

**HELICOBACTER PYLORI INFECTION AND RISK
FACTORS IN THE DEVELOPMENT OF
GASTRODUODENAL DISEASES IN A POPULATION
FROM THE CENTRAL-WEST REGION OF BRAZIL**

**PERFIL SOCIODEMOGRÁFICO E CORRELAÇÃO COM A INFECÇÃO
POR HELICOBACTER PYLORI EM PACIENTES DISPÉPTICOS NA
REGIÃO CENTRO-OESTE DO BRASIL**

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Resumo: *Helicobacter pylori* é uma bactéria gram-negativa associada ao desenvolvimento de patologias severas como o adenocarcinoma gástrico. Aproximadamente 50% da população mundial está infectada por este microrganismo. A infecção está associada a fatores socioeconômicos, sociodemográficos e estilo de vida. Em função disso o presente estudo teve o objetivo de avaliar os fatores de risco e patologias gástricas associadas a infecção pela *H. pylori*. Foram aplicados 117 questionários que contemplavam fatores sociodemográficos, econômicos, sintomatologia e estilo de vida de pacientes submetidos a endoscopia digestiva alta. O diagnóstico foi realizado a partir do exame histopatológico e molecular. A prevalência da infecção foi de 69,2%, sendo 70,4% entre adultos e 79% do sexo feminino. Não foi observada diferença estatística nos níveis educacional, socioeconômico e condições expostas na infância. O hábito de consumir álcool demonstrou significância para a infecção ($p=0,049$). A sintomatologia mais frequente foi o arroto ($p=0,023$). Entre as patologias gástricas, a gastrite foi o desfecho clínico mais encontrado. O conhecimento dos fatores de risco para a infecção bacteriana é de extrema relevância para dar subsídios para implementação de políticas públicas voltadas para a prevenção e erradicação do microrganismo.

Palavras-chave: Bactéria. Prevalência. Fatores de risco. Dispepsia.

Abstract: *Helicobacter pylori* is a gram-negative bacterium associated with the development of severe pathologies such as gastric adenocarcinoma. Approximately 50% of the world population is infected by this microorganism. Infection is associated with socioeconomic, sociodemographic and lifestyle factors. Therefore, the present study had the goal of evaluating the risk factors and gastric pathologies associated with *H. pylori* infection. A total of 117 questionnaires were used, which included sociodemographic, economic, symptomatology and patient lifestyle factors submitted to upper digestive endoscopy. The diagnosis was done based on histopathological and molecular. The prevalence of infection was 69.2%, being 70.4% among adults and 79% females. No statistical difference was observed in educational, socioeconomic and childhood conditions. The alcohol consumption habit showed significance for the infection ($p = 0.049$). The most frequent symptomatology was belching ($p = 0.023$). Among the gastric pathologies, gastritis was the most frequent clinical outcome. The knowledge of the risk factors for bacterial infection is extremely relevant to provide subsidies for the implementation of public policies aimed at the prevention and eradication of the microorganism.

Key words: Bacteria. Risk factors. Dyspepsia.

Introduction

The *Helicobacter pylori* (*H. pylori*) is a gram-negative, spiral, flagellated and microaerophilic bacterium, that colonizes the gastric mucosa (SARKER et al., 1997). This bacterium has cosmopolitan distribution and it is estimated that about 50% of the world's population is infected. Approximately 80% of the individuals do not present clinical manifestations, and the infection can persist throughout the life, if not treated (GUNALETCHUMY et al., 2014).

H. pylori is an etiologic agent of gastrointestinal diseases such as gastritis, duodenal ulcers, gastric ulcers, gastric adenocarcinoma and mucosal lymphoid tissue lymphoma (GUNALETCHUMY et al., 2014). Due to the association of the bacterium with the development of gastric adenocarcinoma, *H. pylori* was characterized with a class I carcinogen by the International Agency for Research on Cancer (World Health Organization) (IARC, 2012). In addition to these pathologies, researchers have demonstrated the association of infection with extra-gastrointestinal diseases such as vitamin B12 deficiency, metabolic syndrome, diabetes mellitus, and non-alcoholic liver disease and others (TSAY; HSU, 2018).

