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Associated factors for *Helicobacter pylori* infection in eastern of Minas Gerais, Brazil

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ABSTRACT

This study is aimed at assessing the prevalence of *Helicobacter pylori* infection, and the associated potentially factors, in a group of individuals that were examined 10 years ago in a district located in the East part of Minas Gerais State, Brazil, and still lived there. Structured questionnaires were used to explore the characteristics of 143 individuals. The detection of *H. pylori* was performed by Urea Breath test. The results showed that 70% (n = 100) of subjects were infected. It was noted that *H. pylori* infection is associated with the augment of age, individuals between 55 and 69 years of age had the highest probability of infection (OR: 43.33; CI: 4.97-378.00). Besides, individuals that lived with a partner (OR 2.80; 1.34 – 5.85), hypertensives (OR: 3.91, CI: 1.51-10.14) and who never went to school or had concluded elementary course (OR: 2.88, CI: 1.09-7.56; OR: 3.67, CI: 1.05-12.81, respectively) were also associated with infection. The possible improvements of socioeconomic status showed no protective effect in the acquisition of *H. pylori* infection. One can speculate that a longer period will be necessary so that the improvements in living conditions in this locality contribute to reducing the incidence of infection in the population.

Keywords: *Helicobacter pylori*, infection, epidemiology, associated factors, urea breath test.
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INTRODUCTION

Helicobacter pylori infection is one of the most prevalent among humans and affects about half of the world population. *H. pylori* is seen as the main etiologic agent of gastritis in humans, and crucial in the pathogenesis of peptic ulcer, playing an important role in the development of gastric carcinoma and lymphoma (Forman et al., 1991; Wotherspoon et al., 1991; Blaser et al., 1995; Braga et al., 2007; Özen et al., 2006).

In Brazil, studies conducted in several capitals showed prevalence above 50% with rates of infection increased with age. Intrafamilial transmission by direct contact from person to person has been identified as one of the main modes of transmission; however, the exact mechanism of transmission is unknown. The one universally accepted fact is that the bacteria can only reach the gastric mucosa by mouth (Goodman et al., 2008; Parente et al., 2006; Rodriguez et al., 2006; Souto et al., 1998; Zaterka et al., 2007).

Studies on risk factors relate *H. pylori* infection to socioeconomic indicators. Conditions related to personal hygiene, health, high population density in housing, schooling, family income, age, number of people per room in the house, living in institutions (orphanages, shelters, etc.) and inadequate sanitation are often factors associated with high prevalence of infection (Torres et al., 1998; Nabweraet et al., 2000; Kori et al., 2009).

The diagnosis of active infection can be accomplished through the labeled urea breath test (^{13}C-UBT) based on

the enzymatic activity of *H. pylori* urease. The urea, substrate of the enzyme urease, can be labeled with ^{13}C. After hydrolysis of urea, carbon dioxide is exhaled through breath and an increased excretion of labeled CO_2 can be used as an indicator of gastric colonization by *H. pylori* (Ogata et al., 2001). More recently, Queiroz et al. (2013) showed that both ^{13}C-UBT and the monoclonal stool test are reliable for diagnosing *H. pylori* infection in very young children, which will facilitate robust epidemiological studies in infants and toddlers.

According to Oliveira et al. (1994), the high prevalence of *H. pylori* infection was recorded in 249 asymptomatic children between one month and 18 years old among residents of low socioeconomic status in Minas Gerais (MG) state, Brazil. The prevalence of *H. pylori* infection increased significantly ($p = 0.001$) with age as follows: 1 month-2 yr, 16.4% (11/67); 3-5 yr, 36.7% (22/60); 6-8 yr, 29.5% (13/44); 9-11 yr, 48.8% (21/43); 12-14 yr, 42.8% (9/21); and 15-18 yr, 64.3% (9/14). Those authors showed a significant increase in prevalence with age, reaching rates of 64.3% at the ages between 15 and 18 years old. These data corroborate Rocha et al. (1992), who in the same state also evaluated 380 adult blood donors and noted an increase in the prevalence of *H. pylori* infection with age. They found a prevalence of 62.1% between people of 21 and 30 years old and 72.5% between people of 51 and 60 years old. Concerning Araçuaí Municipality, North of Minas Gerais State, there was a prevalence of 62.0% in children between 10 and 18 years old and 87.0% in adults (Oliveira, 1999).

