, age-specific seroprevalence, and acquisition of infection. The high incidence of both *H. pylori* and HAV are reported in populations with low economic status, high density of living, low levels of education, poor hygiene practices, one of a family infected, unsafe water or foods, lack of drinking water, and poor sewage system [10-13]. The acquisition of *H. pylori* and HAV infections occurred during childhood suggesting another association between these types of infection[14-16]. Several reports documented the prevalence of HAV and *H. pylori* infections within the same study area in some countries[15-18]. Yemen is ranked as one of the poorest low-income countries in the world. According to recent reports, about 79% of the total population lives under the poverty line and approximately 65% of these individuals are classified as awfully poor [19].In addition, the majority of Yemenis are without clean drinking water, inadequate sanitation, absence of institutional stability, food insecurity, severe malnourishment, loss of livelihoods and income, inadequate hygienic practices, and inadequate access to healthcare services are factors contributing to increasing exposure to infectious diseases[20-24].

Up-to-date, most of the studies conducted in Yemen interested in the prevalence of hepatitis A virus or *H. pylori* independently[25-27], and only one study has determined hepatitis A virus and *H. pylori* infections among schoolchildren in Yemen[27]. So, this study was intended to find out the seroprevalence and association of *H. pylori* and HAV infections among orphanage children in Sana'a-Yemen.

MATERIALS AND METHODS

Study design and period

This is a cross-sectional study conducted at Sana'a Orphanage which is situated on Taiz Street belonging to Al-Sabeen District, Sana'a City, Yemen between October 2022 to February 2023. The experimental analysis was done at the Medical lab. at Queen Arwa University (QAU).

Sample size

The sample size consisted of 200 samples collected randomly of orphaned children aged between 7-15 years who lived in the Sana'a orphanage.

Data collection

The questionnaire was intended to gather the required data from each study subject enrolled in this study. The questionnaire inquired about the age, educational level (either primary or preparatory school), number of children in the room, contact with flood water, infected before by hepatitis A/*H. pylori*, family history of hepatitis A virus/*H. pylorus*, hospitalizations, surgical operation, blood transfusion, drinking water source, eating vegetables/fruits after washing, washing hand after defecation, and vaccinated for hepatitis A. Moreover, signs and symptoms such as jaundice, fever, headache, weakness, heartburn, regurgitation, heart-burn, and regurgitation were gathered through face-face interviews. Questionnaires were filled out by the orphan children or investigators teams.

Inclusion and exclusion criteria

The participants who lived in Ahmed's orphanage, signed the declaration of agreement, and bring blood and stool samples were included in this study. On the contrary, the participants who didn't reside in Sana'a orphan, refuse to sign conscious consent, and did not correctly collect the required specimens were completely excluded.

Blood and stool specimen collection

The blood specimens (3 mL) were collected from each subject and transported into an anticoagulant tube. In addition, the collection of stool specimens was achieved by giving each participant a clean, dry, codded, and screw-cap container and instructing them on how to collect and set aside the specimens properly. The collected specimens were transported immediately to the medical laboratories at QAU for examination.

Laboratory examination

The immunochromatographic assay technique (rapid test) was used to assess the anti-HAV and *H. pylori* antigen. The screening of HAV antibody in prepared plasma was performed by a commercially available Cassette (Healgen Scientific Limit., US) according to the manufacturer's instructions. Also, the seropositivity of *H. pylori* antigen in stool specimens was performed by using the *H. pylori* Ag Test Cassette (Safecare Bio-Tech Hangzhou Co., UK) based on the manufacturer's instructions.

Ethical declaration

The ethical declaration of this project was permitted by the QAU Ethical Review Committee and approval for sample collection was also obtained from the orphanage administration based on the university's letter. Further, the purpose and objectives of this work were explained briefly to all orphans' children and administrative staff working in the orphanage before specimen collection.

Statistical analysis

All variables were categorical and presented as counts and percentages in tables. The SPSS program (version 26) was used to determine the Odds ratio (OR), Chi-square test (χ^2), and 95% Confidence interval (CI). Pearson's chi-square test was used to evaluate the relationship between *H. pylori* antigen and HAV seropositivity with risk factors. The comparison between the seroprevalence of *H. pylori* antigen and HAV was analyzed by Logistic regression. Also, the relationship between *H. pylori* and HAV infection with age was calculated by linear association. A *p*-value less than 0.05 was regarded as significant.

