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Original Article

Prevalence of *Helicobacter pylori* Infection in Arak, Iran during 2011

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ABSTRACT

Background:
Helicobacter pylori (*H. pylori*) is a global pathogen with a widely varied prevalence (30%-80%) among different countries and populations. This study aims to determine the prevalence of *H. pylori* in the population of Arak, Iran.

Materials and Methods:
This was an epidemiologic cross-sectional population-based study with multistage sampling. The population of Arak according to the 2006 census was 615,722 (493,845 urban and 121,857 rural residents). In this survey, five urban and four rural Health Service Centers were randomly selected. The study population was divided between these centers based on the population of individuals covered by these centers. Subsequently, clustered samples were randomly chosen according to Health Care Unit Family Codes and the Right Hand Rule. After obtaining informed consent and completion of a demographic questionnaire, 5 cc of venous blood was taken from each participant for the *H. pylori* IgG antibody test. In this study IgG antibody against *H. pylori* was measured by ELISA.

Results:
Of 1187 participants, 1150 (853 urban and 297 rural) completed the study. Overall, 673 (58.5%) were positive for *H. pylori*. The prevalence of *H. pylori* infection increased with age from 43.9% among those <20 years old to >70% in participants over 50 years old (p=0.002). A total of 57% urban samples and 63.3% rural samples were *H. pylori* positive (p=0.028). There was no relationship between *H. pylori* infection and education level (p=0.37), career (p=0.39) and income, (p=0.29) in either the urban or rural areas [p=0.64 (education level), 0.48 (career), and 0.57 (income)].

Conclusion:
Our study showed a lower prevalence of *H. pylori* compared to some Asian countries, however this prevalence was more common than Western countries. Using disinfected tap water in both urban and rural areas in addition to improved access to general health care might have a role in this relative lower prevalence.

Keywords: Prevalence; *Helicobacter pylori*; Infection; ELISA; Arak, Iran

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INTRODUCTION

Helicobacter pylori (*H. pylori*) was first described by Warren and Marshall(1). *H. pylori* is a major cause of gastritis and peptic ulcer disease (PUD) and has been implicated in the development of gastric malignancies and common worldwide infections (2-6). Previous sero-epidemiologic studies have estimated that approximately 50% of adults worldwide, 20%-30% in developed countries and up to 80% in developing countries are positive for serum

antibodies against *H. pylori* WGO 2010(5). The prevalence is declining in most developed countries (4,6,7). Epidemiological studies have shown that infection is mainly acquired in early childhood and the incidence increases with age (8-10). Close contact, low socioeconomic status and poor hygiene are the most important risk factors (5,10,11). It seems that the fecal-oral route is the main basis of the infection (11-13). Primary acquisition in adults or reinfection after successful eradication does occur but is less common with an annual incidence of 0.3%-0.7% in developed countries and 6%-14% in developing countries (5, 11). Since humans are the main known reservoir for infection, it is likely that in developed countries *H. pylori* is acquired predominantly via the oral-oral and fecal-oral routes (11-13). Since the acute acquisition of *H. pylori* infection usually remains undiagnosed, the incidence has been determined indirectly through epidemiological studies. Some discrepancies between the prevalence and incidence data may be explained by the decreasing rates of infection over time. Thus, adults who are currently infected are more likely to have acquired their disease in childhood rather than during adulthood (2-5,14).

Water has been suggested as a possible source of *H. pylori* infection (15-24). Studies by Dube in Africa(25), Shi et al (26), and Kelin in Peru(14), Hopkin in Chile (27) have found that the water source may be related to the risk of *H. pylori* infection. One of the most important factors increases risks of *H. pylori* infection in children, drinking water from a stream that may be vulnerable to bacterial contamination. Studies have also assessed the relation between *H. pylori* infection and various hygiene practice indicators in a number of countries. Poor hygiene practices, especially during childhood, appear to be related to a higher sero-prevalence of *H. pylori*. Some practices include the lack of a water closet or bathroom or no hot water supply in the house during childhood, sharing cups as children, and having mothers who did not use soap when they washed their hands (20,27-29). Although there are different tests for the detection of *H. pylori*, the ELISA method remains a reliable and cost effectiveness test for epidemiologic studies (5,30). Public knowledge and expectations have also increased, with numerous patients requesting information about the chances of acquiring the infection, risk of peptic ulcer, gastric cancer and routes of transmission. In order to provide accurate answers, it is necessary to conduct epidemiological studies specific to areas of interest and update data with improvement of health level. This study intends to determine the prevalence of *H. pylori* infection in the general adult population of Arak, Markazi Province, Iran.

