Published online 2022 March **Original Article**

Unexpected high seroprevalence of helicobacter pylori infection in Mashhad, Iran

Bahram Memar[1], Majid Ghayour-Mobarhan[2], Saeid Eslami-Hasanabadi[3], Foad Faroughi[4], Mitra Ahadi[5]*

[1] Department of Pathology, Emam Reza Hospital, Mashhad University of Medical Sciences, Mashhad, Iran
[2] Metabolic Syndrome Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[3] Pharmaceutical Research Center, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran
[4] Students Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran
[5] Department of Gastroenterology and Hepatology, Mashhad University of Medical Sciences, Mashhad, Iran

*** *Corresponding author:*** Mitra Ahadi, Department of Gastroenterology and Hepatology, Mashhad University of Medical Sciences, Mashhad, Iran. E-mail: Ahadim@mums.ac.ir

Received 2021 August 01**; Accepted** 2022 January 17

Abstract

Background and Aims: Helicobacter pylori infection affects almost half of the world's population, making it the most prevalent infection globally. The present study aimed to determine the prevalence of Helicobacter pylori infection in a sample of the general population of Mashhad, Iran, in consideration of the prevalence and importance of Helicobacter pylori infection in the east of the country, especially Mashhad.

Materials and Methods: A total of 1,026 subjects were selected as the sample from the general population of Mashhad, Iran. Their serum samples which were stored in the Mashhad study project were provided to the researchers. The samples were examined for the presence or absence of anti-Helicobacter pylori antibodies.

Results: A mean age of 45 was reported for subjects, and the majority (54.8%) were female. In the study population, Helicobacter pylori infection was 85.2 percent. On the basis of Helicobacter pylori infection, participants were assigned into two groups of infected and non-infected. The laboratory variables were not significantly different between the two groups. Moreover, no significant differences were found between the two groups in any of the underlying variables.

Conclusion: The results of the present study pointed to a very high prevalence of Helicobacter pylori infection in a sample of the general population in Mashhad, Iran. This highlights the importance of investigating this bacterium as one of the major causes of various gastrointestinal problems.

Keywords: Antibody, Helicobacter pylori, Infection

Introduction

Associated with many gastrointestinal and non-gastrointestinal diseases, Helicobacter pylori infection is one of the most common infections in the world. This infection is recognized as one of the leading causes of upper gastrointestinal cancers; moreover, it has been linked to numerous diseases outside the upper gastrointestinal tract (1). The prevalence rates of this infection have been reported as 50% and 70%-80% across the globe and in developing countries, respectively. Economic status in childhood has been cited as one of the major risk factors for this infection since it is often transmitted in childhood and is more prevalent in developing countries (1).

Helicobacter pylori is a gram-negative, microaerophilic bacterium primarily found in deeper portions of gastric mucus and the space between the mucus and the gastric epithelium. The bacterium can attach to the gastric epithelium; nonetheless, it does not invade cells in normal conditions. It is structured such that it can survive in an unfavorable gastric environment. The genome of this bacterium can encode about 1,500 proteins. Among these multiple proteins, some factors can be highlighted that play a critical and decisive role in the pathogenesis and colonization of Helicobacter pylori, such as Helicobacter outer membrane protein (Hop proteins), Ureases, and Vacuolating cytotoxin A (VacA).

The virulence potential of Helicobacter pylori highly depends on its motility and ability to produce urease. Urease converts urea into ammonia, and in doing so, it alkalizes the pH around living organisms. Other bacterial agents include catalase, lipase, binding agents, and platelet-activating factor. Multiple strains of Helicobacter pylori have been identified that differ in the production of various substances (cag A, vac A). In this regard, diverse diseases caused by Helicobacter pylori infection can be attributed to its different strains and pathogenic processes (2).

Helicobacter pylori infection has been associated with lung diseases, such as chronic

obstructive pulmonary disease. Additionally, previous studies have connected Helicobacter pylori infection with adenotonsillar hypertrophy (3). Numerous epidemiological studies have investigated and confirmed the importance of childhood economic status in the prognosis of Helicobacter pylori infection.

