

## Prevalence of *Helicobacter pylori* Infection in a Rural Area of the State of Mato Grosso, Brazil

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*The prevalence of Helicobacter pylori infection was evaluated by ELISA in 40 children and teenagers and in 164 adults from a rural area of the State of Mato Grosso, Brazil. Antibodies to H. pylori were detected in the serum of 31 (77.5%) children and teenagers and in 139 (84.7%) adults. The prevalence of infection increased with age ( $\chi^2$  for trend,  $p < 0.01$ ) even though no variations occurred in the region in the present century in terms of living conditions or sanitation, economical development and migratory influx supporting the hypothesis that the infection is also acquired during later life in developing countries. An inverse correlation was observed between the prevalence of infection and annual family income ( $\chi^2$  for trend,  $p < 0.013$ ). There was no correlation between type of system for sewage disposal and prevalence of infection ( $p = 0.8$ ). In conclusion, the prevalence of H. pylori infection in Nossa Senhora do Livramento, a rural area from Brazil, is very high and similar to that observed in other developing countries. Furthermore, the increase in the prevalence of infection with age observed in this population seems to be due to both, cohort effect and acquisition of the infection during later life.*

Key words: *Helicobacter pylori*/epidemiology - *H. pylori*/socioeconomic level - *H. pylori*/crowding - *H. pylori*/Brazil

*Helicobacter pylori* is recognized as the main etiological agent of gastritis in human beings and as an essential factor in the pathogenesis of peptic ulcer (Mégraud & Lamouliatte 1992). Furthermore, there is evidence that the microorganism is also involved in the pathogenesis of gastric carcinoma (Parsonnet et al. 1991) and MALT type gastric lymphoma (Wotherspoon et al. 1991).

The microorganism is responsible for one of the most frequent chronic bacterial infections involving more than 50% of the world population. Epidemiological studies have demonstrated that the prevalence of *H. pylori* infection increases with advancing age and is higher in developing countries and among low socioeconomic level populations, probably due to conditions that favor the acquisition of infection such as precarious hygiene, crowded living conditions, and absence or deficiency of sanitation (Graham et al. 1991).

In developed countries children and adolescents are only infrequently infected, and in adults over 50 years of age the seroprevalence of the infection ranges from 30% to 60% (Morris et al. 1986, Mégraud et al. 1989). On the other hand, in developing countries up to one half of 10-year-old children are infected with *H. pylori*. In Nigeria the infection involves up to 92% of all children older than 10 years and up to 100% of adults aged 50 to 59 years (Holcombe et al. 1992). High rates of infection are also observed in Chile (Russel et al. 1993) and other developing countries (Mégraud et al. 1989).

In Brazil, a country of continental size, important regional differences are likely to occur. We observed a prevalence of 62.1% and 34.1% among adults (Rocha et al. 1992) and children from Belo Horizonte (Oliveira et al. 1994), capital of the State of Minas Gerais, and 90% and 72% among adults and children from Araçuaí, Jequitinhonha valley (Rocha et al. 1994), considered to be one of the poorest regions in the state. Nevertheless, no data are available about the prevalence of *H. pylori* infection in other regions of Brazil. Therefore, the present study was undertaken to evaluate the prevalence of *H. pylori* infection in a rural population living in the municipality of Nossa Senhora do

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### SUBJECTS AND METHODS

The present study was approved by the Ethics Committee of The University Hospital, Federal University of Mato Grosso, Brazil, and informed consent to participate in the study was obtained from the children and from their parents or persons responsible and from the adults.

Nossa Senhora do Livramento is a municipality with 10,547 inhabitants (IBGE 1991) located in the central-southern region of the State of Mato Grosso. This municipality has not presented population growth over the last decades. The poor economic situation has determined a vegetative decrease (a demographic density of 1.98 inhabitants per km<sup>2</sup>) and a relative isolation of the population over the last few decades. The population of the municipality is predominantly rural and native of the region and mainly consists of descendants of blacks and indians who live on subsistence agriculture (Freire et al. 1989).

