Prevalence and risk factors of *Helicobacter pylori* infection in Tunisian children: 1055 children in Cap-Bon (northeastern Tunisia)

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Summary

**Purpose.** — The aim of this study was to determine the prevalence of *Helicobacter pylori* infection in a population of schoolchildren six years of age and to identify the risk factors that predispose children to such infection.

**Patients and methods.** — A total of 1055 first-grade primary-school pupils were included. Socioeconomic factors, eating habits, gastrointestinal complaints and family history of peptic ulcer or gastric cancer were recorded with a questionnaire. Serum samples were collected to determine *H. pylori* infection status using ELISA for IgG antibodies.

**Results.** — The prevalence of *H. pylori* infection was 51.4%. On univariate analysis, risk factors for *H. pylori* infection were household-crowding, lower socioeconomic status, late weaning from bottlefeeding (more than 18 months), bed-sharing and cup-sharing. Symptoms related to infection were abdominal pain and vomiting. On multivariate analysis, household-crowding, late bottle-weaning, bed-sharing and abdominal pain were the only variables that remained strongly associated with *H. pylori* infection.

**Conclusion.** — The high prevalence of *H. pylori* infection in Tunisian children is associated with poor living conditions.

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**Résumé**

**Objectifs.** — Le but de notre étude est de déterminer la prévalence de l’infection à *Helicobacter pylori* chez des enfants âgés de six ans, scolarisés en première année et d’identifier les facteurs de risque de transmission de la bactérie.

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Introduction

*Helicobacter pylori* is a pathogenic agent commonly incriminated in the development of chronic gastric disorders (gastritis, peptic ulcer, cancer, lymphoma). *H. pylori* infection is acquired during infancy [1] from other people, the only known reservoir of this disease, via feco-oral or oro-oral transmission [2].

Risk factors of transmission are strongly linked to social and economic factors. In developing countries, 70% of children less than 15 years of age are infected [3] while in developed countries the rate of infection in children under 10 is only 10% [3].

The purpose of this work was to ascertain the prevalence of *H. pylori* infection in first-grade schoolchildren in the Cap-Bon region of Northeastern Tunisia, and to search for the risk factors of transmission and clinical signs of infection.

Materials and methods

This prospective survey was conducted from January to June 2007 among schoolchildren in the Cap-Bon region belonging to the recruitment populations of 13 healthcare centers in the Nabeul governorship. Among the 10,703 first-grade pupils identified in the healthcare centers’ databases, 1055 were randomly selected for inclusion (the first, 10th and 20th children on the health-center lists).

The study was conducted with the authorization of the regional director of health and the general director of primary schools. Parents provided their written consent for participation and accompanied their children on the day of the survey.

To determine *H. pylori* status, 3–4 mL of blood sample was drawn on a dry tube from each child. After centrifugation, the serum was extracted and held at −20 °C until assay. After thawing, an ELISA kit (Platelia®, Bio-Rad; 3, boulevard Raymond-Poincaré, 92430 Marnes-la-Coquette, France) was used to search for anti-*H. pylori* IgG antibodies.

On the day of the survey, the physician in charge recorded each child’s weight and height to determine growth retardation, and completed a standard questionnaire. The purpose of the questionnaire was to obtain social and economic data from the parents. The following items were noted:

- number of persons per household;
- presence or not of potable water, electricity, radio, television and refrigerator;
- total number of persons living with the child;
- number of rooms in the house;
- duration of breastfeeding;
- age at weaning from bottlefeeding;
- bed-sharing;
- eating habits (sharing utensils such as a cup, plate or spoon).

History-taking focused on abdominal pain, signs of anemia (notion of iron supplementation), vomiting and a family history of peptic ulcer or gastric cancer.

Statistical analyses

Data were recorded using an Excel spreadsheet and processed with SPSS version 11.5. Results are reported as the relative frequency of qualitative variables, and the mean, median, range and standard deviation of quantitative variables.