RESULTS

Socio-demographic characterization

A total of 200 orphan children participated in this study aged between 7-15 years, with a mean age of 12.7 years. Most of the study subjects were aged 13-15 years (65%), attended a preparatory school (58%), lived in a room with children size between 9-12 individuals (27%), always contacted with flood water (97%), didn't have a history of hepatitis A (92%) and *H. pylori* (92.5%), no cases in their family hepatitis A (94%) and *H. pylori* (83%), didn't hospitalize 10(90%), surgical operation (83.5%), didn't receive a blood transfusion (93%), and vaccinated against hepatitis A (91%) Table (1).

Table 1. Socio-demographic characterization of study participating in a study.

Variables	Categories	Examined	Rate (%)
Age (in years)	7-9	8	4
	10-12	62	31
	13-15	130	65
Study level	Primary	84	42
	Preparatory	116	58
Number of children in the room	3-5	62	31
	6-8	44	22
	9-12	94	27
Contact with flooding water	Always	194	97
	Sometimes	6	3
History of hepatitis A	Yes	16	8
	No	184	92
History of *H. pylori*	Yes	15	7.5
	No	185	92.5
Hepatitis A cases in the family	Yes	12	6
	No	188	94
H. pylori cases in the family	Yes	34	17
	No	166	83
Hospitalizations	Yes	20	10
	No	180	90
Surgical operation	Yes	33	16.5
	No	167	83.5
Blood transfusion	Yes	14	7
	No	186	93
Hepatitis A vaccinated	Yes	182	91
	No	18	9

Prevalence of Hepatitis A antibody and *H. pylori* antigen

This result reported that the seropositivity rate of HAV antibody and *H. pylori* antigen, respectively, were 2(1.0%) and 63(31.5%) recorded among the orphan children (Figure 1).

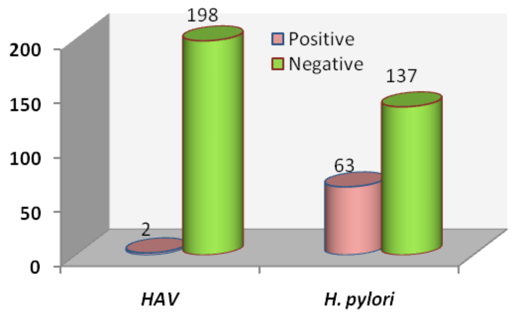

Figure 1: Prevalence of HAV antibody and *H. pylori* antigen.

Risk factors associated with anti-HAV and *H. pylori* antigen

The current result revealed that the prevalence rate of HAV antibody and *H. pylori* antigen, respectively, was detected in the group aged 10-12 years (3.2%; *p*=0.125) and13-15 years (40%; *p*=0.000), attending a primary (2.4%; *p*=0.096) and preparatory school (41.4%; *p*=0.000). Also, the higher rate of anti-HAV and *H. pylori* antigen was found among children who lived in a room containing between 3-5 individuals (1.6% and 35.5%, respectively) and always contact with flooding water (1% and 31.9%, respectively) (Table 2).

However, the hepatitis A antibody was observed among children who had and their families a history of HAV at 12.5%, and 16.67%, respectively, (*p*=0.000), and had (6.7%; *p*=0.022) and their families didn't have a history of *H. pylori* (5.9%; *p*=0.522), non-hospitalized (1.1%; *p*=0.638), and had a surgical operation (6.1%; *p*=0.001). While *H. pylori* was among subjects didn't have (33.7%; *p*=0.023) and their families a history of HAV infection (33%; *p*=0.075), didn't have a history of *H. pylori* (31.9%; *p*=0.677), *H. pylori* cases in their family (58.8%; *p*=0.000), hospitalized (60% *p*=0.004), and didn't subject to surgical operation (32.9%; *p*=0.328) as listed in the Table 2. Furthermore, a higher prevalence of HAV antibody and *H. pylori* antigen, respectively, was observed in participating respondents who received blood transfusion (14.28%; *p*=0.000) and 30.6%; *p*=0.345), drunk treated water (1.4%) and (34%; *p*=0.204). The majority of anti-HAV seropositivity was detected among individuals who eat unwashed vegetables (1.6%) and washed fruits (2.4%), washed their hands after defection (1.1%), and non-vaccinated for hepatitis A (1.11%; *p*=0.657). Whereas *H. pylori* antigen was found among participants who eat washed vegetables (37.3%) and fruits (37.4%), didn't wash their hands after defection (41.2%), and vaccinated for hepatitis A (33.5%; *p*=0.051) as summarized in Table 2. This data showed that the detection of anti-HAV was only reported among participants who suffer from jaundice (25%; *p*=0.000), fever (6.45%; *p*=0.001), headache (1.26%; *p*=0.466), and weakness (2.6%; *p*=0.070). While most of the study subjects who didn't suffer from eye jaundice (32.8%) and headache (33.3%) were positive for *H. pylori* antigen, as well as it, was detected among subjects who had a fever (38.7%) and weakness (34.2%) signs with no significant difference (*p*>0.05) as summarized in Table 3.The anti-HAV was only noticed among participants having signs and symptoms of heartburn (3.3%), regurgitation 2(3.2%), and heartburn and regurgitation 2(5.4%) with statistically significant (*p*<0.05).

