Original Article

Prevalence of *Helicobacter pylori* infection in healthcare workers

Maliheh METANAT[1], Batool SHARIFI-MOOD[1], Shahrokh IZADI[2]

Aim: *Helicobacter pylori* (*H. pylori*) is a major factor in inflammatory and malignant diseases of the gastrointestinal tract. The epidemiologic pattern of this infection varies among developed and developing countries, and is related to the general standards of living in each region. In view of the importance of this infection and its different prevalence in different regions of Iran, as well as its long-term complications, this study was conducted to investigate the prevalence of *H. pylori* infection and its contributing factors in Zahedan.

Materials and methods: Ninety-seven healthcare workers without digestive symptoms or a history of *H. pylori* eradication were randomly selected. Infection was diagnosed by measuring IgG levels using the ELISA method, which has a sensitivity and specificity of 94% and 98%, respectively. Data, including age, gender, level of education, and type of water consumed, were collected using a questionnaire and analyzed by SPSS (version 13). Descriptive statistics, chi-square, Pearson correlation coefficient, and linear regression were used to interpret the results.

Results: The total frequency of the infection was 34% with a relative frequency of 36.4% and 32.8% in men and women, respectively. No relation was observed between gender, age, family dimension, education attained, and antibody titer in linear regression analysis (P = 0.965). The level of education was statistically related to antibody titer; in the group with high school and an associates science education, 75% had negative titer and 25% had positive titer (P = 0.040).

Conclusion: The presence of *H. pylori* infection in asymptomatic individuals and its ensuing complications necessitates health education, careful control of water sources, and strict control of infection.

Key words: *Helicobacter pylori*, serology, Zahedan

Introduction

H. pylori infection is one of the most common infections in humans. *H. pylori* is a microaerophilic gram negative curved bacillus with a terminal flagellum that is found in the mucous layer lining the gastric epithelium. Humans are the known major host. The majority of the infected are asymptomatic, but a limited number develop digestive symptoms. Some 30% to 60% of duodenal ulcers and 70% of gastric ulcers are associated with *H. pylori* infection that can eventually lead to gastric adenoma and lymphoma. The prevalence of *H. pylori* infection is about 30% in America and increases with age so that it reaches 50% at 50 years of age. This pattern is different from that observed in developing countries where 80% of the population become infected by 20 (1). In these populations, colonization occurs at very young ages, and before school (2). Evidence shows that infection at a young age is a risk factor for gastric cancer later in life (3).

Transmission of *H. pylori* occurs from person to person through fecal-oral and oral-oral route, as well as through consumption of contaminated water (4). Risk factors for *H. pylori* infection include birth or residence in developing countries, low socioeconomic and health status, improper

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handling of swage, and illiteracy (5). *H. pylori* infection is more commonly found in gastroenterologists, endoscopy staff, intensive care nurses, groups of healthcare workers, and those caring for developmentally disabled individuals (6-11).

The organism can be identified by various methods such as culture, urease breath test, and histological studies of biopsy specimens; however, most of these methods are invasive and costly. Serologic methods seem to be useful in the screening of large populations (12). A large number of serologic studies in developing and developed countries have been performed on certain groups of patients (blood donors, health programs, and patients presenting to medical centers (13)).

In a study in Kazakhstan, the epidemiology of *H. pylori* and the effect of water resources and environmental hygiene were investigated. Results showed that transmission of *H. pylori* could occur through contaminated water, as well as improper hygienic conditions (14).

In another study on pre-school aged children in Taiwan in 1999, the total prevalence of *H. pylori* infection was reported to be 8.1%; moreover, seropositivity of *H. pylori* infection increased with increasing age, family dimension, unhealthy water supply, improper swage system, and sanitary conditions (15).

The prevalence of *H. pylori* infection was reported as 48% in 700 patients assessed by the ELISA method in Semnan, Iran, in 1999 (16).

In another research in Sari in 2001, which involved 394 patients, the prevalence of *H. pylori* infection was observed to be 64.3% using the ELISA method. While researchers noted a relation to age and gender, they failed to document any relation between the prevalence of infection and parental level of education, socioeconomic, or health status (17).