An epidemiologic survey was carried out in Nossa Senhora do Livramento between 1993 and 1994 to determine the prevalence of hepatitis B in the population older than 10 years. A total of 253 dwellings selected at random from the 3,038 dwellings existing in the municipality were visited, for a total of 740 individuals included in the survey. The subjects responded to a questionnaire requesting information about age, water supply, sewage, number of rooms and number of persons residing in each dwelling and annual family income. Serum samples were obtained and were stored at -20°C until the time of processing.

Serum samples from 204 of the 740 individuals were selected at random respecting a proportional distribution for each age range. We studied 40 children and teenagers (20 boys and 20 girls, mean age 14 years, range 10 to 19 years) and 164 adults (95 males and 69 females, mean age 50 years, range from 20 to 90 years).

Anti-*H. pylori* antibodies were assayed by the Cobas Core anti-*H. pylori* IgG EIA (Roche Diagnostic Systems, Switzerland), second-generation EIA that had previously been standardized for the Brazilian population with 95.4% sensitivity and 100% specificity for adults (Rocha et al. 1996) and for children over 10 years old (Oliveira et al., unpublished data). The test was performed according to manufacturer's instructions.

The association of the presence of anti-*H. pylori* antibodies with the different sociodemographic variables studied in this survey was analyzed by the determination of the odds ratio and by the chi-square test with Yates correction. The linear tendency of the proportions of positivity of anti-*H.*

*pylori* antibodies in different categories of exposure was analyzed by the chi-square test for trends. The level of significance was set at  $p < 0.05$ .

### RESULTS

Seventy five per cent of the population lived in the rural area and 25% in the urban area. Annual family income was less than US\$ 3,600.00 for 82.5% of the families studied. The population used water with no treatment and lived in dwellings with no sewer network. The index of crowding was 1.9 person per room.

Thirty one children and teenagers (77.5%) presented anti-*H. pylori* antibodies. No significant difference ( $p = 0.12$ ) was observed between boys and girls.

Among the adults, 139 (84.7%) subjects presented anti-*H. pylori* antibodies with no significant difference ( $p = 0.08$ ) between males and females. The prevalence of infection increased significantly ( $\chi^2$  for trend = 7.49,  $p < 0.01$ ) with age (Table I). An inverse association was observed between the prevalence of the infection and annual family income ( $\chi^2$  for trend = 6.14,  $p = 0.013$ ) (Table II). No association was observed between the system of sewage disposal and the prevalence of infection, which was 81%, 82.9% and 85% for peridomiciliary disposal, septic cesspool and dry cesspool, respectively ( $p = 0.8$ ).

TABLE I

Seroprevalence of *Helicobacter pylori* infection by age in 204 subjects from Nossa Senhora do Livramento, Mato Grosso, Brazil

Age (yr) ratio	Number	Seropositivity (%)	Odds ratio
10 - 19	40 (19.6)	31 (77.5)	1.0
20 - 29	25 (12.3)	16 (64.0)	0.5
30 - 39	29 (14.2)	24 (82.8)	1.4
40 - 49	25 (12.3)	21 (82.0)	1.5
50 - 59	25 (12.3)	23 (92.0)	3.3
60 - 69	34 (16.7)	32 (94.1)	4.6
≥70	26 (12.7)	23 (88.5)	2.2

TABLE II

Seroprevalence of *Helicobacter pylori* infection by annual family income in 184 subjects from Nossa Senhora do Livramento, Mato Grosso, Brazil

Annual family income US\$	Number <sup>a</sup>	Seropositivity (%)	Odds ratio
< 1,200	26	24 (92.3)	1.0
1,201 - 2,400	92	78 (84.8)	0.5
2,401 - 3,600	34	26 (76.5)	0.3
3,601 - 4,800	16	12 (75.0)	0.2
4,801 - 6,000	8	08 (100)	0.6
>6,000	8	04 (50.0)	0.1

*a*: twenty individuals did not know how to classify their annual family income.