Table 2: Frequency of HAV antibody *H. pylori* antigen among study subjects.

Variables	Categories	Examined No. (%)	Hepatitis A		P-value	*H. pylori* antigen		P-value
			+ve n (%)	-ve n (%)		+ve n (%)	-ve n (%)	
Age (in years)	7-9 10-12 13-15	8 (4) 62 (31) 130 (65)	0(0) 2(3.2) 0(0)	8(100) 60(96.8) 130(100)	0.125	0(0) 11(17.7) 52(40)	8(100) 51(82.3) 78(60)	0.000
Educational level	Primary Preparatory	84 (42) 116 (58)	2(2.4) 0(0)	82(97.6) 116(100)	0.096	15(17.9) 48(41.4)	69(82.1) 68(58.6)	0.000
Number of children in the room	3-5 6-8 9-12	62 (31) 44 (22) 94 (27)	1(1.6) 0(0) 1(1.1)	61(98.4) 44(100) 93(98.9)	0.795	22(35.5) 13(29.5) 28(29.9)	40(64.5) 31(70.5) 66(70.1)	0.477
Contact with flooding water	Always Sometimes	194 (97) 6 (3)	2(1) 0(0)	192(99) 6(100)	0.804	62(31.9) 1(16.7)	132(68.1) 5(83.3)	0.430
History of hepatitis A	Yes No	16 (8) 184 (92)	2(12.5) 0(0)	14(87.5) 184(100)	0.000	1(6.3) 62(33.7)	15(93.7) 122(66.3)	0.023
Hepatitis A cases in the family	Yes No	12 (6) 188 (94)	2(16.7) 0(0)	10(83.3) 188(100)	0.000	1(8.3) 62(33)	11(92.7) 126(67)	0.075
History of *H. pylori*	Yes No	15 (7.5) 185 (92.5)	1(6.7) 1(0.5)	14(93.3) 184(99.5)	0.022	4(26.7) 59(31.9)	11(73.3) 126(68.1)	0.677
H. pylori cases in the family	Yes No	34 (17) 166 (83)	2(5.9) 0(0)	32(94.1) 6(100)	0.522	20(58.8) 43(25.9)	14(41.2) 123(74.1)	0.000
Hospitalizations	Yes No	20 (10) 180 (90)	0(0) 2(1.1)	20(100) 178(98.9)	0.638	12(60) 51(28.3)	8(40) 129(71.7)	0.004
Surgical operation	Yes No	33 (16.5) 167 (83.5)	2(6.1) 0(0)	31(93.9) 167(100)	0.001	8(24.3) 55(32.9)	25(75.7) 112(67.1)	0.328
Blood transfusion	Yes No	14 (7) 186 (93)	2(14.3) 0(0)	12(85.7) 186(100)	0.000	6(42.9) 57(30.6)	8(57.1) 129(69.4)	0.345
Source of drinking water	Treated Untreated	147 (73.5) 53 (26.5)	2(1.4) 0(0)	145(98.6) 53(100)	0.396	50(34) 13(24.5)	97(66) 40(75.5)	0.204
Eating vegetables after washing	Yes No	125 (62.5) 75 (37.5)	0(0) 2(1.6)	75(100) 123(98.4)	0.273	28(37.3) 35(28)	47(62.7) 90(72)	0.171
Eating fruits after washing	Yes No	117 (58.5) 83 (41.5)	2(2.4) 0(0)	81(97.6) 117(100)	0.092	31(37.4) 32(27.4)	52(62.6) 85(72.6)	0.135
Washing hand after defecation	Yes No	183 (91.5) 17 (8.5)	2(1.1) 0(0)	181(98.9) 17(100)	0.667	56(30.6) 7(41.2)	127(69.4) 10(58.8)	0.372
Hepatitis A vaccinated	Yes No	182 (91) 18 (9)	0(0) 2(1.1)	182(100) 16(98.9)	0.657	61(33.5) 2(11.1)	121(66.5) 16(88.9)	0.051

In similar, the *H. pylori* antigen was significantly more detected among participants suffering from heartburn (34.4%; *p*=0.557), regurgitation (38.7%; *p*=0.143), and heartburn and regurgitation (56.7%; *p*=0.000) as recorded in the Table 4.