Yet another study focused on the prevalence of *H. pylori* infection among children and adolescents, aging 7 to 18 years, in Sari in 1999. The prevalence measured by ELISA was 19.3% in 400 participants. A correlation was observed between the prevalence of infection age, educational level, and family dimension, in contrast to gender, occupation, and type of water consumed (18).

Regarding the high prevalence of *H. pylori* infection in Iran, the inconsistency in its statistics, and the possibility of a higher prevalence in Zahedan (due to water resources and hygienic conditions), as well as the long-term complications of such infection, this study was carried out to determine the prevalence of *H. pylori* infection using the ELISA method (sensitivity of 94% and specificity of 98%) (19). The present prospective study evaluated the prevalence of *H. pylori* infection in health-care workers in primary-care clinics. The underlying factors contributing to the infection were also studied.

Materials and methods

In a cross-sectional design, a descriptive analytical study was performed in volunteer healthcare workers in the Zahedan health center in 2006-2007. The study was approved by the Institutional Ethics committee of the university. Participants lacked gastrointestinal symptoms such as heartburn, dyspepsia, gastric pain, history of recent peptic ulcer, gastric cancer, and use of antacids, antibiotics, and proton pump inhibitors (PPIs). Considering the reported prevalence of at least 60%, randomized cluster sampling was used, and the sample size was calculated to be 96 considering the design effect (sample size × 1.5 = 96). Considering the setting and facilities, 6 cases were assigned to each cluster; dividing the sample size by the size of each cluster yielded 16 as the number of clusters needed. This covered approximately the half of health centers located in the city.

After obtaining consent, a questionnaire containing questions about age, gender, family dimension, level of education, and type of consumed water was completed by the workers. Five milliliters of blood was drawn from each case, and after separating the plasma, it was sent for measurement of *H. pylori* IgG under cold chain conditions (-20 °C). Levels of IgG were measured by the ELISA method using the Q-1DIAPLUS kit manufactured in Iran. Levels above 20 U/mL were considered positive. Data were analyzed using SPSS (version 13; SPSS, Chicago, IL, USA). For univariate analysis the odds ratios, their 95% confidence intervals, and chi-square tests were used. Adjusted residuals were used to complete the chi-square tests. An adjusted residual that exceeds

about 2 or 3 in absolute value indicates lack of fit for null hypothesis in that cell (20). Linear regression was used for multivariate analysis.

Results

Ninety-seven asymptomatic healthcare workers who did not have a history of *H. pylori* treatment were studied, including 33 men (34%) and 64 women (66%). Mean age was 43 ± 7 years with a range of 21 to 57 years. The majority were between 31 and 40 years of age (41.3%). Mean level of education was 12.2 ± 3.5 years in men and 12.7 ± 3.5 years in women. The majority had a high school diploma or an associate's of science (61.8%). In general, 33 cases had a positive antibody titer (≥ 20 U/mL), which is equivalent to a frequency of 34% in the studied population. Range of age was 21-57 years. The frequency of *H. pylori* infection was highest in the age group of 31-40 years (33.4%) and lowest in the group of 51-60 years (9.2%). Peak frequency of *H. pylori* infection was observed in the group with an educational level of diploma and AS (45.4%); however, the frequency was 27.3% in both the under diploma, and BS to PhD groups. The highest frequency of *H. pylori* infection was noted in families with 3 to 5 members (63.7%). A high frequency of infection was also noted in those subjects who only consumed tap water (93.9%). In univariate analysis only the level of education was shown to have a meaningful relation in the chi-square test (P = 0.040) (Table 1); however, no relation was observed between antibody titer, age, gender, family dimension, level of education, and type of consumed water in multivariate linear regression (P = 0.965).

Table 1. The relation between antibody titer, age, gender, family dimension, level of education, and type of consumed water.