Córrego dos Melquíades, where this study was carried out, is a rural district in the east of Minas Gerais State, has been a place of *H. pylori* infection studies, since the 90s (Ursino, 2002). Ursino (2002) reported a high prevalence of infection in adults (86.2%) and children (51.9%). They also observed that 100% of the interviewees consumed untreated water and residences had no sewage system. Among the risk factors associated with infection in the district, the author highlighted: conditions related to personal hygiene, inadequate sanitation, and low socioeconomic status.

Therefore, the current research aims to assess the presence of *H. pylori* infection, and the potential factors associated with the disease in a group of individuals that were examined 10 years ago by Ursino (2002), and still living in the district of Córrego dos Melquiades, In addition, the data obtained may contribute to the planning of disease prevention strategies in the study location.

MATERIALS AND METHODS

Local and study group

The study was conducted in Córrego dos Melquíades, a rural district of Governador Valadares municipality, in the east of Minas Gerais state, Brazil. The study sample is composed of 143 individuals. The inclusion criterion was having participated in the previous study carried out by Ursino (2002).

Test for *H. pylori* detection

All individuals were subjected to Urea Breath test (^{13}C-UBT) for *H. pylori* detection. The ^{13}C-UBT test allows assessment of the presence of bacteria in the stomach detecting only active infection. It was performed using urea labeled with ^{13}C by the technique of infrared spectrometry (Graham et al., 1987). After fasting for 4 to 6 hours, a sample was collected from air exhaled by the patient in a proper balloon (baseline sample). Immediately afterward the patient ingested 200 ml of orange juice, containing 75 mg of urea labeled with ^{13}C. After 30 minutes new air sample was collected (sample test). Reading of the content of carbon in the exhaled air was done through infrared spectrometry in both samples. An increase higher than 5% in the content of ^{13}C of the test sample related to the baseline sample was considered positive for H. pylori. The sensitiveness and specificity of the test are 97.0% and 95.0% respectively.

Anamnesis and physical exam

H. pylori detection and information about possible associated factors to *H. pylori* infection were obtained. For this, a structured, pre-coded questionnaire was prepared that contained variables about socioeconomics aspects (gender, age, scholarly, income, if have a partner, if shared the bedroom, feces destination, water supply, and if the residence was connected to sewage); habits (hand wash before meal, used shared cups and cutlery); clinical anamnesis about digestive tract disorders (family history of gastritis, burning and gastric cancer; previous treatment *for H. pylori*, gastritis, diabetes, hypertension, leishmaniasis, and burning; current claims of postprandial fullness, alcoholism, acid foods intolerance and use of proton-pumps inhibitory (PPI). The anamnesis was performed by two general practitioner medical doctors and a gastroenterologist.

Statistical analysis and ethical aspects

Chi-square or Fisher's exact test was done for the verification of the equality of variables between the interest groups, and Mann-Whitney test was applied for continuous variables, after discarding normality by Kolmogorov-Smirnov test data. To estimate the effect of the independent variables on the *H. pylori* infection, variables that showed $P < 0.20$, in the Chi-square or Fisher's exact tests, were analyzed by logistic regression to investigate which factors could be associated with *H. pylori* infection. The 95% confidence interval (CI) was used to estimate the precision of the odds ratio (OR), and we set the significance level at 0.05. All analyzes were performed with SPSS software (IBM Corp).

The research was carried out considering the ethical issues involved in the resolution 196/96 of the National

Health Council, after acceptance of the Research Ethics Committee of the Federal University of Minas Gerais (ETIC019/00 register). All patients who showed abnormalities in ^{33}C-UBT or clinical examination were referred for specific treatment.

RESULTS

The study sample comprises of 86 women and 57 men. The prevalence of *H. pylori* infection in the group was 70% (n = 100), affecting in absolute numbers 1.5 times more women than men (Table 1). The mean age was 48.2 years ± 20.7, with the youngest being 14 years and the oldest 90 years old. Most individuals had never gone to school or only completed elementary school (85%) (Table 1).