Associations of risk factors with seropositivity of HAV antibody *H. pylori* antigen

Table 5 reveals the association between some risk factors and seropositivity of the HAV antibody *H. pylori* antigen. This finding found that the high risk of HAV infection was in children whose family had a history of HAV cases (*OR*=19.800; *95% CI*=10.824–36.220), followed by receiving blood transfusion (*OR*=16.500; *95% CI*=9.535–28.552), and had a history of surgical operation (*OR*=6.387; *95% CI*=4.623–8.825). In addition, the high risk of *H. pylori* infection was noticed among participant study who were hospitalized (*OR*=3.262; *95% CI*=1.403–7.581). Moreover, the result of logistic regression showed that age was the only factor affecting the prevalence of *H. pylori* significantly. Also, no significant correlation was detected between the seropositivity of anti-HAV and *H. pylori* antigens in this study (Table 6).

Table 3: Hepatitis A and *H. pylori* infection concerning signs and symptoms of Hepatitis A.

Variables		Examined No. (%)	Hepatitis A +ve n (%)	Hepatitis A -ve n (%)	*P*-value	H. pylori +ve n (%)	H. pylori -ve n (%)	*P*-value
Jaundice	Yes	8(4)	2(25)	6(75)	0.000	0(0)	8(100)	0.051
	No	192 (96)	0(0)	192(100)		63(32.8)	129(67.2)	
Fever	Yes	31 (15.5)	2(6.5)	29(93.5)	0.001	12(38.7)	19(61.3)	0.350
	No	169 (84.5)	0(0)	169(100)		51(30.2)	118(69.8)	
Headache	Yes	158 (97)	2(1.3)	156(98.7)	0.466	49(31.)	109(67)	0.775
	No	42 (21)	0(0)	42(100)		14(33.3)	28(66.7)	
Weakness	Yes	76 (38)	2(2.6)	74(97.4)	0.070	26(34.2)	50(65.8)	0.521
	No	124 (62)	0(0)	124(100)		37(29.8)	87(68.2)	

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

Table 4: Hepatitis A and *H. pylori* infection concerning signs and symptoms of *H. pylori*.

Variables		Examined No. (%)	Hepatitis A +ve n (%)	Hepatitis A -ve n (%)	*P*-value	*H. pylori* +ve n (%)	*H. pylori* -ve n (%)	*P*-value
Heartburn	Yes	61 (30.5)	2(3.3)	59(96.7)	0.032	21(34.4)	40(65.6)	0.557
	No	139 (69.5)	0(0)	139(100)		42(30.2)	97(69.8)	
Heartburn and regurgitation	Yes	62 (31)	2(3.2)	60(96.8)	0.034	24(38.7)	38(61.3)	0.143
	No	138 (69)	0(0)	138(100)		39(28.3)	99(71.7)	
Regurgitation	Yes	37 (18.5)	2(5.4)	35(94.6)	0.003	21(56.7)	16(43.3)	0.000
	No	163 (81.5)	0(0)	163(100)		42(25.8)	121(74.3)	

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

DISCUSSION

The acquiring infections of HAV and *H. pylori* are commonly occurring early in the life of childhood and most of them become infected when they reach late adolescence[28,29]. The overall rate of HAV antibody and *H. pylori* antigen were recorded among the orphan children at 1% and 31.5%, respectively. This result is lower than that of the rate of HAV and *H. pylori*, respectively, reported among children at 63% and 87% in Italy[30], 20.5% and 7% in South Korea[31], 31% and 5% in Japan[17], 71.3% and 61.6% in Lebanon[18], 21.1% and 26% in Turkey[32], and higher than reported in Taiwan (6% and 0.8%)[15], and similar to that reported in Yemen before (2.7% and 12.3%) in Sana'a[27].

The difference in prevalence rate may be referred to by some factors such as geographical distribution, size of the sample, study population, hygienic practices, environmental conditions, socioeconomic status, food consumption, and diagnostic techniques employed by the participants.

Table 5: The association between risk factors with seropositivity of anti-HAV and *H. pylori* Ag.

