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## Sero-prevalence and factors associated with *Helicobacter pylori* infection in Eastern Sudan

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## PEER REVIEW

## Peer reviewer

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## Comments

This is a very interesting epidemiological point of view that socio-economic factors are associated with the incidence of infection by *H. pylori*. The results show that there is a positive correlation between rural life and the presence of *H. pylori*, which can show the areas that need more attention by the authorities to combat the disease.

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## ABSTRACT

**Objective:** To investigate the prevalence of *Helicobacter pylori* (*H. pylori*) among patients with dyspepsia and to evaluate the correlation between *H. pylori* infection and socio-demographic factors.

**Methods:** This cross-sectional hospital-based study, which ran from June to August 2012, determined seroprevalence of *H. pylori* among adult patients in Eastern Sudan. The presence of *H. pylori* was determined using ELISA.

**Results:** A total of 225 adult Sudanese patients were enrolled in the study. Of these, 148 (65.8%) tested positive for *H. pylori*. In logistic regression analysis, rural residency (OR=3.933, CI=1.337–11.26,  $P=0.01$ ) was the only socio-demographic factor that was associated with *H. pylori* infection. The most common symptoms among seropositive patients were heartburn (OR=30.442, CI=9.478–97.776,  $P\leq 0.001$ ) and/or epigastric pain (OR=28.225, CI=4.365–182.508,  $P\leq 0.001$ ).

**Conclusions:** Clinical suspicion can facilitate the detection of *H. pylori* among patients with dyspeptic symptoms in a geographic area with high prevalence of *H. pylori* infection.

## KEYWORDS

*Helicobacter pylori*, Sero-prevalence, Dyspepsia, Sudan

### 1. Introduction

*Helicobacter pylori* (*H. pylori*) are Gram-negative, micro-aerophilic, spiral, rod-shaped bacteria, which are a major health problem worldwide[1]. More than half of the world's population is infected with this pathogen and humans are considered the only reservoir of infection[2,3]. Gastritis, peptic ulcer, gastric carcinoma and mucus associated lymphoid tissue (MALT) lymphoma are recognized complications of *H. pylori* infection[4,5]. The majority of infected individuals remain asymptomatic; however, 17% of

them will develop manifestations of peptic ulcer disease[6–8]. The exact mode of contracting *H. pylori* infection is unknown, but direct contact between people (oral–oral or faecal–oral) is regarded as the main route of transmission of infection, followed by contaminated sources of water and food[9]. Although the rate of infection in the developed world has decreased to a minimum rate[10], seroprevalence of *H. pylori* has risen to 50% among adults of more than 50 years of age[11]. In developing countries, up to 93.6% of adults are infected with *H. pylori*[12]. The diagnosis of *H. pylori* infection is by either invasive (urease test, culture,

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histology) or non-invasive tests (serology, urea breath test) [13]. Serological tests are used to detect immunoglobulin (IgG) antibodies in the sera of *H. pylori* infected subjects. ELISA is very useful, especially in epidemiological studies[10,14]. In Sudan, the prevalence of infection was estimated to be 80% among patients with gastritis and Barrett's oesophagus[15,16]. However, there have been few published data considering the prevalence of *H. pylori*. Therefore, the aims of this study were to investigate the prevalence of *H. pylori* among patients with dyspepsia and to evaluate the correlation between *H. pylori* infection and socio-demographic factors.

## 2. Materials and methods

### 2.1. Study area and approach

This cross-sectional hospital-based study was carried out between June and August 2011 among patients attending the outpatient clinic at Kassala Teaching hospital, Sudan. The hospital is 400-bed tertiary care facility which serves as a referral centre for Kassala State, Eastern Sudan. The average patient turning over at the hospital is 150–300 patients per day. All patients presented to the outpatients with dyspeptic symptoms during the study period were asked to answer a structured questionnaire consisting of socio-demographic data (age, gender, residence and education) and dyspeptic symptoms, history of smoking and ingestion of non-steroidal anti-inflammatory drugs (NSAIDs). Physical findings (pulse, body temperature, blood pressure, pallor, abdominal tenderness etc.) were also recorded. Peripheral venipuncture (under completely a septic condition) was used to draw 5 mL of blood from each patient. Samples were sent to the laboratory within 5 min, immediately centrifuged and the sera stored frozen at  $-20^{\circ}\text{C}$ . Sera samples were tested for *H. pylori* IgG antibodies using an ELISA kit (Monobind; Inc., California, USA) according to the manufactures' instructions. The cutoff value for positive antibody activity was taken as 20 U/mL. Patients with IgG levels of *H. pylori* less than 20 U/mL were considered *H. pylori* negative. All patients provided written informed consent and none of them refused to participate in the study.