Regarding the intimate contact and sharing of utensils, it was verified that 57% of the study sample lived with a companion and 73% shared the dormitory with at least one person (Table 1). Concerning hygiene habits, only 30% shared glasses and cutlery, and 14% did not wash their hands before meals (Table 1). A wide proportion of the participants declared that they had no sewage system channeled in the street or at home (96%) and, despite having a bathroom at home; the feces were thrown to the stream, near their households. In addition, 90% of the individuals used the water stream to perform some labor (Table 1), and some still reported using exclusively stream water for all household labor and personal hygiene.

Anamnesis related to disorders of the digestive system

During anamnesis, it was found that 53% of the subjects reported burning and 55% exhibited postprandial fullness. Furthermore, 26% reported discomfort with ingestion of acidic foods and only 10% consumed a proton-pump inhibitor. About the clinical history of the participants, 20% had gastritis, 12% diabetes, 30% were hypertensive and only 6.3% had Leishmaniasis (Table 2).

For family history, 30% had family members diagnosed with gastritis, 62% of family members complained of burning sensation and the prevalence of gastric cancer in their families was 7.4%. Only 6% of the relatives received treatment for *H. pylori* (Table 2).

Assessment of associated factors to *H. pylori* infection

Infected individuals were significantly older (p <0.001, Mann-Whitney), the mean age of the infected individuals was 52.3 years (19.1) and of the non-infected individuals was 38.4 years (21.3). The distribution of the individuals by age groups was also made and a significant positive association with the infection was found (Table 1 and Figure 1). From the age of 40, the risk of *H. pylori* infection increased by 3.8 times (OR 3.80; CI: 1.17-12.3) until 54 years; it was 43 times in individuals between 55 and 69 years (OR 43, 33; CI: 4.97-378.0) and 4 times in individuals over 70 years old (OR: 4.13; CI: 1.23-13.83) (Table 1 and Figure 1).

H. pylori infection was associated with schooling (p <0.056), with people that had concluded elementary school having 3.67 times higher risk of infection than those with High school/college education (OR: 3.67; CI 1.05-12.81). In individuals who never attended school, the risk of infection was 2.88 times higher (OR: 2.88; CI: 1.09-7.56). The fact that the individual lived with a partner also significantly associated with *H. pylori* infection (OR: 2.80; CI: 1.34-5.85; p = 0.005).

The anamnesis variables related to the infection were the burning sensation in the family history (OR:0.4; CI:0.18-0.93). Although the burning sensation and postprandial fullness were not specific symptoms, there was a negative association (OR: 0.36, CI: 0.17-0.79) Table 2.

The arterial hypertension was positively associated with the infection, and the hypertensive subjects were almost 4 times more likely to belong to the infected group than non-hypertensive patients (OR: 3.91; CI: 1.51-10.14). Diabetes was a factor associated with *H. pylori* infection, with a 7.5-fold higher chance of infection in individuals with this health condition. The other variables were not significantly associated with the occurrence of the infection (Table 2).

DISCUSSION

In this study, it was found that the proportion of infected individuals by *H. pylori* residing in Córrego dos Melquíades remains high (70%), ten years after the study conducted by Ursino (2002) that described a prevalence of 69.7% in the general population. A similar prevalence (69.5%) was found in a study conducted with individuals aged 18 years and older who presented gastric disorders in the Campina Grande city, the State of Paraíba, Northeast Brazil (Basílio et al., (2018).

We found that *H. pylori* infection is associated with the following variables: age, live with a partner, schooling, and hypertension. Although the highest frequency of infection was observed among individuals from 40 years, it was noted that the children who had the infection in 2002 possibly remain infected nowadays, since the proportion of positive cases in the age group of 10-24 years old was 15.4%.