Variable		Positive antibody titer		Negative antibody titer		Odds ratio	CI (Confidence interval)	P/value
Gender	Male	12	36.4%	21	63.6	0.9	0.4-2.0	0.727
	female	21	32.8%	43	67.2%			
Age	≤ 30	10	30.3%	12	18.8%	0.5	0.2-1.4	0.198
	Over 30	23	69.7%	62	81.3%			
Type of water consumed	Filtered tap water	31	93.9%	62	96.9%	-	-	0.215*
	Filtered tap water + tanker water	-	-	2	3.1%			
	Filtered tap water+ mineral water	2	6.1%	-	-			
Family dimension	Less than 3	3	9.1%	6	9.4%	-	-	0.91
	3 to 5	21	63.7%	38	59.4%			
	More than 5	9	27.3%	20	31.3%			
Level of education	Below diploma	9	27.3%	12	18.8%	-	-	0.040
	Diploma and AS	15	45.4%	45	70.3%			
	BS to PhD	9	27.3%	7	10.9%			

*Exact test.

In order to assess the significance of the level of education, the adjusted residual test was used (AR > 2.2 is considered significant). Analysis showed that the greatest difference existed in the diploma and associate's of science educational group (AR = 2.4). In this group, 75% had positive antibody titer and 25% had negative antibody titer (Table 2).

Discussion and conclusion

In our study, the total frequency of *H. pylori* infection was 34% among healthcare workers in Zahedan; that is lower when compared to studies performed in other cities in Iran, including Semnan, Sari, and Kerman. In the mentioned cities, the reported frequencies were, 48%, 64.2%, and 61.6%, respectively (16,17,21). This may be attributed to the difference in socioeconomic status of the studied population (healthcare workers of rural health centers in our study), as well as the difference in demographic characteristics.

The frequency of *H. pylori* infection in men (36.4%) and women (32.8%) was not significantly different in our study (P = 0.727); this is compatible with results obtained in studies performed in Taiwan, Albania, Semnan, and Sari (11,15,16,18). However, in another study in Sari, the frequency was higher in women, and in one study in China, men were more frequently infected (17,22).

In the current study, the highest frequency was observed in the third decade of life (33.4%), but the lowest frequency was observed in the fifth decade (9.1%) with no significant difference (P = 0.198). In the studies of Sari and Taiwan, the frequency of *H. pylori* infection increased with age, while in a study in Kerman, the frequency of infection did not differ among various age groups (15,17,21). This shows that an infection with *H. pylori* follows the pattern observed in other developing parts of the world, and occurs mainly in early childhood. However, the under 20 population, who have the highest rate of acquisition of the infection, was not studied here.

In the present study, families with 3 to 5 members had the highest frequency of infection (63.7%), while families with more than 5 members were least commonly infected (27.2%); however, the noted difference was not significant statistically (P = 0.913). In contrast, in the studies in Taiwan and Sari, *H. pylori* infection was more prevalent in families with more than 5 members (15,18).

No significant difference was observed among various types of consumed water regarding the frequency of infection (P = 0.215), similar to results reported in the study in Sari (18). In contrast, the prevalence of infection was shown to decrease with improvement of the hygienic index of water in Kazakhstan (14). This is probably due to the fact that virtually all the participants in our study consumed filtered water.

The only statistically significant correlation observed in this study was between frequency of *H. pylori* infection and level of education (P = 0.040). The highest difference was observed in the diploma and AS group, according to the AR test. This group had the lowest frequency of positive antibody titer (25%).

Suggestions

In light of the high frequency of *H. pylori* infection, and since infection most commonly occurs during childhood (especially at the school age), further

Table 2. The difference between various educational levels.

Level of education	Positive Ab* titer			Negative Ab titer		
	n	%	AR	n	%	AR
Under high school diploma	12	57.1	-1.5	9	42.9	1.5
High school diploma	45	75	2.4	15	25	-2.4
AS[†]	7	43.8	-2.1	9	56.3	2.1

* antibody, [†] associate's of science, [‡] bachelor of science

studies focusing on seroepidemiology of other age groups with more detailed information about demographic data like place of residence, socioeconomic status, presence of pet animals, and smoking, are necessary.

References

1. Valle JD: Peptic ulcer disease and relative disorder. In: Braunwald E, Fauci AS, Kasper DL, Hauser SL, Longo DL, Jameson JL. Harrison's principles of internal medicine. 16th Edition. New York: McGraw-Hill; 2005; 1746-62.

2. Thomas JE. *Helicobacter pylori* colonization in early life. Pediatric Research J 1999; 45: 218- 223.

3. Lin JT, Wang LY, Wang JT, Wang TH, Yang CS, Chen CJ. A nested case-control study on the association between *Helicobacter pylori* infection and gastric cancer risk in a cohort of 9775 men in Taiwan. Anticancer Res 1995; 15: 603-606.