### 2.2. Statistical analysis

Data were entered into our computer database using SPSS software (SPSS® Inc, Chicago, IL, USA, version 15.0) and double-checked before analysis. Univariate and multivariate analyses were performed. Means and proportions for socio-demographic characteristics were compared between the seropositive and seronegative groups of the study using the

student's *t* and  $\chi^2$  tests.  $P < 0.05$  was considered significant. Seropositivity was the dependant variable and the socio-demographic characteristics and the clinical data were the independent variables.

### 2.3. Ethics

The study received ethical permission from the Research Board at the Ministry of Health, Kassala State, Eastern Sudan.

## 3. Results

### 3.1. Patients' characteristics

During the study period, a total of 225 adult Sudanese patients underwent screening for *H. pylori*. The baseline characteristics of the *H. pylori* infected subjects are shown in Table 1. Their mean age was  $(35.7 \pm 11.0)$  years; the majority of patients were female [123 (54.7%)], housewives [72 (32%)] and rural residents [122 (54.2%)]. A history of smoking and regular use of NSAIDs was found in 60 (26.7%) and 65 (28.9%) of patients, respectively. In total, 148 patients showed positive results for *H. pylori* infection, yielding a prevalence rate of 65.8%. The male to female ratio among the reported seropositive patients was 9:10 (71:77).

**Table 1**  
Base line characteristic of patients infected with *H. pylori*.

Variable	Total HP infected patients	HP IgG +ve (148)	HP IgG -ve (77)	<i>P</i>
Gender (female)	123 (54.7%)	77 (52%)	46 (59.7%)	0.323
Age				
<35 yrs	119 (52.9%)	72 (48.6%)	47 (61%)	0.077
35–40 yrs	34 (15.1%)	20 (13.5%)	14 (18.2%)	0.353
41–45 yrs	27 (12%)	21 (14.2%)	6 (7.8%)	0.161
>45	35 (23.6%)	10 (13%)	45 (20%)	0.057
Rural residence	122 (54.2%)	93 (62.8%)	29 (37.7%)	<0.001
Education	85 (37.8%)	57 (38.5%)	45 (30.4%)	0.950
Heart burn	120 (53.3%)	110 (74.3%)	10 (13%)	<0.001
Epigastric pain	205 (91.1%)	146 (98.6%)	59 (76.6%)	<0.001
Smoking	60 (26.7%)	43 (29.1%)	17 (22.1%)	0.340
NSAIDs	65 (28.9%)	45 (30.4%)	20 (26%)	0.537
Vomiting	64 (28.4%)	64 (43.2%)	84 (56.8%)	<0.001

Data was shown as proportion (%),  $n=225$ . HP: *H. pylori*.

### 3.2. Socio-demographic factors associated with *H. pylori* infection

Logistical regression analysis found that rural residency (OR=3.933, CI=1.337–11.26,  $P=0.01$ ) was the only socio-demographic factor that was associated with *H. pylori* infection. The most prevalent symptoms among sero-

positive patients were heartburn (OR=30.442, CI=9.478–97.776,  $P \leq 0.001$ ) and/or epigastric pain (OR=28.225, CI=4.365–182.508,  $P \leq 0.001$ ) (Table 2).

**Table 2**

Factors associated with *H. pylori* infection according to Univariate and multivariate analysis.

Variable	Univariate analysis			Multivariate analysis		
	OR	CI	P	OR	CI	P
Gender (female)	1.368	0.783–2.391	0.271	0.744	0.250–2.218	0.595
Age	0.968	0.943–0.994	0.016	1.001	0.944–1.062	0.965
<35 yrs			0.085			0.440
35–40 yrs	2.285	1.034–5.050	0.041	1.427	0.268–7.584	0.677
41–45 yrs	2.450	0.920–6.528	0.073	2.467	0.464–13.113	0.289
>45 yrs	1.000	0.317–3.151	1.000	3.956	0.496–31.570	0.194
Rural residence	2.799	1.585–4.943	<0.001	3.933	1.337–11.260	0.011
Heart burn	19.395	9.071–41.468	<0.001	30.442	9.478–97.776	<0.001
Epigastric pain	22.271	5.010–99.001	<0.001	28.225	4.365–182.508	<0.001
Vomiting	0.009	0.000	0.997	0.008	0.000	0.996
Education	1.053	0.756–1.466	0.762	0.494	0.212–1.127	0.094
Smoking	1.445	0.758–2.755	0.263	1.283	0.411–4.005	0.668
NSAID	1.245	0.671–2.310	0.487	1.694	0.644–4.456	0.285

OR=odd ratio, IR=confidence interval.