There is no consensus in the literature that age is associated with an increased risk of infection (Eusebi et al., 2014). Therefore, some authors report that *H. pylori* infection occurs mainly in childhood, in a proportion ranging from 30 to 50%, reaching more than 90% in adulthood. According to studies conducted by Rodrigues et al. (2004), in a community in the city of Fortaleza, the rate of *H. pylori* infection in the general population was 56%. However, it reached much higher values in children aged 12-14 years old (75.4%) and in children under 2

Table 1. Socioeconomic variables possibly associated with *H.pylori* infection in individuals residing in Córrego dos Melquíades, Governador Valadares, MG, in 2012.

Variable[a]	Infected Individuals n(%)	Uninfected Individuals n(%)	Total n(%)	OR (95% CI)[b]	*p*-value
Gender (*n* = 143)					
Male	40 (40.0)	17 (39.5)	57 (39.9)		
Female	60 (60.0)	26 (60.5)	86 (60.1)	NA	0.958*
Age (*n* = 143)					
10 – 24	9 (9.0)	13 (30.2)	22 (15.4)	-	
25 – 39	20 (20.0)	14 (32.6)	34 (23.8)	2.06 (0.69 – 6.14)	
40 – 54	21 (21.0)	8 (18.6)	29 (20.3)	**3.80 (1.17 – 12.30)**	
55 – 69	30 (30.0)	1 (2.3)	31 (21.7)	**43.33 (4.97 – 378.00)**	
≥ 70	20 (20.0)	7 (16.3)	27 (18.9)	**4.13 (1.23 – 13.83)**	**<0.001***
Schooling (*n* = 141)					
High School/College	10 (10.2)	11 (25.6)	21 (14.9)	-	
Primary School	68 (69.4)	26 (60.5)	94 (66.7)	**3.67 (1.05 – 12.81)**	
Never went to school	20 (20,4)	6 (13.9)	26 (18.4)	**2.88 (1.09 – 7.56)**	**0.056***
Live with a partner (*n* = 142)					
No	35 (35.3)	26 (60.5)	61 (43.0)	-	
Yes	64 (64.7)	17 (39.5)	81 (57.0)	**2.80 (1.34 – 5.85)**	**0.005***
Number of people sleeping in the same room (n = 142)					
1	24 (24.2)	14 (32.6)	38 (26.8)		
2	55 (55.6)	17 (39.5)	72 (50.7)		
3	16 (16.2)	9 (20.9)	25 (17.6)		
4	4 (4.0)	3 (7.0)	7 (4.9)	NA	0.361*

years old the rate was 35.1%. Those authors also showed that the prevalence of *H. pylori* infection increased significantly with age and that the infection rate was 84.7% in the group of individuals of 18-30 years old and 92% aged 46-60 year old. Above 60 years old the infection rate decreased slightly.

We also noted an increase in the frequency of *H. pylori* infection among individuals of 55-69 years old and occurring decrease in frequency after 70 years old, according to other studies (Rodrigues et al., 2004; Kodaira et al., 2002). The increase in the prevalence of infection in relation to age was interpreted as the acquisition of *H. pylori* at any stage of one's life. Cross-sectional studies have shown an increase in the proportion of individuals infected with the increasing of age, which has been primarily attributed to a cohort effect, reflecting a higher transmission during a period in which the groups (cohorts) above were children, suggesting that the acquisition occurs almost exclusively in the first five years of life (Braga et al., 2007).

Regarding interpersonal transmission that appears to be the main route, we found that residing with a partner was considered an important factor associated with infection. Didelot et al. (2013) reported several transmission clusters detected in one family, including one cluster made of three siblings living in the same house. According to Silva et al. (2004), 52.4% of patients infected by *H. pylori* were married. Hypothetically, the bacteria can also be transmitted by oral-oral route between husband and wife through contaminated saliva by gastric juice (Kodaira et al., 2002). Furthermore, it is known that parental transmission has been frequently reported and transmission events were more frequent between close relatives and between individuals living in the same house (Eusebi et al., 2014).

The mentioned village consists of rural workers, housewives, and students. More than 80% of the inhabitants have the only basic educational level or no formal education and most of the houses used untreated water of cisterns or wells. The frequency of waste directly connected to stream is higher. The most common reason for the use of stream water was leisure, domestic activities, and work-related activities. Agriculture is based on subsistence planting (Magueta et al., 2015, Bethony et al., 2001). Research conducted in China by Brown et al., (2002) evaluating *H. pylori* infection in a rural area, correlating lifestyle and environmental factors, found no relationship between schooling, family income

Table 1. Contd.