The prevalence of *H. pylori* infection is highest in developing countries and is related to age, gender, ethnicity and socioeconomic diversity (YU et al., 2017). In developed countries like Canada, USA and Australia, the prevalence rate is less than 30%. In Brazil the prevalence of *H. pylori* is about 71.2% and has decreased over the years due improvements in sanitary conditions (FRUGIS et al., 2016). However, the prevalence remains high in the poorest regions of Brazil, and this rate is similar to that of Africa of 70-90% (FIALHO, 2012; HOOI et al., 2017).

H. pylori transmission ways involve oral-oral, fecal-oral, iatrogenic, via endoscopic instruments contaminated with gastric secretions (GUIMARÃES; CORVELO; BARILE, 2008), through oral sex (DIMITRIADI, 2014), zoonotic, through flies and cockroaches as vectors (ALLEN et al., 2004). In addition, the bacteria have been found in feces, vomiting, water and saliva, which justifies their predominance in the intrafamilial environment (FIALHO, 2012; RASMUSSEN et al., 2010).

Risk factors for *H. pylori* infection include sex, age, educational level, sanitary conditions, water treatment, poor household conditions, poor accessibility to health care and lifestyle. All these risk factors are sociodemographic indicators, which are significantly associated to the contamination predisposition by the bacteria (BASÍLIO et al., 2018).

Since *H. pylori* infection is a public health problem and associated with socioeconomic conditions, the present study aimed to conduct a sociodemographic study correlating lifestyle to the prevalence of *H. pylori* infection and its various clinical forms.

In this sense, this work will contribute for the public health policies in order to reduce the infection rate, improving the control of the forms of transmission, and consequently

decreasing the costs of the Brazilian Public Health System with the treatment of gastric diseases.

Methodology

Study participants

The study was conducted in a university hospital, in Goiânia, Goiás, Brazil. The study consisted of 117 dyspeptic patients who underwent upper digestive endoscopy from November 2017 to September 2018. Patients who agreed to participate in the study signed the Free and Informed Consent Form (TCLE) and were asked to answer to socioeconomic, sociodemographic, symptomatology and lifestyle issues questionnaires.

Patients who used proton pump inhibitors in the last two weeks or blocking agents in the last week were excluded from the study as well as patients who have taken immunosuppressants or antibiotics in the last eight weeks; patients with active gastrointestinal bleeding, pregnant patients, infants or those who were unable to undergo endoscopy.

Endoscopic evaluation and *Helicobacter pylori* diagnosis infection

Endoscopic evaluation as well as histopathological analysis was performed in the Department of Endoscopy and in the Laboratory of Clinical Pathology of a University Hospital. During the endoscopic examination, fragments of gastric tissue were collected, according to the recommendations of the Brazilian Society of Digestive Endoscopy. Three fragments were sent for histopathological analysis and one for molecular diagnosis (Polymerase Chain Reaction - PCR). The histopathological diagnosis based on Sidney Classification System was used as reference for polymorphonuclear analysis and mononuclear cell infiltration (DIXON, 2001). *H. pylori* infection was confirmed by histopathological diagnosis and PCR.

Statistical analysis

The analyzes were performed based on the questionnaires applied, endoscopic diagnosis and histological report. Fisher's exact test and G test were used to compare categorical variables and the Student's *t* test for continuous variables. Logistic regression models were used to improve the demographic, socioeconomic, and lifestyle analysis associated to the risk of developing *H. pylori* infections. All analyzes were performed using SPSS IBM software version

20.0 (SPSS Inc., Chicago, IL, USA) and Bioestat version 5.0 with 95% confidence interval (CI) and set the level of significance (α) at 0.05.

ETHICS CONSIDERATIONS

The study protocol was approved according to the standards of the Research Ethics Committee of the Clinical Hospital of the Federal University of Goiás, consubstantiated opinion number 2.519.032, according to Resolution CNS / 196/96.

RESULTS

*Prevalence of infection by *H. pylori**

The study included 117 patients who signed the Informed Consent Term. The patients' ages ranged from 18 to 83 years old with an average of 45.3 years. The prevalence of *H. pylori* infection was 69.2% (81/117), and this rate was evaluated through histopathological examination and PCR.

Among *H. pylori* infected patients, 21% (17/81) were males and 79% (64/81) females ($p = 0.925$). From the infected patients 8.6% (7/81) were less than 21 years old, 70.4% (57/81) were between 22 and 59 years old, 21% (17/81) were 60 years or older ($p = 0.766$) (Table I e II).

