# Seroprevalence of *Helicobacter pylori* in Nahavand: a population-based study

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**معدَّل الانتشار المصلي للمَلويَّة البوابية في نهاوند: دراسة سكّانية المرتَكَز**

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**الخلاصة:** أجرى الباحثون دراسة مستعرضة لتقييم معدَّلات انتشار الـمَلويَّة البوابية والعوامل المتعلّقة بانتقالها لدى 1518 شخصاً تزيد أعمارهم على ست سنوات من بين سكان نهاوند في غرب جمهورية إيران الإسلامية. وقد استكملت الاستبيانات حول المتغيّرات الاجتماعية والديموغرافية من خلال المقابلات. وأخذت عينات الدم من كلٍّ منهم، واختبرت الأمصال لتحرِّي الغلوبولين المناعي IgG الخاص بالـمَلويَّة البوابية باستخدام المقايسة المناعية الإنزيمية المتوافرة تجارياً. وقد كان معدَّل الانتشار المصلي الإجمالي للـمَلويَّة البوابية مرتفعاً إذ بلغ 71.0٪ (بفاصلة ثقة 95٪ وتراوح معدَّل الانتشار بين 69 و73) ولوحظ ازدياد تدريجي مع العمر. واستناداً إلى التصحيح المتعدد المتغيرات فإن الأنوثة والعمر فقط هما اللّذان يمكن اعتبارهما من عوامل الاختطار.

ABSTRACT In this cross-sectional study, we evaluated *H. pylori* seroprevalence and the relevant factors in 1518 people aged ≥ 6 years from the general population of Nahavand, western Islamic Republic of Iran. Questionnaires covering sociodemographic variables were completed by interview. Blood samples were taken from each individual. Sera were tested for anti-*H. pylori* IgG using commercial enzyme immunoassay. Overall, seroprevalence of *H. pylori* was high, 71.0% (95% CI: 69.0%–73.0%). There was a gradual increase with age. Based on multivariate adjustment, only female sex and age could be considered risk factors.

**Séroprévalence de *Helicobacter pylori* à Nahavand : étude en population**

RÉSUMÉ Dans cette étude transversale, nous avons évalué les taux de séroprévalence de *H. pylori* et les facteurs pertinents chez 1 518 personnes âgées de 6 ans et plus choisies parmi la population générale de Nahavand, dans l'ouest de la République islamique d'Iran. Des questionnaires sur les variables sociodémographiques ont été complétés dans le cadre d'entretiens. Des prélèvements sanguins ont été effectués sur chaque sujet. La présence d'anticorps anti-*H. pylori* de type IgG a été recherchée dans les sérums grâce à un test immunoenzymatique disponible dans le commerce. Globalement, la séroprévalence de *H. pylori* était élevée, à 71,0 % (IC 95 % : 69,0–73,0), et elle augmentait progressivement avec l'âge. Après ajustement multivarié, seuls l'appartenance au sexe féminin et l'âge pouvaient être considérés comme des facteurs de risque.

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## Introduction

The incidental discovery in 1983 of a bacterium that infects one-half or more of the world population [*1*] proved to have profound public health implications [*2*]. Infection with *Helicobacter pylori* occurs worldwide, but prevalence varies greatly between countries and between population groups within the same country [*3*]. The prevalence among middle-aged adults is > 80% in many developing countries, compared with 20%–50% in industrialized countries [*3,4*]. The infection in adults is usually chronic and will not heal without specific therapy; on the other hand, spontaneous elimination of the bacterium in childhood is probably relatively common, aided by the administration of antibiotics for other reasons [*5*]. We now know that *H. pylori* causes chronic gastritis, peptic ulcer and probably gastric cancer as well. [*6*]. The clinical course of infection is highly variable and is influenced by both microbial and host factors [*7*].

The overall prevalence of *H. pylori* infection is strongly correlated with socioeconomic conditions. It seems likely that in industrialized countries direct transmission from person to person by vomitus, saliva or faeces predominates; additional transmission routes, such as water, may be important in developing countries [*8*].