Among the factors associated with the impact of economic and social status, one can refer to the number of people living in a house, the number of children, the status of bed-sharing, lack of hot water, and living conditions (1). The main transmission route of Helicobacter pylori infection is still unknown; nonetheless, humans are seemingly the major source of infection. This infection predominantly spread from person-to-person contact via gastrointestinal, fecal-oral, and even oral-oral routes. In addition, it has been observed that the infection passes from the affected people to their spouses or children (1).

Similarly, studies suggest that Helicobacter pylori transmission risk varies among siblings depending on whether they live together. Furthermore, younger children have also been observed to be more susceptible to infection when older children are infected (1). According to previous studies, Iran is expected to have a high Helicobacter pylori infection rate due to its socio-economic, demographic, and health status. In a review study conducted by Moosazadeh et al., Helicobacter pylori infection prevalence was reported as 54% in Iran (4).

The obtainment of information about Helicobacter pylori infection in Iran, especially Mashhad, can provide a solid basis for short- and long-term planning for the education of people and medical staff. This knowledge would be of great help in the prevention and treatment, and finally, reduction of the prevalence and complications of this infection in the community. One of the first necessary pieces of information in this regard is the prevalence assessment of this infection and its related factors in Mashhad, Iran.

Materials and Methods

This cross-sectional study was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (IR.MUMS.fm.REC.1394.16). The statistical population included people who were recruited into the MASHHAD study project and represented the population of Mashhad, Iran. Therefore, 1,026 participants were randomly selected from the general population of Mashhad, northeast of Iran. It is worth noting that they were selected from 14,000 participants in the MASHHAD study project using the random number table. This project started in 2010 and continued until 2020.

In this study, people living in Mashhad between the ages of 35 and 65 years were selected via random cluster sampling method from three areas of the city and entered the study after completing the informed consent form. All patients underwent clinical examination upon admission; thereafter, demographic and socio-economic characteristics, as well as the history of various diseases, were enquired about and registered in special checklists. Moreover, blood and urine samples were obtained from all patients, centrifuged, and kept frozen at -80ºC for further analysis (5).

In the present study, the information about the subjects extracted by the researcher from the Mashhad Study Project Database includes age, gender, body mass index (MBI), education level, employment status, marital status, smoking, history of hypertension, diabetes, dyslipidemia, osteoporosis, as well as such tests as Complete blood count (CBC), C-reactive protein (CRP), serum vitamin D, calcium, phosphorus,

Magnesium, and liver enzymes. Subsequently, their serum samples were examined by enzyme-linked immunosorbent assay (ELISA) for the presence or absence of Helicobacter pylori, and the results were added to the data. The used materials included Helicobacter Pylori IgG ELISA Kit (Pishtaz Teb Co., Iran), Elx800 microplate readers (Biotech Co., USA), 100-microliter sampler (Brand manufacturer, Germany), yellow sampler tip (Isolb, Germany), 1.5-cc microtube storage box (Iran), powder-free latex gloves (Max Life, Malaysia), and distilled water. In the end, the data were entered into SPSS software (version 16), and the analyses were carried out. As a first step, the Kolmogorov-Smirnov test was performed to determine whether quantitative variables adhered to a normal distribution. Additionally, two qualitative variables were tested using the Chi-square test. Following that, the quantitative and qualitative variables were tested using the Mann-Whitney test.

Results

A total of 1,026 participants participated in the study. Helicobacter pylori infection was reported to be 85.3% in the study population (875 people were positive for Helicobacter pylori). Subjects ranged in age from 35 to 65 years (mean age: 46.69 years). Additionally, their mean BMI ranged from 15.62 to 48.27

kg/m2. A comparison was made between two groups of Helicobacter pylori-infected patients and those without an infection. Table 1 shows that the mean scores of age (P=0.901) and BMI (P=0.212) are not different between the two groups.

Table 1. Mean±SD of underlying quantitative variables in the study population

Variable (unit)	Group	n	Mean	SD	P-value
Age(year)	Infectedwith Helicobacter pylori infection	868	46.70	7.97	0.922
	Non-infected with Helicobacter pylori infection Total	146	46.63	8.07	
		1014	46.69	7.98	
Body Mass Index (Kg/M²)	Infected with Helicobacter phlori infection Non-infected with Helicobacter pylori infection Total	867	27.50	4.58	0.342
		146	27.10	5.01	
		1013	27.44	4.64	

#: Independent t-test

In terms of gender, the majority of cases (n=556) were female. To assess the level of education, the subjects were assigned to three groups of low (n=522; 51.5%), medium (n=370; 36.5%), and high level of education (n=121; 12%). Regarding employment status, 40.8%, 51.1%, and 8.2% of cases were employed, unemployed, and retired, respectively. Furthermore, considering marital status, the majority of subjects (94.7%) were married. As displayed in Table 2, the frequency distribution of variables of gender (P=0.788), level of education (P=0.561), employment status (P=0.213), and marital status (P=0.929) was not significantly different between the two groups of patients with and without Helicobacter pylori infection.