Table I. Association between epidemiologic factors and *H. pylori* infection.

Characteristics of participants	Helicobacter pylori				p-value	Total (n=117)	
	Positive (n=81)		Negative (n=36)			n	f (%)
	n	f (%)	n	f (%)			
Sex							
Female	64	79	28	77.8	0.925	92	78.6
Male	17	21	8	22.2		25	21.4
Age Group (years)							
Up to 21	7	8.6	2	5.6	0.776	9	7.7
22-59	57	70.4	25	69.4		82	70.1
60 or more	17	21	9	25		26	22.2
Age years							
Mean (SD)	45.7	15	52.6	14.5	0.021*	98	15.1
Min - Max	18	71	19	83		37	83
Schooling							
Low	47	58	22	61.1	0.256	69	59
Average	25	30.9	13	36.1		38	32.5
High	9	11,1	1	2.8		10	8.5
Family income							
Up to 2 wages	40	49.4	14	38.9	0.495	54	46.2
3 to 5 salaries	26	32.1	10	27.8		36	30.8
> 5 wages	3	3.7	3	8.3		6	5.1
Do not know	12	14.8	9	25		21	17.9
Childhood residence							
Countryside	50	61.7	23	63.9	0.824	73	62.4
Urban area	31	38.3	13	36.1		44	37.6
Items missing in childhood							
Piped water	60	74.1	25	69.4	0.805	85	72.6
Sewer	62	76.5	25	69.4		87	74.4
Toilet	61	75.3	25	69.4		86	73.5
There were no	18	22.2	11	30.6		29	24.8
People by Rooms							
Two people	3	3.7	4	11.1	0.233	7	6
Three people	77	95.1	32	88.9		109	93.2
> 3 people	1	1.2	0	0		1	0.9
Types of Supply							
General Network	76	93.8	34	94.4	0.896	110	94
Water in tank	5	6.2	2	5.6		7	6
Number of endoscopies							
None	18	22.2	10	27.8	0.495	28	23.9
Up to two	34	42	17	47.2		51	43.6
3 or more	29	35.8	9	25		38	32.5

The G-test was applied for the p-value calculation; (*) Student's t-test.

Table II. Risk factors and their association/non-association with *H. pylori* infection.

Characteristics of participants	Positive (n=81)		OR	CI 95%		p-value
	n	f (%)		Inf	Sup	
Sex						
Female	64	79,0	1,000	--	--	--
Male	17	21,0	0,930	0,36	2,41	0,925
Age group (years)						
Up to 21	7	8,6	1,000	--	--	--
22-59	57	70,4	0,651	0,13	3,36	0,896
60 or more	17	21,0	0,540	0,09	3,16	0,784
Schooling						
Low	47	58,0	1,000	--	--	--
Average	25	30,9	0,900	0,39	2,09	0,976
High	9	11,1	4,213	0,5	35,35	0,293
Family income						
Up to 2 wages	40	49,4	1,000	--	--	--
3 to 5 salaries	26	32,1	0,910	0,35	0,35	0,961
> 5 wages	3	3,7	0,350	0,06	1,94	0,445
Do not know	12	14,8	--	--	--	--
Childhood residence						
Countryside	50	61,7	1,000	--	--	--
Urban area	31	38,3	1,097	0,49	2,48	0,987
Items missing in childhood						
Piped water	60	74,1	1,000	--	--	--
Sewer	62	76,5	1,033	0,54	2,00	0,944
Toilet	61	75,3	1,017	0,53	1,97	0,905
There were no	18	22,2	0,682	0,28	1,65	0,535
People by Room						
Two people	3	3,7	1,000	--	--	--
Three people	77	95,1	0,208	0,04	1,05	0,128
> 3 people	1	1,2	--	--	--	--
Smokes						
Not	74	91,4	1,000	--	--	--
Yes	7	8,6	1,608	0,32	8,15	0,840
Consume alcohol						
Not	54	66,7	1,000	--	--	--
Yes	27	33,3	2,500	0,93	6,73	0,104
Consume coffee						
Not	7	8,6	1,000	--	--	--
Yes	74	91,4	1,321	0,36	4,83	0,937
Types of supply						
General Network	76	93,8	1,000	--	--	--