#### 4. Discussion

To our knowledge, the current study is the first study conducted in Eastern Sudan to investigate the prevalence and the impact of socio-demographic factors on the prevalence of *H. pylori* infection. The overall prevalence of *H. pylori* infection in the present study was 65.8% which is lower than that of 80% in patients with gastritis reported by Azim Mirghani *et al*[15]. However, it is higher than recent report from central Sudan where a seroprevalence of 48% has been documented[17]. This comparison should be considered cautiously since our study is serology-based while other study is endoscopy-based. The lower rate of infection in the present study may be explained by improvement in standards of living. The rate of *H. pylori* sero-positivity in this study was also lower when compared to studies obtained in other neighboring countries such as Libya (94%), Ethiopia (89%) and Uganda (87%)[18–20], which might be explained by the difference in socio-demographic characteristics of the studied populations. Our findings appear to be similar to study carried out in Saudi Arabia among urban populations suffering from dyspeptic symptoms, which showed a prevalence of 67%[21]. Our results were also consistent with the prevalence detected in China and Southern Brazil[22,23]. Although the prevalence found in the current study is lower than that of observed in other African countries, it is much higher than reports from developed countries, such as United State and United Kingdom[24,25], where the prevalence of *H. pylori* was reported as 36.3% and 27.6% respectively. The lower rate in these two countries may be due to their high

socioeconomic status compared with developing countries. Among the clinical characteristics, this study as well as other studies conducted in other countries found that epigastric pain and heart burn were significantly associated with *H. pylori* infection[21,26,27]. The present study revealed that there was no statistically significant association between the prevalence of *H. pylori* infection and age, which was in accordance with observations documented by other researchers[28–30], however, some other studies have shown different results[21,31]. The explanation for these contradictory findings might be due to the difference in studied population and samples size. There was no significant association between *H. pylori* infection and gender in this study. This observation has been reported by many other investigators[31,32], however, a contrasting finding was documented by Valliani *et al.* who found that *H. pylori* sero-positivity occurred more commonly in male than that of in female patients[33]. We found that rural residency was strongly associated with *H. pylori* infection. This corroborates results obtained from a study of Jordanian school children in which *H. pylori* infection was higher among rural residents[34]. In contrast, other studies carried out in Brazil and Vietnam showed high rates of *H. pylori* infection among urban populations[23,35], and a further study in Korea showed a low prevalence of infection in rural areas[36]. The high prevalence observed among rural residents in the present study is likely explained by factors which facilitate acquisition of infection, such as inadequate living resources and poor sanitation. Although other studies have reported significant links between *H. pylori* infection and a lower level of education[22,23,37,38], our data confirmed the findings of some authors, who demonstrated a negative correlation between the rate of infection and the level of education[39,40]. A history of smoking was not associated with *H. pylori* seropositivity in our study, which is similar to observations by other studies[22,23]. This may be attributable to high levels hydrochloric acid excretion which is stimulated by cigarette smoking[41]. Hydrochloric acid is regarded as a protective barrier against infective microorganism. This study confirmed there is no significant relationship between *H. pylori* infection and ingestion of NSAIDS as first found in Libyan study[18].

This study has highlighted the high prevalence of *H. pylori* infection and its association with rural residency in Eastern Sudan. The limitations of this study are the fact that it is a hospital-based study and that no other test were available for the detection of *H. pylori*.

This study shows that clinical suspicion can facilitate the detection of *H. pylori* among patients with dyspeptic

symptoms. This is particularly relevant in geographical areas with a high prevalence of *H. pylori* infection.

### Conflict of interest statement

We have no competing interests to declare.

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### Comments

#### Background

The bacterium *H. pylori* is exclusively associated with cells of the gastric mucosa, being the causative agent of chronic gastritis, peptic and duodenal ulcers and is associated with increased gastric cancer and lymphoma. Thus, the diagnosis becomes very important to start the correct treatment.

#### Research frontiers

This study is a correlation between the presence of the bacterium *H. pylori* and socio–demographic conditions in Eastern Sudan through the research of specific IgG antibodies present in the sera of these patients, targeting improvements in the treatment of these individuals.

#### Related reports

Several studies in the literature describe the incidence of infections by *H. pylori* in different countries, even in Sudan. However, in many cases the methods used for diagnostic are invasive and the symptoms of the patients are other, such as gastritis.

#### Innovations & breakthroughs

The paper proposes a study that correlates the incidence of stomach problems such as heartburn and epigastric pain caused by *H. pylori* with socio–demographic factors of the inhabitants of Eastern Sudan, in the search for factors that cause a predisposition to the incidence of bacteria.

#### Applications

Clinical suspicion can facilitate the detection of *H. pylori*

among patients with dyspeptic symptoms in a geographic area with high prevalence of *H. pylori* infection.

#### Peer review

This is a very interesting epidemiological point of view that socio–economic factors are associated with the incidence of infection by *H. pylori*. The results show that there is a positive correlation between rural life and the presence of *H. pylori*, which can show the areas that need more attention by the authorities to combat the disease.

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