Table 2. Frequency distribution of underlying qualitative variables in the study population based on Helicobacter pylori

Variable		Infected With Helicobacter pylorin (%)	Non-infected With Helicobacter pylorin (%)	Total n (%)
Gender	Male	394 (45.4)	64 (43.8)	458 (45.2)
	Female	474 (54.6)	82 (56.2)	556 (54.8)
	Total	868 (100)	1456 (100)	1014 (100)
P-value		0.787 $		
Education Level	Low	441 (50.9)	81 (55.5)	522 (51.5)
	Medium	320 (36.9)	50 (34.2)	370 (36.5)
	High	106 (12.2)	15 (10.3)	121 (12)
	Total	867 (100)	146 (100)	103 (100)
P-value		0.561$		
Employment status	Employed	359 (41.4)	55 (37.7)	414 (40.8)
	Unemployed	434 (50)	83 (56.8)	517 (51)
	Retired	75 (8.6)	8 (5.5)	83 (8.2)
	Total	868 (100)	146 (100)	1014 (100)
P-value		0.213$		
Marital Status	Single	46 (5.3)	8 (5.5)	54 (5.3)
	Married	822 (94.7)	138 (94.5)	960 (94.7)
	Total	868 (100)	146 (100)	1014 (100)
P-value		**0.929$**		

$: Chi-square test

The laboratory results were assessed as a whole and separately in the two groups of patients with and without Helicobacter pylori infection (Table 3). According to

Table 3, the two groups of patients with and without Helicobacter pylori infection did not significantly differ in the mean scores of hemoglobin (P=0.910), platelet count (P=0.633), CRP (P=0.620), phosphorus (P=0.053), magnesium (P=0.077), calcium (P=0.755), vitamin D (P=0.054), aspartate transaminase (AST) (P=0.322), and alanine transaminase (ALT) (P=0.617).

Table 3. Mean±SD of underlying quantitative variables in the study population

Variable (Unit)	Group	n	Mean	SD	P-value
Hemoglobin (g/dL)	Infected With Helicobacter pylori	861	13.76	1.60	0.858
	Non-infected With Helicobacter pylori	144	13.74	1.71	
	Total	1005	13.76	1.61	
Platelet count (1000/µL)	Infected With Helicobacter pylori	858	229.7	62.71	0.783
	Non-infected With Helicobacter pylori	144	231.2	61.04	
	Total	1002	229.9	62.45	
C-reactive protein (mg/dL)	Infected With Helicobacter pylori	867	3.73	9.18	0.706
	Non-infected With Helicobacter pylori	146	4.03	7.12	
	Total	1013	3.77	8.91	
Serum phosphorus (mg/dL)	Infected With Helicobacter pylori	587	4.24	0.87	0.093
	Non-infected With Helicobacter pylori	103	4.09	0.64	
	Total	690	4.22	0.84	
Serum magnesium (mg/dL)	Infected With Helicobacter pylori	581	1.03	0.16	0.086#
	Non-infected With Helicobacter pylori	102	1.00	0.12	
	Total	683	1.03	0.16	
Serum calcium (MG/DL)	Infected With Helicobacter pylori	590	9.17	1.11	0.394#
	Non-infected With Helicobacter pylori	103	9.27	0.67	
	Total	693	9.18	1.05	
Serum Vitamin D (NG/ML)	Infected With Helicobacter pylori	512	15.36	9.70	0.109#
	Non-infected With Helicobacter pylori	90	13.59	9.20	
	Total	602	15.10	9.64	
Aspartate transaminase (IU/L)	Infected With Helicobacter pylori	553	23.01	9.80	0.208#
	Non-infected With Helicobacter pylori	90	24.47	12.00	
	Total	643	23.22	10.14	
Alanine transaminase (IU/L)	Infected With Helicobacter pylori	550	17.36	10.50	0.452#
	Non-infected With Helicobacter pylori	91	18.26	11.25	
	Total	641	17.49	10.60	