Variable[a]	Infected Individuals n(%)	Uninfected Individuals n(%)	Total n(%)	OR (95% CI)[b]	*p*-value
Shared cups or cutlery (n = 142)					
No	71 (71.7)	28 (65.1)	99 (69.7)	NA	
Yes	28 (28.3)	15 (34.9)	43 (30.3)		0.432*
Washing hands before meals (n = 141)					
No	13 (13.1)	7 (16.7)	20 (14.2)		
Yes	86 (86.9)	35 (83.3)	121 (85.8)	NA	0.582*
discards feces in the stream (n =136)					
No	84 (88.4)	32 (78.0)	116 (85.3)	-	
Yes	11 (11.6)	9 (21.9)	20 (14.7)	0.466 (0.18 – 1.23)	0.117*
Uses water from the stream (n = 142)					
No	12 (12.1)	2 (4.7)	14 (9.9)		
Yes	87 (87.8)	41 (95.3)	128 (90.0)	NA	0.228**
House connected to sewage collect system (n = 142)					
No	2 (2.0)	3 (7.0)	5 (3.6)	-	
Yes	97 (98.0)	40 (93.0)	137 (96.4)	0.275 (0.44 – 1.71)	0,163**

[a]Excluded individuals without information**.** [b]Only the results of Crude OR that showed significance in the statistic calculation were added to the table.*****Frequencies were compared by Chi-square test, and ******by Fisher's exact test. Bold values are significant at 95% level. **OR**: *Odds ratio*; **95% CI**: confidence interval 95%. **NA** = not applicable.

level and infection by the bacteria. However, other studies have shown that infection with *H. pylori* and socioeconomic factors are interrelated, such as those researches carried out in Colombia (Goodman et al., 1996), South Africa (Sathaar et al., 1997), Northern Brazil (Almeida et al., 2003) and in Saudi Arabia (Hasosah et al., 2015).

Furthermore, Vergueiro et al. (2008) showed the association of infection with the types of water ingested. It was found in the study that the absence of potable water and sewage collect were factors associated with *H. pylori* infection. Likewise, Rodrigues et al. (2005) observed that *H. pylori* infection is highly prevalent in one urban community in Northeastern Brazil, characterized by poor living conditions.

The low level of education was also identified as a risk factor for *H. pylori* infection among the participants of our study. Individuals with lower educational levels were more infected than those with higher education (Bastos et al., 2013; Hollander et al., 2013). It is known that the difficulty of access to information observed in subjects with low level of education contributes to the maintenance of specifics habits, such as spending saliva on nipple before breastfeeding, pre-chewing food by the mothers or feeding in the same container are associated with the transmission of *H. pylori* (Kodaira et al., 2002; Vergueiro et al., 2005).

The association between *H. pylori* infection and hypertension is controversial. We found that hypertensives people presented highest *H. pylori* infection levels than non-hypertensives. Similar results were found in a study conducted in China by Wang et al., (2018). However, other studies have identified that hypertension might be considered as protective factors (Constantinescu and Constantinescu, 2014). A possible association between *H. pylori* infection and cardiovascular and autoimmune disorders has been found. The release of cytotoxic substances either of bacterial origin or produced by the host may represent mediators of these systemic sequelae. According to Migneco et al. (2003) the possible links between hypertensive disease and *H. pylori* infection may involve the activation of cytokine cascade with release of vasoactive substances from the primary site of infection, or molecular mimicry between the CagA antigens of *H. pylori* and some peptides expressed by endothelial cells and smooth muscle cells.