4. Everhart JE. Recent developments in the epidemiology of *Helicobacter pylori*. Gastroenterol Clin North Am J 2000; 29: 559-78.

5. Zinsser, Microbiology, 20th ed, Appleton and Lang, United States of America, 1992; 676-691.

6. Cutler AF, Havstad S, Ma CK, Blaser MJ, Perez-Perez GI, Schubert TT. Accuracy of invasive and noninvasive tests to diagnose *Helicobacter pylori* infection. Gastroenterology 1995; 109: 136-41

7. De Schryver AA, Van Winckel MA. *Helicobacter pylori* Infection: Epidemiology and Occupational Risk for Health Care Workers. Ann Acad Med Singapore 2001; 30: 457-63

8. Birkenfeld S, Keter D, Dikman R, Shevah O, Shirin H, Niv Y. Prevalence of *Helicobacter pylori* infection in health-care personnel of primary care and gastroenterology clinics. J Clin Gastroenterol 2004; 38: 19-23.

9. Angtuaco TL, Sharma VK, Corder FA, Raufman JP, Howden CW. Seroprevalence of *H. pylori* infection and symptoms of upper gastrointestinal tract disease in two groups of health-care workers. Dig Dis Sci 2002; 47: 292-7.

10. Triantafillidis JK, Gikas A, Hyphantis T, Cheracakis P, Rokkas T, Konstantellou E, et al. *Helicobacter pylori* infection in hospital workers over a 5-year period: correlation with demographic and clinical parameters. J Gastroenterol. 2002; 37: 1005-13.

11. Monno R, Volpe A, Basho M, Fumarula L, Trerotoli P, Kondili LA et al. *Helicobacter pylori* seroprevalence in selected groups of Albanian volunteers. Infection 2008; 36: 345-50.

12. Von Wulffen H. An assessment of serological tests for detection of *Helicobacter pylori*. Eur J Clin Microbial Infect Dis 1992; 11: 577-582.

13. Pounder RF, Ng D. The prevalence of *Helicobacter pylori* infection in different countries. Aliment Pharmacol Therapeut 1995; 9: 33-39.

14. Nurgalieva ZZ, Malaty HM, Graham DY, Almuchambetova R, Machmudova A, Kapsultanova D et al. *Helicobacter pylori* infection in Kazakhstan: Effect of water source and household hygiene. Am J Trop Med Hyg 2002; 67: 201-206.

15. Lin DB. Seroepidemiology of *Helicobacter pylori* infection among preschool children in Taiwan. Am J. Trop Med Hyg 1999; 61: 554-558.

16. Moradi A, Rashidi PA. Seroepidemiologic study of *Helicobacter pylori* infection in Semnsn, Iran in 1999. Journal of Medical University of Semnan 1999; 1: 45-49

17. Babamahmoodi F, Ajemi A, Kalhor M, Shfiei GhR, Khalilian AR. Seroepidemiologic study of infection with *Helicobacter pylori* in Sari, Iran in 2001-02. Journal of Mazandaran University of Medical Sciences. 2003; 14: 39-47.

18. Farhadi A, Bahar A, Kowsarian M, Mahdavi M. Seroepidemiologic study of *Helicobacter pylori* infection in children aged 7-18 in Sari, Iran in 1999. Journal of Mazandaran University of Medical Sciences, 2000; 10: 19-25

19. Weiss J, Mecca J, Silva E, Gassner D. Comparison of PCR and other diagnostic techniques for detection of *Helicobacter pylori* infection in dyspeptic patients. J Clin Microbiol 1994; 32: 1663-1668.

20. Agresti, A. An introduction to categorical data analysis. John Wiley & Sons, New York. 1996; 31-32.

21. Zahedi MJ, Darvish Moghadam S, Atapour M, Jahanbakhsh Absasi M. Relative frequency of *Helicobacter pylori* infection in patients referring to health centers in 2000, in Kerman, Iran. Journal of Medical University of Kerman 2000; 3: 140-144

22. Suerbaum S, Michetti P. *Helicobacter pylori* infection. NEJM 2002; 347: 1175-1186.