#: Independent t-test

The findings related to the history of diseases in the study population as a whole and each of the two groups of patients with and without Helicobacter pylori

infection were assessed and reported in Table 4. As presented in this table, the frequency distribution of smoking (P=0.972), history of hypertension (P=0.695), diabetes mellitus (P=0.173), dyslipidemia (P=0.754), and osteoporosis (P=0.754) did not significantly differ between Helicobacter pylori infection patients and patients without it.

Table 4. Frequency distribution of variables related to the history of diseases in the study population based on Helicobacter pylori infection

Variable		Infected With Helicobacter pylorin (%)	Non-infected With Helicobacter pylorin (%)	Totaln (%)
Smoking	Non-Smoker	583 (67.2)	98 (67.1)	681 (67.20
	Ex-Smoker	82 (9.4)	13 (8.9)	95 (9.4)
	Current Smoker	203(23.4)	35 (24)	238 (23.50
	Total	868 (100)	146 (100)	1014 (100)
P-value		0.972$		
History Of Hypertension	Yes	112 (14.20	19 (13)	141 (14.1)
	No	735 (85.8)	127 (87)	862 (85.9)
	Total	857 (100)	146 (100)	1003 (100)
P-value		0.685$		
History of diabetes mellitus	Yes	56 (6.5)	14 (9.7)	70 (7)
	No	801 (93.5)	131 (90.3)	932 (93)
	Total	857 (100)	145 (100)	1002 (100)
P-value		0.173$		
History Of Dyslipidemia	Yes	157 (18.7)	25 (17.6)	182 (18.6)
	No	682 (81.3)	117 (82.4)	799 (81.4)
	Total	839 (100)	142 (100)	981 (100)
P-value		0.745$		
History of Osteoporosis	Yes	82 (9.8)	15 (10.6)	97 (9.9)
	No	756 (90.2)	126 (89.4)	882 (90.1)
		838 (100)	141 (100)	979 (100)
P-value	Total	0.754$		

$: Chi-square test

Discussion

Detecting serum antibodies from a sample taken from the general population of Mashhad was the purpose of the present study, which aimed to examine the prevalence of Helicobacter pylori infection in Mashhad, Iran. In the present study, 1,026 subjects were recruited. Infection with Helicobacter pylori was reported to be 85.3%. Assessment of underlying factors revealed that the mean scores of age and body mass index were not significantly different between the two groups of patients with and without Helicobacter pylori infection. Additionally, the gender, level of education, employment status, and marital status of patients with and without Helicobacter pylori infection did not significantly differ between the two groups.

Laboratory findings also revealed that hemoglobin, platelet count, CRP, phosphorus, magnesium, calcium, vitamin D, AST, and ALT scores between patients with and without Helicobacter pylori were not significantly

different. A similar analysis of the medical history of patients indicated no significant differences between the two groups of patients with and without Helicobacter pylori infection in terms of smoking, hypertension, diabetes mellitus, dyslipidemia, and osteoporosis.

Numerous studies have examined the prevalence of Helicobacter pylori infection in different communities. A review study conducted by Zamani et al. in 2018 examined the prevalence of Helicobacter pylori infection in different countries. The study found the global prevalence of this infection at 44.3%; meanwhile, the highest and lowest prevalence rates were found in Nigeria (89.7%) and Yemen (8.9%), respectively. According to the study performed by Zamani et al., Figure 4 illustrates the prevalence of Helicobacter pylori infection in different countries. According to the referred study, the prevalence of Helicobacter pylori infection in Iran ranges between 55% and 69.9% (6).

In addition, several studies have assessed the prevalence of Helicobacter pylori infection in the general population in Iran. Helicobacter pylori

infection was found to be 54% prevalent in Iran, according to their review study Moosazadeh et al. (2016). Similar to a study conducted by Malekzadeh et al., 85.3% of the population in the present study was infected with Helicobacter pylori. The results of the present study indicate that Mashhad has a high prevalence of Helicobacter pylori infection in Iran. Preventing and treating this infection in Mashhad is therefore important.