Storage / Cistern	5	6,2	1,090	0,20	5,90	0,746
Number of endoscopies						
None	18	22,2	1,000	--	--	--
Up to two	34	42,0	1,111	0,42	2,92	0,973
3 or more	29	35,8	1,790	0,61	5,25	0,429

OR: odds ratio; 95% CI: 95% confidence interval

Socioeconomic issues and life habits associated with *H. pylori*

No statistical difference was observed in the current educational, socioeconomic and childhood conditions of *H. pylori*-positive or *H. pylori*-negative groups (Table I and II). The main risk factors associated with bacterial infection include smoking in 8.6% (7/81) of the patients ($p = 0.437$); the alcoholism present in 33.3% (27/81) of the patients ($p = 0.049$); coffee consumption was present in 91.4% (74/81) of the patients ($p = 0.454$) (Table III).

Table III: Lifestyle factors and their association/non-association with *H. pylori* infection.

Life habits	Helicobacter pylori				p-valor	Total (n=117)	
	Positive (n=81)		Negative (n=36)				
	n	f (%)	n	f (%)		n	f (%)
Smokes							
Not	74	91,4	34	94,4	0,437	108	92,3
Yes	7	8,6	2	5,6		9	7,7
Drink							
Not	54	66,7	30	83,3	0,049	84	71,8
Yes	27	33,3	6	16,7		33	28,2
Consume Coffee							
Not	7	8,6	4	11,1	0,454	11	9,4
Yes	74	91,4	32	88,9		106	90,6

The G-test was applied for the *p*-value calculation; (*) Student's *t*-test.

Helicobacter pylori infection and its association with gastric diseases

Most of the patients infected by the bacteria presented symptoms and only 6.2% (5/114) of the participants did not report symptoms ($p = 0.153$). The pain / burn symptom in the

abdomen was reported in 54.3% (44/81) of patients positive for *H. pylori* ($p = 0.518$), followed by heartburn 24.7% (20/81) ($p = 0.356$), eructation/ belching 14.8% (12/81) ($p = 0.023$) and nausea / vomiting 12.3% (10/81) ($p = 0.559$) (Table IV).

Table IV: Profile of symptoms and their association/non-association with *H. pylori* infection

Main symptoms	Helicobacter pylori				p-valor	Total	
	Positive (n=81)		Negative (n=36)			(n=117)	
	n	f (%)	n	f (%)		n	f (%)
Pain / Burning	44	54,3	19	52,8	0,518	63	53,8
Eruptions / Streams	12	14,8	12	33,3	0,023*	24	20,5
Heartburn	20	24,7	7	19,4	0,356	27	23,1
Nausea / Vomiting	10	12,3	4	11,1	0,559	14	12
No symptoms	5	6,2	0	0	0,153	5	4,3

The G-test was applied for the *p*-value calculation; (*) Student's *t*-test

Regarding to the associated pathologies, gastritis was present in 69.1% (56/81) of the positive patients, followed by duodenitis 16% (13/81), esophagitis 13.6% (11/81), atrophy 7.4% (6/81), metaplasia 16% (13/81) and ulcer 2.5% (2/81) (Table V).

Table V: Clinical outcomes and their association/non-association with *H. pylori* infection

Clinical outcome	Helicobacter pylori				p-valor	Total (n=117)	
	Positive (n=81)		Negative (n=36)				
	n	f (%)	n	f (%)		n	f (%)
Gastritis	56	69,1	23	63,9	0,362	79	67,5
Normal	17	21	5	13,9	0,262	22	18,8
Esophagitis	11	13,6	6	16,7	0,429	17	14,5
Atrophy	6	7,4	6	16,7	0,118	12	10,3
Duodenite	13	16	3	8,3	0,206	16	13,7
Metaplasia	3	3,7	4	11,1	0,129	7	6
Ulcer	2	2,5	3	8,3	0,169	5	4,3
Adenocarcinoma	2	2,5	0	0	0,478	2	1,7

The G-test was applied for the *p*-value calculation; (*) Student's *t*-test.