MATERIALS AND METHODS

This cross-sectional epidemiologic population-based study was conducted during a five-month period from March to July 2011 to determine the prevalence of *H. pylori* infection on people over the age of 20 years in Arak, Markazi Province, Iran. The population of Arak according to the 2006 census was 615,702 (493,845 urban and 181,857 rural). This study recruited 1150 participants based upon a sample size that took into consideration the world wide prevalence (4) of 20%-80%, p=50%, d=0.03 and α=0.05 and was estimated at 1150 (853 urban, 297 rural) individuals who represented the general population based on the weighted multistage stratified cluster pattern for sampling. All individuals over the age of 15 years were enrolled with respect to the urban-rural population distribution. The Arak Township Health Service is covered by 11 urban and 8 rural Health Service Centers. In this survey 5 urban and 4 rural Health Service Centers were randomly selected. The study participants were divided between these centers based on the population covered by these centers. Subsequently, the clustered sample was randomly chosen according to the Health Care Unit Family Codes and Right Hand Rule. After obtaining informed consent and completion of the demographic questionnaire that included items such as gender, age, height, weight, education level, family member, career and family income, a total of 5 cc of venous blood was taken from each participant for the *H. pylori* IgG antibody test. Serum was directly separated and stored at -20^{o}C. In case of the participant refuses, samples were collected from the nearest neighbor. *H. pylori* status of the samples was determined by the ELISA IgG Antibody Mono-bind Inc. *H. pylori* Kit (no CA92630, USA) and by a Stat Fax 3200 (USA) ELISA reader that had a sensitivity of 95% and specificity of 98%. Any titer above 20 units was considered positive. Data were analyzed with SPSS version 11.5, the chi-square test, logistic regression and t-test. p-values <0.05 were considered statistically significant.

RESULT

From 1187 participants, 1150 participants (853 urban and 297 rural) completed the study. Participants' mean age was 39.22±12.7 years. Overall, 673 (58.5%) had evidence of antibodies to *H. pylori* (ELISA IgG- Ab+); 57% urban and 63% rural samples were antibody positive. According to two-tailed analysis, there was no difference

in the positive *H. pylori* results between urban and rural populations (p=0.379). However in the one-tailed test, this overall difference was meaningful (p=0.038). The prevalence of *H. pylori* infection increased with age from 43.9% among <20 year-old group to >70% in those over 50 years of age (p=0.002). There was no relationship between *H. pylori* infection and education level (p=0.37), career (p=0.35) and income (p=0.29) for urban residents, or for rural residents in terms of education level (p=0.64), career (p=0.48), and income (p=0.57). Regarding gender, 57% of women and 60.08% of men were *H. pylori* positive which was not significant (p=0.335). Among males, 59.5% of urban and 62.1% of rural groups were seropositive (p=0.092). In females, 54.7% of urban and 64.8% of rural groups were seropositive (p=0.028). Average BMI in the *H. pylori* negative group was 25.03±4.55 whereas in the *H. pylori* positive group it was 25.94±16.14 (p=0.238). Heartburn symptoms were seen in 11.3% of seronegative and 16.9% of seropositive participants (p=0.207). In Arak, all study participants in both urban and rural areas used chlorinated closed well water.