According to previous studies, the prevalence of *H. pylori* in the Islamic Republic of Iran is high (30.6%–79.4%), but unfortunately all studies involved volunteers, blood donors or attendants at health clinics whereas population-based studies would be needed to give a precise estimate of the burden of *H. pylori* infection and the relevant factors [*9–11*].

Thus, the objective of this study was to evaluate the seroprevalence of *H. pylori* infection and the relevant factors among a large number of people from the general population of Nahavand, western Islamic Republic of Iran.

## Methods

This cross-sectional study was conducted during a 2-month period, February–March 2003, on people aged 6 years and over in the city of Nahavand, population 72 000, in the western part of the Islamic Republic of Iran. It was approved by the ethics committee at the Reserch Centre for Gastroenterology and Liver Diseases, Shaheed Beheshti University of Medical Sciences.

Of the 6 urban regions in Nahavand, 5 (total population > 61 000) were selected for the study and 1518 participants were recruited through systematic random sampling (304 in each region). All participants signed a form giving informed consent prior to entry into the study. Refusals to participate were replaced by the nearest neighbour. Questionnaires were completed by face-to-face interview; questions covered age, sex, education level, number of family members in the household, hand washing prior to meals, hand washing after using the lavatory and hygienic disposal of sewage/excreta (both indoors and outdoors).

Blood samples were taken from each individual by trained health care workers. Sera were transported to the laboratory of the Research Centre for Gastroenterology and Liver Diseases and stored at –20 °C. They were tested for anti-*H. pylori* IgG using a commercial enzyme immunoassay kit (*H. pylori* EIA, Genesis Biotechnology, England) following the manufacturer's instructions. Cut-off was defined with positive and negative control sera that were included in each assay, according to the manufacturer's instructions. Samples were considered positive if the optical density was > 6.25.

All positive samples were verified with a second assay using the same test.

Statistical analyses were performed using *Stata*, version 8. The bivariate and multivariate associations of seropositivity (as binary dependent variable) with other independent variables were examined using a logistic regression model and crude and adjusted odds ratios were estimated. Age was entered into the models as a continuous variable. Also, chi-squared was used to test the potential statistical association of *H. pylori* seropositivity with demographic and hygiene factors. Fisher exact test was used if the assumptions of chi-squared were not met.

## Results

Of the 1518 participants, 653 (43.0%) were men and 865 (57.0%) were women. Mean age was 36.4 years [standard deviation (SD) 19.8], median 34 years.

Overall seroprevalence of *H. pylori* was 70.6% (95% CI: 69.0%–73.0%). Seropositive subjects had a mean age 39.9 (SD 19.3) years, median 37 years.

Table 1 shows the age-specific prevalence of *H. pylori* ($\chi^2$ for trend = 106.3, df = 1, $P < 0.001$).

Table 2 shows the frequency of *H. pylori* seropositivity by some sociodemographic characteristics. Based on multivariate adjustment, only female sex, adjusted odds ratio 0.72 (95% CI: 0.57–0.91), and age, adjusted odds ratio 1.04 (95% CI: 1.03–1.05), could be considered risk factors.

Mean number of family members per household was 4.54 (SD 2.06) in the *H. pylori* positive group and 4.69 (SD 1.70) in the negative group. The difference was not statistically significant. We considered families with > 5 members per household as having a high crowding index. Neither crowding index nor hygiene practices of the participants had a statistically significant effect on seropositivity of *H. pylori* (Table 2).