Discussion

H. pylori infection is a worldwide public health problem and it is estimated that approximately 4.4 billion people worldwide are infected with the microorganism (HOOI et al., 2017). The prevalence of *H. pylori* has declined over the years due industrialization and health conditions improved in some countries. The highest prevalence reported by Hooi et al. (2017) was in Nigeria (87.7%) and the lowest in Switzerland (18.9%). These values may vary, since the level of urbanization, sanitation, access to treated water and economic status are distinct from region to region (AWUKU et al., 2017).

The prevalence rate in the present study was 69.2% (81/117), which corroborates the current scenario in Brazil, where it ranks 75th in the ranking of the Human Development Index of the countries (HDI) (PNUD, 2015). It is important to consider that Brazil has a wide geographic distribution, different ethnic groups and discrepant socioeconomic levels in different regions.

The female sex corresponds to 78.6% (92/117) of the study population, which can be justified by the greater number of women who seek care in the hospital presenting symptoms of dyspepsia. The Brazilian Institute of Geography and Statistics showed that Brazilian women look more for medical assistances than men (IBGE, 2014) agreeing with the high rate of women in the survey. Among *H. pylori* infected patients, 21% (17/81) were males and 79% (64/81) females ($p = 0.925$). Although women had a higher prevalence of *H. pylori* infection, there was no statistically significant difference between men and women, corroborating other findings in which a prevalence was 70% in the female sex and 30% in the male sex (AGBOR et al., 2018; NIKNAM et al., 2014).

The highest prevalence of infection was among patients who were between 22 and 59 years old (70.4%, 57/81). The prevalence was lower in a patients under the age of 21 and over 60 years, agreeing with Toscano (2018), who states that there may be a decrease in prevalence at ages greater than 60 years. Although it was not significant among the age groups, the highest prevalence among individuals aged 22-59 years is justified by the appearance of symptoms in the youth and adults group. According to Ford and Axon (2010), the prevalence of infection increases with age. Aging is considered to be a risk factor for *H. pylori* colonization. Decreased epithelial cell turnover rate and decreased capacity to repair gastric mucosa have been associated with decreased prostaglandin levels, leading to reduced mucus protection and inhibition of acid secretion (HOOI et al., 2017).

The predominance of patients with low schooling and low monthly family income is justified by the majority of the population served by the Brazilian Public Health System which has lower socioeconomic conditions (MESA-LAGO, 2007). In a study by Basílio et al. (2018) (13), there was no statistical significance between the infection and socioeconomic conditions, similar to the present study.

Most the infected patients that resided during childhood in rural areas, did not have basic sanitation, and there were three people sharing a rooms in their home. Although these data were considered risk factors for the infection, the research did not find statistical significance. Most of the study population consumed potable water but it was not significant. Carvalho (CARVALHO, 2014), in a study carried out in the Meia Ponte river basin, showed that there was absence of *H. pylori* bacteria in the water that supplies the Goiânia city and region.

In the present study, we demonstrated from statistical analysis that there was no relation of *H. pylori* infection to smoking habits and coffee consumption. Studies on this association have achieved conflicting results. A study carried out in Brazil by Vinagre et al. (2013), did not demonstrate a correlation of smoking in the prevalence of *H. pylori*. Park et al. (2018), found a statistically significant association, assuming that nicotine can alter gastric mucosal blood flow and mucus secretion, which may facilitate bacterial colonization (ENDO; LEUNG, 1994). Smoking has been considered a risk factor for *H. pylori* infection (BASÍLIO et al., 2018). Tobacco stimulates the secretion of gastric acid compromising the mucosa, causing peptic ulcer and gastric atrophy that may evolve to a cancer (GHOSH et al., 2012).

Bujanda (2000) has demonstrated that alcoholic beverages can stimulate gastric acid secretion, inducing a decrease in stomach pH and making the environment even less favorable for *H. pylori*. Basílio et al. (2018) demonstrated that *H. pylori* infection was higher among alcohol users than not users. This result was consistent to this study. However, other studies have not demonstrated this association (VINAGRE et al., 2013). It is important to emphasize that the more associated risk factors the greater the chance of developing gastric diseases (KOIVISTO; VOUTILAINEN; FÄRKKILÄ, 2008).