DISCUSSION

We used epidemiologic study data to produce the population-based estimation of the prevalence of *H. pylori* infection in Arak and explored the relationships between various demographic factors of infection. There was no significant difference in the prevalence of *H. pylori* between the urban and rural population (p=0.379). The lower rate of infection in the urban population could be related to improvements in public health care services (availability of hot water and soap use). In this study, in terms of gender we observed no difference in the prevalence of *H. pylori* in both the rural and urban areas. However this prevalence was slightly more common in females from rural areas compared to urban females, which might be related to the family crowding and poorer hygienic conditions in rural areas. Few epidemiologic and community-based studies that determined the *H. pylori* infection in the general population have been performed in Iran. The majority of these studies were undertaken in gastroenterology clinics (16,24,30). Overall, our survey results showed lower prevalence than previous epidemiologic studies conducted in Hormozgan Province (67.1%) and Nahavand 71% (16,19). In the <20 year old age group, we reported a prevalence of 43.9%, which was more common than the prevalence in Yazd that had a 30.6% *H. pylori* sero-positivity (p=0.045) (18). This difference was significant. In comparison with Ardabil that reported a 47.5% sero-positivity, the difference was not significant. A study in Shiraz (24) reported 52.7% *H. pylori* positivity. Although their findings were similar to the findings of the current study, these results might not be comparable because subjects in the Shiraz study were selected from patients with dyspepsia who had higher rates of current infection and were not representative of the general population. Results of these studies have shown that the prevalence of *H. pylori* infection in Iran varies according to ethnicity, cultural and healthcare factors. The overall prevalence of *H. pylori* infection in our study was lower than some published studies from other developing countries (22, 32). In comparison with Asian countries such as Kazakhstan, Bangladesh and India, we have shown that *H. pylori* infection was less common in Iran (Arak) and inversely correlated with the health care system and more common use of closed wells and hot water. Family crowding showed no significant effect on *H. pylori* prevalence in Iran and Kazakhstan (15). *H. pylori* infection appeared to be less common in Iran compared to other Middle Eastern countries. An overall estimation of *H. pylori* prevalence in Turkey was 82.5% according to the Urea Breath Test (UBT) method as reported by Sinan (31). Although comparable with some Iranian studies, there was a meaningful difference with the results of the current study (p=0.001). In a review article from Africa(25), the prevalence of *H. pylori* infection was reported to be 74.8%-92% and depended on the drinking water source (tap water versus well water) which was more common than Iran, particularly Arak. Tkachenko et al. (22) in a 10-year follow-up study in Russia observed a significant drop from 48% in 1995 to 25% in 2005 in *H. pylori* infection among 15-19 year olds which was concurrent with health care improvements. They concluded that there was an inverse correlation between mothers' and fathers' educational levels and *H. pylori* sero-positivity. In our study there was no association between the prevalence of *H. pylori* and any factor tested, including sex, type of dwelling, income, or the number of people living in the home. These results were inversely comparable with the same age group findings in a Russian study (p=0.017) (22). Naja et al. (8), conducted a sero-epidemiologic study in Ontario, Canada among individuals 50 to 80 years of age. In that study a prevalence of 23.1% with a higher prevalence among males was reported. The sample size and methods were similar to the current study, however the age factor differed. Staat et al. (23) studied *H. pylori* infection in the US population by measuring IgG antibody levels in serum from 2581 subjects aged 6-19 years. Overall, 24.8% of participants had evidence of *H. pylori* infection which was less common than our

Table 1: World Gastroenterology Organization Global Guidelines for *Helicobacter pylori* (*H. pylori*) in developing and developed countries, August 2010.

Developing Countries	*H. pylori* positive		Developed Countries	*H. pylori* positive	
Country	Age group <20 years	Adults	Country	Age group <20 years	Adults
Africa	-	-	North America		
Ethiopia	<6 80%	95%	Canada	<20 7.1%	50-80 23.1%
Nigeria	<10 82%	91%	USA and Canada	-	30%
Central & South America	-	-	Hong Kong	<20 13.1%	-
Guatemala	<10 51%	70-90%	Japan	-	20-70 55.4%
Mexico	<10 43%	70-90%	Taiwan	13–15 12.3%	>25 45.1%
Brazil	10-19 78%	82%	Australasia	<20 15.4%	20%
Chile	<10 36%	70-90%	Europe		-
Asia	-	-	Eastern Europe	-	70%
Bangladesh	<10 82%	90%	Eastern Europe	-	30-50%
India	<20 87%	88%	Germany	-	48.8%
Turkey	General population	82.5%	Iceland		36%

Table 2: Summary and prevalence comparison of *H. pylori* in residents <20 years of age from Arak, Iran with studies in Iran and other countries.