Univariate analysis was applied to search for risk factors associated with *H. pylori* infection. The receiver operating curves (ROC) method was used to determine the cut-off value giving the best sensitivity–specificity relationship to transform quantitative variables into binomial qualitative variables. After checking that the area under the curve was significant (> 0.50), this cut-off was used to generate the odds ratio (OR).

Logistic-regression multivariate analysis was then applied to identify risk factors directly linked with *H. pylori* infection. The adjusted OR gave the relative impact of each factor. The significance threshold was 0.05.

Results

All children included in the survey were enrolled in the first grade of primary school: 813 (77.1%) were six years old and 242 (22.9%) were seven years old. The gender ratio was 0.99 (49.9% male and 50.1% female). Other characteristics of the surveyed children are shown in Table 1.

Abdominal pain was noted in 264 children (25%); the pain was considered atypical in 255 children (24.2%) and suggestive of an ulcer in nine (0.8%). One hundred and thirty-six children (12.9%) were receiving or had received iron supple-
Table 1  Characteristics of the 1055 children included in the survey. Caractéristiques des enfants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
<th>Mean ± S.D.</th>
<th>Median (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 years</td>
<td>813 (77.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 years</td>
<td>242 (22.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>526 (49.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>529 (50.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socioeconomic level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>163 (15.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>809 (76.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>81 (7.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bed-sharing</td>
<td>342 (32.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plate-sharing</td>
<td>581 (55.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spoon-sharing</td>
<td>105 (10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cup-sharing</td>
<td>612 (58.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td></td>
<td>22.34 ± 4.13</td>
<td>22 (14—47)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td>118.9 ± 6.5</td>
<td>119 (90—145)</td>
</tr>
<tr>
<td>Number of persons in household</td>
<td></td>
<td>4.6 ± 1.49</td>
<td>4 (2—18)</td>
</tr>
<tr>
<td>Number of rooms in house</td>
<td></td>
<td>2.9 ± 0.99</td>
<td>3 (1—10)</td>
</tr>
<tr>
<td>Number of persons per room</td>
<td></td>
<td>3.2 ± 1.77</td>
<td>3 (1—14)</td>
</tr>
<tr>
<td>Duration of breastfeeding (months)</td>
<td></td>
<td>12.2 ± 8.9</td>
<td>12 (0—48)</td>
</tr>
<tr>
<td>Age at bottle-weaning (months)</td>
<td></td>
<td>22.1 ± 12.08</td>
<td>24 (1—72)</td>
</tr>
</tbody>
</table>

Vomiting was noted in 92 children (8.7%), and growth retardation in 22 children (2.1%). There was a family history of gastric cancer in 29 children (2.7%) and of peptic ulcer in 167 (15.8%).

H. pylori serology was positive in 51.4% of children, and ranged from 61.6% to 31%, depending on the geographical region. The highest prevalence of infection was observed in Menzel Bouzelfa (Fig. 1).

Statistically, there was no difference between infected and non infected children in terms of the following variables: gender, weight, height, number of rooms in house, number of children per room, duration of breastfeeding, anemia, and family history (Table 2).

Univariate analysis showed a link between the number of persons living with the child and H. pylori infection: the risk of infection was 1.5 times greater for children in households with more than five members. Late weaning (more than 18 months) from bottlefeeding was also a risk factor for infection (Table 3).

Other risk factors were sharing an eating utensil (plate), bed-sharing and having a lower socioeconomic status. Sharing other eating utensils (spoon and cup) was also more frequent among infected children (11% versus 9% and 61% versus 55%, respectively), but the difference was not statistically significant.

Clinical signs associated with infection were abdominal pain and chronic vomiting. A history of anemia, gastroenteritis and growth retardation was also more frequent among H. pylori-infected children but, again, the difference was not significant.

As for family history, the frequency of peptic ulcer and gastric cancer was similar in infected versus non infected children.