Some studies have reported an association between *H. pylori* infection and an increased risk of cardiovascular disease (Harvey et al., 2001). The strength of the association has been hard to judge because of the varied methods of the studies and substantial heterogeneity of the findings. Mechanisms that may contribute to this association include abnormalities in the levels of certain blood proteins (fibrinogen or C reactive protein) secondary to the chronic infection and raised blood pressure in people infected with *H. pylori.* According to researchers, their findings indicate that, contrary to some previous suggestions, the association that exists between cardiovascular disease and *H. pylori* infection is

Table 2. Anamnesis and physical exam associated with infection by *H.pylori* in individuals residing in Córrego dos Melquíades, Governador Valadares, MG, in 2012.

Variable[a]	Infected Individuals n(%)	Uninfected Individuals n(%)	Total n(%)	OR(95% CI)[b]	*p*-value
Family History					
Gastritis (n = 132)					
No	70 (74.5)	22 (57.9)	92 (60.7)	-	
Yes	24 (25.5)	16 (42.1)	40 (30.3)	0.471 (0.21 – 1.04)	0,061
Burning Sensation (n = 134)					
No	41 (44.1)	10 (24.4)	51 (38.1)	**-**	
Yes	52 (55.9)	31 (75.6)	83 (61.9)	**0.41 (0.18 – 0.93)**	**0.030**
Gastric Cancer (n=135)					
No	85 (90,4)	40 (97,6)	125 (92.6)		
Yes	9 (9,6)	1 (2,4)	10 (7.4)	NA	0,282**
Previous treatment for *H. pylori* (n = 122)					
No	82 (96.5)	33 (89.2)	115 (94.3)	-	
Yes	3 (3.5)	4 (10.8)	7 (5.7)	0.30 (0.06 – 1.42)	0.197**
Clinical History Past					
Gastritis (n = 132)					
No	75 (80.6)	31 (79.5)	106 (80.3)		
Yes	18 (19.4)	8 (20.5)	26 (19.7)	NA	0.879
Diabetes (n = 136)					
No	80 (84.2)	40 (97.6)	120 (88.2)	-	
Yes	15 (15.8)	1 (2,4)	16 (11.8)	7.5 (0.96 – 58.82)	**0.039****

Continue…

Variable[a]	Infected Individuals n(%)	Uninfected Individuals n(%)	Total n(%)	OR (95% CI)[b]	*p*-value
Systemic arterial Hypertension (n=141)					
No	60 (61.2)	37 (86.0)	97 (68.8)	-	
Yes	38 (38.8)	6 (14.0)	44 (31.2)	**3.91 (1.51 – 10.14)**	**0.003**
Leishmaniasis (n = 143)					
No	92 (92.0)	42 (97.7)	134 (93.7)		
Yes	8 (8.0)	1 (2.3)	9 (6.3)	NA	0.278**
Current Clinical History					
Burning Sensation (n =142)					
No	52 (52.5)	15 (34.9)	67 (47.2)	-	
Yes	47 (47.5)	28 (65.1)	75 (52.8)	0.48 (0.23 – 1.02)	**0.053**
Post prandial fullness (n =142)					
No	52 (52.0)	12 (27.9)	64 (44.8)	-	
Yes	48 (48.0)	31 (72.1)	79 (55.2)	**0.364 (0.17 – 0.79)**	**0.009**
Used PPIs (n = 141)					
No	91 (92.9)	36 (83.7)	127 (90.1)	-	
Yes	7 (7.1)	7 (16.3)	14 (9.9)	0.396 (0.13 – 1.2)	0.126**
Intolerance to acidic foods (n= 141)					
No	69 (69.7)	35 (83.3)	104 (73.8)	-	
Yes	30 (30.3)	7 (16.7)	37 (26.2)	2.174 (0.87 – 5.44)	0,092

[a]Excluded individuals without information**.** [b]Only the results of Crude OR that showed significance in the statistic calculation were added to the table.*****Frequencies were compared by Chi-square test, and **by Fisher's exact test. Bold values are significant at 95% level. **OR**: *Odds ratio*; **95% CI**: confidence interval 95%. **NA** = not applicable.

not accounted for by an increase in blood pressure. Furthermore, Kim et al. (2012) detected *H. pylori* more frequently in patients with high intraocular pressure (IOP). This suggests that *H. pylori* infection may have a role in increasing IOP in anterior uveitis patients, though a potential causative role for *H. pylori* in anterior uveitis is not clear. In general, during uveitis, the blood-ocular barrier is broken down following the influx of immunocompetent cells, inflammatory materials, and proteins. These mediators, including cytokines and chemokines, are thought to have a major impact on secondarily elevating IOP.