In Iran, Helicobacter pylori infection has been reported differently in various studies, as indicated previously. The discrepancy can be explained by differences in the study population, methods, and type of test used for the diagnosis of Helicobacter pylori infection. An ELISA method was used to detect antibodies against Helicobacter pylori in patients' serum samples in the present study. As a result, this method reports more positive cases than other methods (4); hence, this factor might explain the high prevalence of Helicobacter pylori infection in the present study.

According to the current study, the mean ages of patients with and without Helicobacter pylori did not differ significantly. Age has been a factor in the emergence of Helicobacter pylori infection in previous studies. Depending on the route of transmission, Helicobacter pylori infection risk increases with age. In addition, most patients have been exposed to this bacterium in their early years of life in communities that have a high prevalence of infection. The prevalence of this infection in adults in these communities does not change significantly as a result.

Consequently, most studies failed to detect a significant link between aging and Helicobacter pylori infection in adults. In some studies, however, age is cited as a risk factor for Helicobacter pylori infection, and it has been reported that this infection is more prevalent in the elderly. Nonetheless, this finding can be justified by the fact that most of these studies were conducted in countries where the infection is rare. In addition, the results of this study showed that the mean scores of BMI were not significantly different between the two groups of patients with and without Helicobacter pylori.

In previous studies, there has been an inconsistent correlation between obesity and Helicobacter pylori infection. A significant correlation has been found between high BMI and Helicobacter pylori infection, and people with a higher MBI are more likely to contract the infection. By affecting natural killer cells, monocytes, and cytokines, obesity, and overweight can affect the immune system (both innate and acquired immunity) and increase susceptibility to various infections, including Helicobacter pylori.

On the other hand, some studies have suggested that people with high BMI have a lower prevalence of Helicobacter pylori infection, compared to those with normal BMI. In support of this finding, studies have indicated that Helicobacter pylori-associated gastritis may bring about changes in intestinal hormones, such as ghrelin, thereby affecting appetite and caloric homeostasis. These studies have detected no significant relationship between BMI and Helicobacter pylori infection; nonetheless, it seems that more studies are still needed to investigate this issue.

In terms of gender distribution, there was no significant difference between the two groups of patients with and without Helicobacter pylori infection. The prevalence of Helicobacter pylori infection was not significantly different between males and females in numerous studies, such as the present research (10). Furthermore, in the present study, there was no significant difference in education level or employment status between patients with and without Helicobacter pylori infection.

Studies have assessed socioeconomic factors in patients with Helicobacter pylori infection and shown a relationship between these factors and the prevalence of this infection. As opposed to the current study, multiple studies have linked education level to Helicobacter pylori infection. Due to the observance of proper hygiene, people with a higher level of education are less likely to develop Helicobacter pylori infection. (11). Nevertheless, in accordance with the present research, in two studies, no clear correlation was found between education level and Helicobacter pylori infection (12).

Studies have also shown that occupational status is not related to Helicobacter pylori infection; therefore, occupational status cannot be considered a risk factor for Helicobacter pylori infection (12). Another finding of the present study was that marital status did not significantly differ between patients with and without Helicobacter pylori infection. Marital status and Helicobacter pylori infection have been examined in a limited number of studies, with inconsistent results. Elmanama et al. (13) and Zhou et al. (12) found no association between marital status and Helicobacter pylori infection.

According to Chen et al. (2014), married individuals were more likely to have Helicobacter pylori infection (14). Patients become infected with Helicobacter pylori during their early years of life; therefore, they develop the infection before they get married. Due to the high prevalence and low age of infection in Iranian society, the results of this study differ from those of other studies.

In the current study, it was observed that the mean scores of serum hemoglobin did not differ significantly between patients with and without Helicobacter pylori. A review study conducted in 2016 demonstrated that Helicobacter pylori infection was significantly associated with anemia, especially iron-deficiency anemia, in patients compared to those

without this infection. According to the study, Helicobacter pylori infection increases the risk of iron-deficiency anemia by 1.33 times (15).

It has been argued that Helicobacter pylori infection in individuals leads to chronic gastritis, and this clinical condition brings about gastric changes, especially acidity and ascorbic acid levels. Gastric juice ascorbic acid and pH are effective in the absorption of dietary iron; therefore, it can be stated that Helicobacter pylori infection may increase people's susceptibility to iron-deficiency anemia by altering iron homeostasis (15). Other findings of the present study illustrated that the mean scores of serum platelet count were not significantly different in patients with and without Helicobacter pylori infection.