Variables	Hepatitis A virus OR	Hepatitis A virus CI 95%	Hepatitis A virus χ^2	*H. pylori* Ag OR	*H. pylori* Ag CI 95%	*H. pylori* Ag χ^2
Educational level	1.193	0.295–4.816	0.053	1.407	1.021–1.939	0.143
Number of children in the room	N.A	N.A	0.076	N.A	N.A	0.038
Contact with flooding water	1.031	1.002–10.57	0.018	1.021	0.976–1.069	0.056
History of hepatitis A	15.231	N.A	0.341	0.145	0.071–1.016	-0.160
Hepatitis A cases in the family	19.800	10.824–36.220	0.398	0.198	0.023–1.498	-0.126
History of *H. pylori*	N.A	N.A	0.353		1.059–1.191	0.015
H. pylori cases in the family	1.207	1.133–1.286	-0.045	3.107	1.681–5.742	-0.193
Hospitalizations	1.112	1.062–1.166	-0.034	3.262	1.403–7.581	0.205
Surgical operation	6.387	4.623–8.825	0.226	0.696	0.333–1.456	-0.069
Blood transfusion	16.500	9.535–28.552	0.366	1.631	0.591–4.503	0.067
Source of drinking water	1.366	1.255–1.485	0.060	1.121	0.950–1.323	0.090
Eating vegetables after washing	1.610	1.444–1.795	0.078	0.846	0.657–1.088	-0.097
Eating fruits after washing	2.444	2.068–2.890	-0.119	-0.106	0.621–1.079	-0.106
Washing hand after defecation	1.026	1.048–1.142	0.031	0.052	0.951–1.125	0.052
Hepatitis A vaccinated	1.100	1.053–1.150	0.032	0.138	1.017–1.182	0.138

χ^2= Chi-square test. OR=odds ratio, CI 95%=confidence interval, NA= not applicable

Also, the study conducted in Orphanage revealed the decline in hepatitis B virus among study subjects[33] and this may be due to the fact that the environment in which the orphans live, which separates them from the external environment, has contributed significantly to reducing the spread of pathogenic viruses. The high rate of communicable diseases in some parts of Yemen is well-reported[21,34-37]. These data showed that the prevalence rate of anti-HAV was observed in the age group of 10-12 years (3.2%) while *H. pylori* antigen was in the group aged 13-15 years (40%; *p*=0.000). These data are in accordance with the results observed in the preceding reports[27,31]. Several previous reports that had documented a relationship between the HAV and *H. pylori* in transmission routes revealed the seroprevalence of HAV and *H. pylori* increasing simultaneously when increasing age[31,32,38].

H. pylori and HAV, as indicated by a similar pattern of increase in seropositivity with age, may share a common mode of transmission, but changes in environmental conditions make this very difficult if not impossible to prove with seroepidemiological data[32].

The seropositivity rate of HAV was in this result only found among students who attended primary schools (2.4%). Whereas, the *H. pylori* antigen was highly detected in children who attended a preparatory school (41.4%) with a significant difference (*p*=0.000).

Similarly, the low-education individuals in some parts of Yemen were found to be more infected compared to high-educated persons[24,39,40]. Education is a significant social determinant of health. Also, strength of association between educational status and health has been recognized. The effect of education is affecting better general self-awareness of individual health and the creation of healthcare more accessible. Well-educated persons have better health as revealed in the low levels of mortality, morbidity, and disability[41].

Table 6: Logistic regression analysis of anti-HAV and *H. pylori* antigen.

Variables	*H. pylori* Ag			
	Beta	Standard error	*P*- value	CI 95%
Age	0.612	0.058	0.027	0.015–0.244
Hepatitis A	-0.267	0.329	0.417	-0.912–0.381
	Hepatitis A			
	Beta	Standard error	*P*- value	CI 95%
Age	-0.011	0.013	0.404	0.036–0.014
H. pylori	-0.013	0.015	0.417	0.043–0.018
		r=0.338**		

**Regression tests, 95% CI=confidence interval, *p*-value <0.05

However, a higher percentage of HAV and *H. pylori* infections were found in this result in children living in room content between 3-5 individuals (1.6% and 35.5%, respectively). This finding is in agreement with published studies documented that HAV and *H. pylori* prevalence were significantly augmented among individuals when person size per room is increasing[32, 42,43]. Moreover, a study by Bizri *et al.*,[18] indicated that family size is a significant factor in increasing the prevalence rate of *H. pylori* but not to HAV. On the other hand, our result was in disagreement with the results of Kury *et al.*,[44] and Edrees *et al.*,[27].