## Discussion

Overall, 70.6% of the study population was infected with *H. pylori.* This corresponds very closely to figures from other develop-

Table 1 **Seroprevalence of *Helicobacter pylori* among 1518 people aged 6 years and over in Nahavand, Islamic Republic of Iran by age group and sex**

| Age group (years) | *H. pylori* positive | | | | | |
|---|---|---|---|---|---|---|
| | Females[a] | | Males[b] | | Total[c] | |
| | No. | % | No. | % | No. | % |
| 6–10 | 17/31 | 54.8 | 11/30 | 36.7 | 28/61 | 45.9 |
| 11–20 | 79/172 | 45.9 | 96/179 | 53.6 | 175/351 | 49.9 |
| 21–30 | 124/169 | 73.4 | 55/100 | 55.0 | 179/269 | 66.5 |
| 31–40 | 134/165 | 81.2 | 80/102 | 78.4 | 214/267 | 80.1 |
| 41–50 | 104/122 | 85.2 | 63/75 | 84.0 | 167/197 | 84.8 |
| 51–60 | 70/81 | 86.4 | 47/58 | 81.0 | 117/139 | 84.2 |
| 61–70 | 60/71 | 84.5 | 39/51 | 76.5 | 99/122 | 81.1 |
| > 70 | 48/54 | 88.9 | 45/58 | 77.6 | 93/112 | 83.0 |

[a] $\chi^2_{\text{for trend}} = 68.95$; df = 1, $P < 0.001$.
[b] $\chi^2_{\text{for trend}} = 38.49$; df = 1, $P < 0.001$.
[c] $\chi^2_{\text{for trend}} = 106.3$; df = 1, $P < 0.001$.

Table 2 **Seroprevalence of *Helicobacter pylori* infection and crude and adjusted odds ratios (OR) for infection in Nahavand, Islamic Republic of Iran, by sociodemographic characteristics and other risk factors**

| Variable | No. positive/ no. tested | % | Crude OR | 95% CI | Adjusted OR | 95% CI |
|---|---|---|---|---|---|---|
| *Sex* | | | | | | |
| Female | 637/865 | 73.4 | 0.72 | 0.58–0.90 | 0.72 | 0.57–0.91 |
| Male | 435/653 | 66.6 | 1.04 | 1.03–1.05 | 1.04 | 1.03–1.05 |
| *Education level* | | | | | | |
| Illiterate | 286/341 | 83.9 | 1.86 | 0.28–0.72 | 0.99 | 0.99–1.00 |
| Elementary school | 247/361 | 68.4 | 1.09 | 0.70–1.67 | 0.99 | 0.99–1.00 |
| Middle school | 130/202 | 64.4 | 1.30 | 0.81–2.08 | 0.99 | 0.98–1.01 |
| High school | 315/480 | 65.6 | 1.23 | 0.81–1.86 | 1.00 | 0.99–1.01 |
| University | 94/134 | 70.1 | 0[a] | | 0.99 | 0.98–1.01 |
| *Family members in household* | | | | | | |
| ≤ 5 | 746/1060 | 73.6 | 1.01 | 0.94–1.09 | 1.00 | 0.99–1.00 |
| > 5 | 326/458 | 66.6 | 0.97 | 0.82–1.15 | 1.00 | 0.99–1.01 |
| *Hand washing before meals* | | | | | | |
| Missing data | 17/20 | 85.0 | – | – | – | – |
| Never | 41/60 | 68.3 | 2.63 | 0.69–10.05 | 0.99 | 0.97–1.02 |
| Sometimes | 289/397 | 72.8 | 2.12 | 0.61–7.37 | 1.00 | 0.99–1.01 |
| Often | 63/91 | 69.2 | 2.52 | 0.68–9.29 | 1.00 | 0.99–1.02 |
| Always | 662/950 | 69.7 | 2.47 | 0.72–8.48 | 0.99 | 0.99–1.00 |
| *Hand washing after using lavatory* | | | | | | |
| Missing data | 26/31 | 83.9 | – | – | – | – |
| Never | 27/40 | 67.5 | 2.50 | 0.78–8.02 | 1.00 | 0.98–1.03 |
| Sometimes | 188/247 | 76.1 | 1.63 | 0.60–4.44 | 1.00 | 0.99–1.01 |
| Often | 56/73 | 75.3 | 1.58 | –0.53–4.74 | 0.98 | 0.95–1.01 |
| Always | 775/1127 | 68.4 | 2.36 | 0.90–6.20 | 1.00 | 0.99–1.00 |
| *Hygienic sewage disposal* | | | | | | |
| Yes | 241/349 | 69.1 | 1.08 | 0.88–1.31 | 1.00 | 0.99–1.01 |
| No | 831/1169 | 71.1 | 0.98 | 0.92–1.04 | 0.99 | 0.99–1.00 |