Previous studies have suggested a role for Helicobacter pylori infection in the development of Idiopathic thrombocytopenic purpura (ITP) (16, 17). In addition, eradicating Helicobacter pylori infection was shown to improve ITP in patients with mild ITP (16). However, it is not clear whether Helicobacter pylori infection increases platelet count in the general population (and non-ITP). In agreement with the results of the current study, Samson et al. (2014) observed no significant differences in serum platelet counts between patients suffering from Helicobacter pylori infection and those without this complication (18).

The mean*SD of CRP was not significantly different between patients with Helicobacter pylori infection and those without it. It was found that people with and without Helicobacter pylori infection did not significantly differ in CRP levels in a study completed in 2016 to investigate the relationship between Helicobacter pylori infection and non-alcoholic fatty liver disease (19). Vafaeimanesh et al. (20) also reported the same finding. A Helicobacter pylori infection does not seem to raise the levels of acute-phase proteins, especially CRP.

Additionally, in the present study, the mean serum phosphorus, magnesium, and calcium scores did not differ significantly between patients with and without Helicobacter pylori infection. Serum phosphorus levels in patients with Helicobacter pylori infection and the effect of this infection on phosphorus levels have only been studied one time. According to the present study, there were no significant differences in serum phosphorus levels between patients with and without Helicobacter pylori infection.

There are also few studies on serum magnesium and calcium levels. A study conducted by Hu et al. in 2018 found that serum magnesium and calcium levels were not significantly different in patients with and without Helicobacter pylori infection (21). Other studies have also reported similar findings. Furthermore, in the present study, the mean levels of serum vitamin D were not significantly different between patients with and without Helicobacter pylori infection. Previous studies have also examined this issue. The vitamin D levels of patients with and without Helicobacter pylori infections did not differ significantly according to a study by Chen et al. (22).

Research has shown that serum vitamin D levels are not significantly different between patients with and without Helicobacter pylori infection, however, recent studies have shown that vitamin D and its metabolites have antibacterial effects, especially against Helicobacter pylori; thus, it may be possible to use them to eradicate this infection. Assessment of this issue, however, is beyond the scope of this study. In addition, the present study found that the mean AST and ALT scores of patients with and without Helicobacter pylori infection were not significantly different.

Helicobacter pylori infection was not significantly associated with liver enzymes in the studies by Baeg et al. in 2016 and Kalantar et al. (23). In contrast, in a 2017 study, liver enzymes were significantly higher in patients with Helicobacter pylori infection than in those without. Nevertheless, this increase in liver enzymes in infected patients was very low and clinically insignificant (24). It does not appear that Helicobacter pylori infection affects liver enzymes clinically in infected individuals.

Among patients with and without Helicobacter pylori infection, smoking status did not differ significantly. The majority of previous studies have not linked smoking to Helicobacter pylori (12). It has been suggested that smoking may increase the risk of Helicobacter pylori (25). A significant difference was not observed between patients with and without Helicobacter pylori infection in the history of hypertension, diabetes mellitus, or dyslipidemia.

Although several studies have examined the association between Helicobacter pylori infection and diabetes mellitus, their results are inconsistent. In some studies, it has been reported that diabetic patients are more likely to be infected by Helicobacter pylori than non-diabetic patients (26). When Helicobacter pylori is infected, proinflammatory cytokines are released, altering the structure of insulin receptors and preventing them from binding to insulin. Some studies, however, have suggested that the prevalence of diabetes is not significantly different between patients with and without Helicobacter pylori infection (27).

Helicobacter pylori infection has also been associated with hypertension in several studies. These studies suggest that Helicobacter pylori infection is positively associated with hypertension. The present study, however, failed to link Helicobacter pylori infection with hypertension, and other investigations have shown a negative association between this infection and hypertension. In order to shed more light on this relationship, more studies with fewer confounders are needed.