This report is in agreement with earlier reports[27,43]. Also, the transmitting hepatitis A virus among hospitalized persons was established earlier[45]. This result is in agreement with the observations reported by Pirinççioğlu *et al.*,[43] and Edrees *et al.*,[27]. Mothers play an important role in the transmission of the *H. pylori* bacterium to their children[11].

The current result showed the respondents receiving blood transfusion had a higher rate of anti-HAV (*p<0.05*). This result is in accordance with the result of Edrees *et al.*,[27] where the rate of HAV infection is significantly more among children receiving blood transfusion. The rate of HAV and *H. pylori* seropositivities were found in this project among subjects drunk from treated water. These findings are in apparent disagreement with the results of Edrees *et al.*,[27]. Also, a report by Nassrolahei and Khalilian[46] revealed there was a non-significant relationship between *H. pylori* seropositivity and the source of drinking water. Moreover, transmission routes for *H. pylori* occur mainly oral–oral or faecal–oral route is further most probable while the role of water as a transmission route for *H. pylori* remains unproven[11,47].

The seropositivity of HAV was detected among individuals who eat unwashed vegetables, washed fruits, and washed their hands after defection. This result is concordant with the previous study[27]. Infected persons are able to transmit hepatitis A infection through dirty hands during food preparation to family members[9]. Furthermore, the *H. pylori* antigen was observed in this result among subjects who consumed washed vegetables and fruits. In contrast, the previous results documented that a high rate of anti- *H. pylori* was reported among children who eat unwashed vegetables and fruits and washed their hands after defecation[24,42,49]. The study participants non-vaccinated for hepatitis A showed positive for HAV antibodies at1.11% and this is comparable to outcomes by Wu *et al.*,[15] and Obyyah *et al.*,[39]. The detection of anti-HAV in this work was only observed in subjects suffering from jaundice and fever (*P<0.05*) as well as headache and weakness. This finding is in conformity with Obyyah *et al.*,[39].

In similar, the highest seropositivity of *H. pylori* was detected in this finding among children with heartburn, regurgitation, and heartburn and regurgitation. This result is in consonance with the recent finding[27]. The infection of *H. pylori* in some children may be asymptomatic throughout life[11]. However, the result of this work revealed that the high risk of HAV infection was among children whose families were infected before with HAV (*OR*=19.800; *95% CI*=10.824–36.220), followed by receiving blood transfusion (*OR*=16.500; *95% CI*=9.535–28.552), and had a history of surgical operation (*OR*=6.387; *95% CI*=4.623–8.825). In addition, the high risk of *H. pylori* infection was noticed in participants who were hospitalized (*OR*=3.262; *95% CI*=1.403–7.581) and *H. pylori* cases in the family (*OR*=3.107; *95% CI*=1.681–5.742). Moreover, an insignificant correlation was detected between the seropositivity of anti-HAV and *H. pylori* antigen. This result is in agreement with previous studies[31,32,50].

Limitations of the study

The limitations of this work are including; the small sample size, serologic tests done by rapid tests, and the absence of advanced diagnostic techniques such as Enzyme-linked Immunosorbent assay (ELISA) that is highly accurate and reliable due to limited resources.

CONCLUSIONS

In conclusion, the high seroprevalence of *H. pylori* among study subjects remaining life-threatening to infected individuals when will become adults if not completely eradicated. Also, poor hygiene practices, inadequate awareness, living in overcrowded conditions, absence of institutional stability, and lack of access to safe water may contribute to spread of the HAV and *H. pylori* infections. So, effective preventative measures are important to reduce infections among orphaned children through increasing knowledge about disease transmission, hygiene practices, improving living conditions, and supply of safe water and foods.

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AUTHOR'S CONTRIBUTION

Edrees WH: conceived the project and designed the experiments. **Al-Aomary NM:** collected and analyzed the samples. **Alrahabi LM:** data collection and data analysis. **Thabit JM:** drafting of manuscript. **Ali HM:** Literature survey, analysis of data. **Saran AQ:** data interpretations. **Saleh AAK:** Literature survey. **Al-shaouri EM:** lab work. **Al-Nahdi MT:** methodology, investigation. **Dibwan FA:** data analysis, report drafting. All authors reviewed, revised, and approved the manuscript for submission.

DATA AVAILABILITY

Data will be made available on reasonable request.

CONFLICT OF INTEREST

None to declare.

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