Of these risk factors, multivariate analysis retained four as risk factors of infection: more than five persons living in the household, bottle-weaning beyond 18 months, bed-sharing, and abdominal pain (directly linked) (Table 4).

Figure 1  Prevalence of H. pylori infection in different regions of Tunisia. Menzel Bouzelfa: 64.6%; Korba: 60.2%; Bou Argoub: 58.6%; Grombalia: 57.6%; Hammamet: 54.5%; Kelibia: 53.5%; Haouaria: 53.2%; Beni Khaled: 52.5%; Menzel Temim: 52.4%; Beni Khiar: 45.6%; Soliman: 42.4%; Nabeul: 41.2%; Dar Chaabène: 31%.

Prévalence de l’infection à H. pylori selon les régions.
Table 2 Analysis by serology.
Analyse des différentes variables selon le résultat de la sérologie.

| Variable                        | H. pylori (+) | H. pylori (−) | P  
|---------------------------------|--------------|---------------|---
| Gender                          |              |               |   
| Male                            | 49.8%        | 50.4%         | 0.85 
| Female                          | 50.2%        | 49.6%         |   
| Socioeconomic level             |              |               |   
| Lower                           | 18%          | 12.6%         | 0.013 
| Average/upper                   | 82%          | 87.4%         |   
| Bed-sharing                     | 37.8%        | 26.3%         | 0.000 
| Plate-sharing                   | 59.5%        | 50.6%         | 0.005 
| Spoon-sharing                   | 10.6%        | 9%            | 0.403 
| Cup-sharing                     | 60.8%        | 55.1%         | 0.063 
| Weight (kg)                     | 22.1         | 22.5          | 0.269 
| Height (cm)                     | 118.7        | 119.2         | 0.242 
| Number of persons in household  | 4.7          | 4.45          | 0.006 
| Number of rooms in house        | 2.9          | 2.98          | 0.269 
| Number of persons per room      | 3.23         | 3.11          | 0.278 
| Duration of breastfeeding (months) | 12.48    | 11.85         | 0.266 
| Age at bottle-weaning (months)  | 23.3         | 20.81         | 0.006 
| Abdominal pain                  | 28.1%        | 21.2%         | 0.97 
| Anemia                          | 12.5%        | 12.6%         | 0.011 
| Vomiting                        | 10.6%        | 6.8%          | 0.03 
| Growth retardation              | 2.3%         | 2%            | 0.759 
| Family history of gastric cancer| 2.7%         | 3%            | 0.74 
| Family history of peptic ulcer  | 14.2%        | 17.6%         | 0.14 

Discussion

H. pylori is a long-lasting infection that is usually acquired during childhood. We chose to determine the prevalence of H. pylori infection in six-year-old because the data suggest that most infections are acquired before the age of five [4]. Malaty et al. [5] found that the highest rate of acquisition occurs before the age of 10. All the available epidemiological studies show that most of the risk factors of infection are related to living conditions during early childhood [4].

We used a non invasive method to determine H. pylori serology. The Platelia® kit has a 98.1% sensitivity and 89.3% specificity in children aged 9 ± 4.7 years. In their study of 160 children, Raymond et al. [6] reported a 94.4% sensitivity and 86.8% specificity.

Ni et al. [7] studied the feasibility of several invasive and non invasive tests in 53 children aged 10—14 years, and found 85% positive serology for 98.1% positive histology.

The rate of 51.4% observed in our study may therefore be an underestimate.

In the series of 191 asymptomatic Tunisian children aged one to 15 years reported by Maherzi et al. [8], the prevalence of H. pylori infection, as determined by serology, was 30.4%. This prevalence increased with age — from 18% in children aged under two years to 35% in those aged 10—15 years.

The lower prevalence of H. pylori infection in the developed countries highlights the important role of socioeconomic conditions in bacterial transmission [9].

Table 3 Risk factors and symptoms related to infection (univariate analysis).
Les facteurs de risque et les signes cliniques liés à l’infection (étude univariée).