Country	Editor, year published	Study population (years)	Method, sample size, results			*p*-value
			Sample size and method	Negative	Positive	
Iran, Arak	Present study, 2011	<20	66 ELISA	37 (56.06%)	29 (43.94%)	
Iran, Ardabil	Mikaeili(18), 1999	<20	358 ELISA	188 (52.5%)	170 (47.5%)	0.688
Iran, Yazd	Mikaeili(18), 1999	<20	353 ELISA	245 (59.4%)	108 (30.6%)	0.045
Turkey	Apan(20), 2008	<20	529 ELISA	370 (70%)	159 (30%)	0.025
Russia	Tkachenko(22), 2005	15-19	100 ELISA	75 (75%)	25 (25%)	0.017
Kazakhstan	Nurgalieva(15), 2002	15-19	55 ELISA	20 (36%)	35 (64%)	0.044

Table 3: Summary and prevalence comparison of *H. pylori* in Arak, Iran with studies held in Iran and other countries (general population).

Country	Editor, year published	Population selection	Method, sample size, results			*p*-value
			Sample size and method	Negative	Positive	
Iran, Arak	Present study, 2011	General population	1150 ELISA	477 (41.5%)	673 (58.5%)	
Iran, Hormozgan	Hashemi(16), 2006	Adult dyspeptic	1000 RUT1	329 (32.9%)	671 (67.1%)	0.001
Turkey	Sinan(31), 2009	General population	2382 ELISA		82.5%	0.001
Iran, Nahavand	Alizadeh(19), 2009	General population	1518 ELISA	449 (29%)	1078 (71%)	0.001
India	Klein(14), 1991	General population	238 ELISA	50 (17.5%)	188 (79%)	0.001
Canada, Toronto	Naja(8), 2007	50-80 years	1306 ELISA	922 (70.6%)	384 (29.4%)	0.001

[1]Rapid urease test

Table 4: Comparison of *H. pylori* sero-positive age groups in urban and rural populations of Arak, Iran during 2011.

Age group (years)	Urban		Rural		*p*-value
	Samples (n)	Seropositive n (%)	Samples (n)	Seropositive n (%)	
<20	35	14 (40)	31	15 (48.4)	0.824
21-30	219	153 (61.2)	62	32 (51.6)	0.902
31-40	250	153 (61.2)	85	58 (69.4)	0.901
41-50	186	112 (60.2)	55	35 (63.6)	0.901
51-60	115	66 (57.4)	45	32 (71.1)	0.484
61-70	40	24 (60)	19	15 (73.7)	0.665
>70	8	7 (87.5)	0	0	-
Sum	853	486 (57)	297	187 (63)	0.379

Table5: The relationship between *H. pylori* and family income (toumans/month/ person)

	Low income (<100000)	Moderate income (200000-400000)	High income (>400000)	*p*-value
H. pylori negative	137 (28.7%)	328 (68.8%)	12 (2.5%)	0.209
H. pylori positive	215 (32%)	453 (67.3%)	5 (0.7%)	
Total	352 (30.6%)	781 (67.9%)	17 (1.5%)	

results although *H. pylori* infection in the US was strongly associated with increasing age and ethnicity (p<0.01). A total of 17.0% of non-Hispanic whites, 40.1% of non-Hispanic blacks and 42% of Mexican Americans were infected. The *H. pylori* prevalence in Arak was more common than non-Hispanic whites and approximated the results of non-Hispanic blacks and Mexican Americans.

There was a lower prevalence of *H. pylori* compared to other studies in the Middle and Far East, excluding Japan, India and Africa. Using disinfected well water in both urban and rural areas and improved access to general health care might have had a role in this relative lower prevalence.

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