Another finding of the present study pointed out

that the history of osteoporosis was not significantly different between the two groups of patients with and without Helicobacter pylori infection. The association between osteoporosis and Helicobacter pylori infection has been also referred to in previous studies. In a study performed in 2015, it was found that Helicobacter pylori infection could be considered a risk factor for osteoporosis in the Japanese population. The possible mechanism in this regard is the effect of Helicobacter pylori and cytokines caused by this infection on the absorption and digestion of minerals (29). This finding was also confirmed in the study by Lu et al. (30). However, some studies have ruled out the link between osteoporosis and Helicobacter pylori infection, and some others have reported that only some strains of this bacterium are associated with osteoporosis.

Conclusion

According to the present study, a sample of the general population in Mashhad, Iran, had a high prevalence of Helicobacter pylori infection. Further study is needed to determine the causes and prevent the increased prevalence of this infection in Mashhad. A larger sample size and a variety of geographic areas are recommended for future studies in this area. The prevalence of Helicobacter pylori infection should also be assessed using other diagnostic tests. This study investigated the prevalence of Helicobacter pylori infection and related factors in a sample of the general population in Mashhad, Iran. This is one of the strengths of the study.

References

1. Morgan D, Crowe S. Helicobacter pylori Infection. In: Feldman M, Friedman L, Brandt L, editors. Sleisenger and Fordtran's Gastrointestinal and Liver Disease. Philadelphia: Elsevier; 2016. p. 856-67.
2. Brooks G, Carroll K, Butel J, Morse S, Mietzner T. Vibrios, Campylobacters, Helicobacter, and Associated Bacteria. Jawetz, Melnick, & Adelberg's Medical Microbiology. 26th ed. New York City: McGraw-Hil; 2013. p. 261-3.
3. Franceschi F, Tortora A, Gasbarrini G, Gasbarrini A. Helicobacter pylori and extragastric diseases. Helicobacter. 2014;19:52-8.
4. Moosazadeh M, Lankarani KB, Afshari M. Meta-analysis of the Prevalence of Helicobacter Pylori Infection among Children and Adults of Iran. International journal of preventive medicine. 2016;7:48.
5. Ghayour-Mobarhan M, Moohebati M, Esmaily H, Ebrahimi M, Parizadeh SMR, Heidari-Bakavoli AR, et al. Mashhad stroke and heart atherosclerotic disorder (MASHAD) study: design, baseline characteristics and 10-year cardiovascular risk estimation. International journal of public health. 2015;60(5):561-72.
6. Zamani M, Ebrahimtabar F, Zamani V, Miller W, Alizadeh-Navaei R, Shokri-Shirvani J, et al. Systematic review with meta-analysis: the worldwide prevalence of Helicobacter pylori infection. Alimentary pharmacology & therapeutics. 2018;47(7):868-76.
7. Roberts SE, Morrison-Rees S, Samuel DG, Thorne K. Review article: the prevalence of Helicobacter pylori and the incidence of gastric cancer across Europe. 2016;43(3):334-45
8. Dorji D, Dendup T, Malaty HM, Wangchuk K, Yangzom D, Richter JM. Epidemiology of Helicobacter pylori in Bhutan: the role of environment and Geographic location. Helicobacter. 2014;19(1):69-73
9. Syam AF, Miftahussurur M, Makmun D, Nusi IA, Zain LH, Zulkhairi, et al. Risk Factors and Prevalence of Helicobacter pylori in Five Largest Islands of Indonesia: A Preliminary Study. PloS one. 2015;10(11):e0140186.
10. Xu C, Yan M, Sun Y, Joo J, Wan X, Yu C, et al. Prevalence of Helicobacter pylori infection and its relation with body mass index in a Chinese population. Helicobacter. 2014;19(6):437-42.
11. Bastos J, Peleteiro B, Barros R, Alves L, Severo M, de Fatima Pina M, et al. Sociodemographic determinants of prevalence and incidence of Helicobacter pylori infection in Portuguese adults. Helicobacter. 2013;18(6):413-22.
12. Zhu Y, Zhou X, Wu J, Su J, Zhang G. Risk Factors and Prevalence of Helicobacter pylori Infection in Persistent High Incidence Area of Gastric Carcinoma in Yangzhong City. Gastroenterology research and practice. 2014;2014:481365.
13. Elmanama AA, Mokhallalati MM, Abu-Mugesieb RM. Risk factors associated with Helicobacter pylori infection in Gaza, Palestine. IUG Journal of Natural Studies. 2015;16(2).
14. Chen HL, Chen MJ, Shih SC, Wang HY, Lin IT, Bair MJ. Socioeconomic status, personal habits, and prevalence of Helicobacter pylori infection in the inhabitants of Lanyu. Journal of the Formosan Medical Association = Taiwan yi zhi. 2014;113(5):278-83.
15. Hudak L, Jaraisy A, Haj S, Muhsen K. An updated systematic review and meta-analysis on the association between Helicobacter pylori infection and iron deficiency anemia. Helicobacter. 2017;22(1).
16. Kuwana M. Helicobacter pylori-associated immune thrombocytopenia: clinical features and pathogenic mechanisms. World journal of gastroenterology. 2014;20(3):714-23.
17. Franceschi F, Tortora A, Gasbarrini G, Gasbarrini A. Helicobacter pylori and extragastric diseases. Helicobacter. 2014;19 Suppl 1:52-8.
18. Samson AD, Schipperus MR, Langers AM, Dekkers OM. Helicobacter pylori infection is not correlated