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>OR</th>
<th>95% Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household members &gt; 5 in number</td>
<td>0.007</td>
<td>1.51</td>
<td>1.1—2</td>
</tr>
<tr>
<td>Bottle-weaning &gt; 18 months</td>
<td>0.004</td>
<td>1.53</td>
<td>1.14—2.06</td>
</tr>
<tr>
<td>Plate-sharing</td>
<td>0.004</td>
<td>1.43</td>
<td>1.12—1.83</td>
</tr>
<tr>
<td>Bed-sharing</td>
<td>0.000</td>
<td>1.7</td>
<td>1.3—2.22</td>
</tr>
<tr>
<td>Lower socioeconomic status</td>
<td>0.017</td>
<td>1.52</td>
<td>1.07—2.14</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>0.01</td>
<td>1.45</td>
<td>1.09—1.93</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0.03</td>
<td>1.63</td>
<td>1.04—2.54</td>
</tr>
</tbody>
</table>

Table 4 Risk factors and symptoms related to infection (multivariate analysis).
Les facteurs de risque et les signes cliniques liés à l’infection (étude multivariée).

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>OR</th>
<th>95% Cl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household members &gt; 5 in number</td>
<td>0.035</td>
<td>1.51</td>
<td>1.02—2.1</td>
</tr>
<tr>
<td>Bottle-weaning &gt; 18 months</td>
<td>0.008</td>
<td>1.51</td>
<td>1.11—2.3</td>
</tr>
<tr>
<td>Bed-sharing</td>
<td>0.003</td>
<td>1.72</td>
<td>1.2—2</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>0.043</td>
<td>1.45</td>
<td>1.01—2.5</td>
</tr>
</tbody>
</table>
In our series, having a lower socioeconomic level increased the risk 1.5-fold, although this did not retain significance in the multivariate analysis. The other risk factors were having more than five members in the household and bed-sharing, both of which are related to crowded living conditions, which have also been identified in earlier reports [10–14].

Among the eating habits investigated, sharing plates was found to be a risk factor. This favors oro-oral transmission. On the other hand, cup-sharing, identified in other reports, was not a risk factor of transmission in our series. It was, however, noteworthy that cup-sharing was more common among the seropositive children (595 versus 480), albeit below the level of statistical significance ($P=0.06$).

Late weaning from bottlefeeding (after the age of 18 months) was also found to be a risk factor. Indeed, Rowland et al. [15] found that bottlefeeding for more than 24 months was a risk factor of infection, suggesting that the bottle might be a disease vector.

However, the role of breastfeeding in the transmission of *H. pylori* infection remains controversial. Some authors believe that it may have a protective role, while others consider it as a factor of transmission because of the intimate contact between the infant and its infected mother [16]. In our series as well as that reported by Rodrigues et al. [17], there was no correlation between the rate of infection and breastfeeding, not even for infants who were breastfed for more than six months.

As regards symptoms, children do not present with the characteristic manifestations of such infection and, as for abdominal pain, the causal effect of infection is not clear. Kalach et al. [18] observed that the rate of epigastric pain was higher in non-infected children than that in ulcer-free infected children whereas other authors, including our team, have found a significant association between pain and infection [19].

However, unlike other studies [20,21], we did not observe any relationship between infection and growth retardation. In addition, *H. pylori* infection appears to favor iron-deficiency anemia [22] although, in our study, no such relationship was found.

It is known that the risk of infection is higher in children with a family history of peptic ulcer or gastric cancer [14]. In our series, there was no significant relationship between these factors and infection.

**Conclusion**

*H. pylori* infection is a major public health problem in the developing countries. Because of the strong link between a high prevalence in children and poor socioeconomic status, preventative measures should be undertaken to improve living conditions and increase awareness of the modes of bacterial transmission. One important problem remains the eradication of asymptomatic infection during childhood in order to prevent the development of gastric cancer later in adulthood.

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**References**