With regard to potential autoimmune reactions, *H. pylori* infection induces humoral and cellular immune responses following activation of macrophages and produces proinflammatory cytokines (including a variety

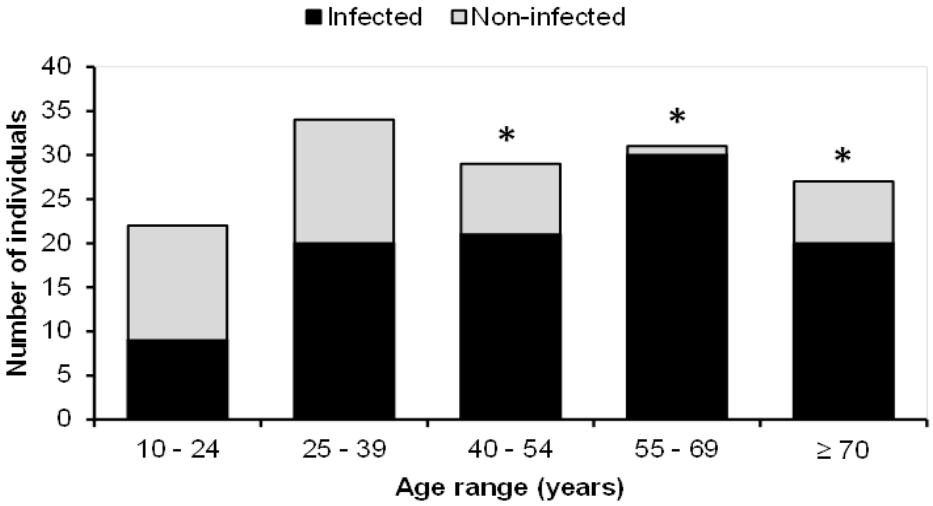

Figure 1. Distribution of individuals infected with *H. pylori*, by age group**.**

of interleukins). These cytokines can be released into the aqueous humor of patients with anterior uveitis and may lead to increased IOP. These studies found an association between *H. pylori* infection and increased IOP in anterior uveitis patients.

Regarding the data of anamnesis and physical examination, it was found that symptoms such as family history of burning sensation and postprandial fullness were associated with protection to infection. On the other hand, in a subset of patients, dyspeptic symptoms are likely to originate from *H. pylori* infection. Population-based studies have demonstrated that this bacterium is detected more frequently in dyspeptic patients compared to controls (Selgrad et al., 2008).

Our study had some limitations. Thus, our findings should be interpreted with caution because the sample size was limited and may have led to an underestimation of the strength of the association between *H. pylori* infection and risk factors. Furthermore, the socioeconomic and behavioral risk factors were self-reported by the studied patients. Understanding the epidemiology and risk factors of *H. pylori* infection is essential to better characterize diseases associated with this pathogen and to design targeted cost-effective prevention strategies.

Conclusion

From the study, the proportion of individuals infected with *H. pylori* in Córrego dos Melquíadesstill remains high (70%), ten years after the study conducted by Ursino (2002). It was noted that currently *H. pylori* infection is associated with: age, living with a partner, schooling and hypertension.

It was found that some parameters considered indicators of better socio-economic status, such as a number of rooms in the house and schooling, possibly occurred in Córrego dos Melquíades between 2002 and 2012, in the interval between this study and Ursino's study. However, there is still a low level of schooling in the district and sewage is released into the stream. Thus, it is possible that constant contact with contaminated water contributes to the high prevalence of *H. pylori* in the group.

The possible improvements of socioeconomic status that occurred were insufficient to promote protective effect in the acquisition of *H. pylori* infection, taking into account the current prevalence of 70% among individuals who participated in the previous study by Ursino. One can speculate that a longer period will be necessary so that the improvements in living conditions in the mentioned locality may contribute to reducing the incidence of infection in the population.

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