with subclinical thrombocytopenia: a cross-sectional study. Platelets. 2014;25(3):221-3.
19. Baeg MK, Yoon SK, Ko SH, Noh YS, Lee IS, Choi MG. Helicobacter pylori infection is not associated with nonalcoholic fatty liver disease. World journal of gastroenterology. 2016;22(8):2592-600.
20. Vafaeimanesh J, Hejazi SF, Damanpak V, Vahedian M, Sattari M, Seyyedmajidi M. Association of Helicobacter pylori infection with coronary artery disease: is Helicobacter pylori a risk factor? 2014;2014:516354.
21. Hu A, Li L, Hu C, Zhang D, Wang C, Jiang Y, et al. Serum Concentrations of 15 Elements Among Helicobacter Pylori-Infected Residents from Lujiang County with High Gastric Cancer Risk in Eastern China. 2018.
22. Chen LW, Chien CY, Hsieh CW, Chang LC, Huang MH, Huang WY, et al. The Associations Between Helicobacter pylori Infection, Serum Vitamin D, and Metabolic Syndrome: A Community-Based Study. Medicine. 2016;95(18):e3616.
23. Kalantar E, Gharavi MJ, Ghaffari Hoseini S, Heshmat R, Oshaghi M, Gharegozlou B, et al. Association of Helicobacter Pylori Infection with Cardiometabolic Risk Factors among Iranian Adolescents: the CASPIAN III Study. International Journal of Pediatrics. 2018;6(2):7045-54.
24. Kim TJ, Sinn DH, Min YW, Son HJ, Kim JJ, Chang Y, et al. A cohort study on Helicobacter pylori infection associated with nonalcoholic fatty liver disease. Journal of gastroenterology. 2017;52(11):1201-10.
25. Ozaydin N, Turkyilmaz SA, Cali S. Prevalence and risk factors of Helicobacter pylori in Turkey: a nationally-representative, cross-sectional, screening with the (1)(3)C-Urea breath test. BMC public health. 2013;13:1215.
26. Marietti M, Gasbarrini A, Saracco G, Pellicano R. Helicobacter pylori infection and diabetes mellitus: the 2013 state of art. Panminerva medica. 2013;55(3):277-81.
27. Tamura T, Morita E, Kawai S, Sasakabe T, Sugimoto Y, Fukuda N, et al. No association between Helicobacter pylori infection and diabetes mellitus among a general Japanese population: a cross-sectional study. SpringerPlus. 2015;4:602.
28. Kopacova M, Koupil I, Seifert B, Fendrichova MS, Spirkova J, Vorisek V, et al. Blood pressure and stature in Helicobacter pylori positive and negative persons. World journal of gastroenterology. 2014;20(19):5625-31.
29. Asaoka D, Nagahara A, Shimada Y, Matsumoto K, Ueyama H, Matsumoto K, et al. Risk factors for osteoporosis in Japan: is it associated with Helicobacter pylori? Therapeutics and clinical risk management. 2015;11:381-91.
30. Lu LJ, Hao NB, Liu JJ, Li X, Wang RL. Correlation between Helicobacter pylori Infection and Metabolic Abnormality in General Population: A Cross-Sectional Study. 2018;2018:7410801.