[a]*This parameter is set to zero because it is redundant.*
*CI = confidence interval.*

ing countries, e.g. 79% for Pakistan and 63% at age 11–12 years in Turkey [*12,13*]. Our result is lower than in previous studies in our country: 75.3% in Tehran and 79.4% in Kerman [*10–11*]. This may be due to the fact that those studies were not population-based, only volunteers or referrals to clinics had been examined.

Many studies have shown no sex difference in the seroprevalence of *H. pylori* [*14–16*]. In a study on healthy persons aged 10–25 years in Tehran, *H. pylori* seroprevalence was equal for men and women [*12*]. In a meta-analysis of seroprevalence studies, seroprevalence was higher in males [*17*]. Relative immunodeficiency in males may be an explanation for higher incidences of other infections in male children. In our survey, seroprevalence was higher in females. Most females in the Islamic Republic of Iran, a developing country, are housewives and are in close contact with children. In the report of the Iranian Ministry of Health and Medical Education, in 2000, 89.1% of females over age 20 years in this region were housewives, i.e. did not work outside the home [*18*].

Cross-sectional serological studies in industrialized countries such as the United States of America show a gradual age-related increase in *H. pylori* prevalence [*14,19*]. A similar trend has been observed in developing countries, since the acquisition of *H. pylori* is known to occur mostly during childhood [*10–16,20*]. In the present study, also, there was an increase in the prevalence of infection with age, which is considered by some investigators to be due to an annual increase in rate of infection [*21*] but others consider it to be due to a cohort effect [*22*]. According to the cohort hypothesis, the infection is acquired in childhood, the children harbour the microorganism all their life and the prevalence curves drawn from cross-sectional population studies reflect the level of infection of each group in its youth.

In this survey, educated participants (as surrogate markers for higher socioeconomic status) had a lower frequency of *H. pylori* infection compared with those who were illiterate. This finding is in agreement with reports by others who have indicated that individuals of higher socioeconomic status are often less likely to be infected [*22*]. To date, almost all epidemiological studies have shown an inverse relationship between *H. pylori* infection and socioeconomic status [*23*].

In our study, the number of family members in the household did not play a significant role in *H. pylori* seropositivity. This is comparable with study from Greenland in which antibody status did not differ with respect to the number of persons per household [*24*]. Large family size is, however, generally accepted as being a risk factor for the aquisition of *H. pylori* infection [*25*] and declining family size reduces the opportunity for transmission and increases the age of acquisition [*23*]. In both the United States of America and Bangladesh, crowding in the home was significantly associated with *H. pylori* infection [*26,27*]. Also, in a study among people referred to health centres in Kerman, Islamic Republic of Iran, large family size was associated with increased prevalence of *H. pylori* [*13*].

We did not find any association between *H. pylori* seropositivity and hand washing before meals or after using the lavatory. In a study of a rural population in China, elevated risk was associated with infrequent hand washing before meals [*28*]. A study in rural Guatemala found evidence of *H. pylori* DNA under the fingernails of infected individuals, suggesting that the hand may play a role in transmission [*29*]. If we consider that not all answers to the question in our study were truthful (there is a tendency to conceal one's unsanitary habits), more

reliable studies need to be carried out to document the true effect of hand washing in *H. pylori* seropositivity.

In conclusion, the high seroprevalence of anti-*H. pylori* IgG is an indicator of a high prevalence of infection in a population from a developing country. Based on multivariate adjustment, female sex and age were significant risk factors. Infection with *H. pylori* should, therefore, be considered in the evaluation of upper gastrointestinal complaints in developing countries.

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