## DISCUSSION

The results of the present study demonstrate that the prevalence of *H. pylori* infection among adults, children and teenagers from Nossa Senhora do Livramento was higher than that observed in Belo Horizonte but similar to that reported in Araçuaí, State of Minas Gerais and in some African countries in which 69 to 82% of children are infected by 10 years of age. Several factors seem to be associated with transmission of the microorganism. According to several authors, precarious basic sanitation conditions have been considered to be an important risk factor in the acquisition of *H. pylori* infection and in this situation or when it is present, the infection may be transmitted by the fecal-oral route by ingestion of contaminated water. Most of the population studied here used untreated water (possibly contaminated with refuse, since a sewage network was also absent) and consequently this population was exposed to the fecal-oral route of bacterial transmission, a condition similar to that observed in Araçuaí, Minas Gerais (Rocha et al. 1994), where the prevalence of infection is also very high. Indeed, in developing countries water has been regarded as a source of infection, as demonstrated in Chile (Hopkins et al. 1993) where the consumption of raw vegetables irrigated with contaminated water is correlated with higher prevalence rates. Klein et al. (1991), in a study of Peruvian children of low socioeconomic level, also demonstrated a higher prevalence of *H. pylori* infection among those who utilized possibly contaminated municipal water than among those who utilized water from their own sources. In addition, the conditions described above are inseparable and low socio-economic level is also associated with crowding conditions that favor oral-oral transmission of the infection. In fact, this was the case for the population studied here which lives in overcrowded homes. Thus, the population of the present study is exposed to several conditions that facilitate the acquisition of infection by both the fecal-oral and oral-oral routes.

In the present study, as also reported in others, there was an increase in the prevalence of infection with age which is considered by some investigators to be due to an annual increase of rate of infection (van Zanten et al. 1994). On the other hand, the increase in prevalence with age is considered to be due to a cohort effect by others (Banatvala et al. 1993, Kuipers et al. 1993). According to the cohort hypothesis, the infection is acquired in childhood, the children harbor 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.

The low rates observed in young persons may be explained by the industrialization and economic development that western countries have undergone, with consequent improvement of living conditions and hygiene facilities. This hypothesis is corroborated by the fact that the annual rates of seroconversion in adults are very low in developed countries such as the Netherlands (0.3%) (Kuipers et al. 1993) and the United States (0.5%) (Parsonnet et al. 1992). On the other hand, seroprevalence studies in very poor countries such as Nigeria (Holcombe et al. 1992) have demonstrated that the prevalence of infection is very high (up to 92% positivity in children older than 10 years) so that it becomes impossible to demonstrate a cohort effect in such populations. In Brazil, conditions are favorable to test the cohort hypothesis since, although the prevalence of infection is high, it is not so high and some populations such as that of the present study have not experienced changes in living conditions for long periods of time. In fact, the socioeconomic and cultural level, and consequently the quality of life of the population studied, as well as the basic sanitation conditions of the region have not improved in the present century and the population has remained stable, with no migratory currents during this period. Even so, an increase in infection with age was observed. Thus, we may assume that, even though the acquisition of the infection mainly occurred in childhood in this population (77.6% among children younger than 19 years), it also continued to occur during later life. It is probable that the living conditions of the population studied, no longer existing in developed countries, also favor the acquisition of the infection by adults.

We also observed a decrease in the prevalence of infection among individuals aged 70 years or older. This is a universal finding both in developed and developing countries which has been explained by the fall in specific serologic response among older individuals due to the fall in general immunity and/or to the decreased number of microorganisms in the gastric mucosa of individuals colonized for many decades as a consequence of the gastric atrophy that sets in after the infection and which creates adverse conditions for bacterial colonization.

In the present study we found an inverse correlation between annual family income and the prevalence of *H. pylori* infection. Similar results were observed in other studies (Fiodorek et al. 1991, Staat et al. 1996). In Wales, Whitaker et al. (1993) found inverse correlations between the prevalence of *H. pylori* infection and socioeconomic level or manual classes. Fiodorek et al. (1991) also demonstrated significant inverse correlations between

prevalence of *H. pylori* infection and income ranging from < 5,000.00 to > 25,000.00 per year in adults and children from the USA. It is noteworthy that in this study, an inverse correlation was observed even among individuals with a very low annual income (less than 5,000.00).

In conclusion, the prevalence of *H. pylori* infection in Nossa Senhora do Livramento, is very high and similar to that observed in other poor regions of Brazil and in other developing countries. Furthermore, the increase in prevalence of infection with age observed in this population seems to be also due to acquisition during later life in addition to a cohort effect.

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