The majority of patients were symptomatic and the manifestations of pain and / or burning in the abdomen were the most reported by dyspeptic patients. Generally, these symptoms induce patients to seek medical help and, therefore, undergo endoscopy (COELHO et al., 2018). Heartburn was the most prevalent symptom among infected patients, but it did not

present statistical significance. The eructation/belching presented statistical significance even though this correlation is still not very well established (BASÍLIO et al., 2018).

Esophageal, gastric and intestinal mucosa inflammation were more prevalent in patients with bacterial infection. Patients with gastric adenocarcinoma were positive for the infection, intensifying the importance of *H. pylori* infection control. Approximately 21% of the patients presenting the infection did not have alterations in the mucosa, probably due to the time of exposure of the microorganism to the host tissue, as well as the expression of the virulence factors of the bacterium.

Conclusion

The prevalence rate of *H. pylori* was high in patients with dyspeptic disorders and gastritis was the most found finding in endoscopy. Alcohol consumption was the main risk factor associated to *H. pylori* infection among adult patients. New studies to evaluate the association of additional risk factors for the infection are important. The knowledge of the risk factors for bacterial infection is extremely relevant to provide subsidies for the implementation of public policies aimed at the prevention and eradication of the microorganism.

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References

- AGBOR, N. E. et al. *Helicobacter pylori* in patients with gastritis in West Cameroon: prevalence and risk factors for infection. **BMC Research Notes**, v. 11, n. 1, p. 559, 2018.
- ALLEN, S. J. et al. Flies and *Helicobacter pylori* infection. **Archives of Disease in Childhood**, v. 89, n. 11, p. 1037–1038, 2004.
- AWUKU, Y. A. et al. Prevalence of *Helicobacter pylori* infection among children living in a rural setting in Sub-Saharan Africa. **BMC Public Health**, v. 17, n. 1, p. 360, 2017.
- BASÍLIO, I. L. D. et al. Risk factors of *Helicobacter pylori* infection in an urban community in Northeast Brazil and the relationship between the infection and gastric diseases. **Revista da Sociedade Brasileira de Medicina Tropical**, v. 51, n. 2, p. 183–189, 2018.

BUJANDA, L. The effects of alcohol consumption upon the gastrointestinal tract. **The American Journal of Gastroenterology**, v. 95, n. 12, p. 3374–3382, 2000.

CARVALHO, L. A. C. W. **Avaliação da ocorrência de *Helicobacter pylori* em água tratada da bacia do Rio Meia Ponte – Goiânia - GO.** [s.l.] Universidade Federal De Goiás, 2014.

COELHO, L. G. V. et al. IVth Brazilian Consensus Conference on *Helicobacter pylori* infection. **Arquivo de Gastroenterologia**, v. 55, n. 2, p. 97–121, 2018.

DIMITRIADI, D. *Helicobacter pylori*: A sexually transmitted bacterium? **Central European Journal of Urology**, v. 67, n. 4, p. 407–409, 2014.

DIXON, M. F. Capítulo 38: Pathology of Gastritis and Peptic Ulceration. In: MOBLEY, H. L.; MENDZ, G. L.; HAZELL, S. L. (Eds.). ***Helicobacter pylori: Physiology and Genetics***. 1^a ed. Washington (DC): [s.n.].

ENDO, K.; LEUNG, F. W. Effects of smoking and nicotine on the gastric mucosa: A review of clinical and experimental evidence. **Gastroenterology**, v. 107, n. 3, p. 864–878, 1994.

FIALHO, A. M. N. **Estudo da transmissão intrafamiliar do *Helicobacter pylori* em uma comunidade de baixa renda em Fortaleza, Ceará.** Fortaleza: Universidade Federal do Ceará, 2012.

FORD, A. C.; AXON, A. T. R. Epidemiology of *Helicobacter pylori* infection and Public Health Implications. **Helicobacter**, v. 15, n. 1, p. 1–6, 2010.

FRUGIS, S. et al. Prevalence of *Helicobacter pylori* ten years ago compared to the current prevalence in patients undergoing upper endoscopy. **ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)**, v. 29, n. 3, p. 151–154, 2016.

GHOSH, P. et al. Cigarette smoking and *H. pylori* infection: A meta-analysis of literature. **Der Pharmacia Lettre**, v. 4, n. 1, p. 128–134, 2012.

GUIMARÃES, J.; CORVELO, T. C.; BARILE, K. A. *Helicobacter pylori*: Fatores relacionados à sua patogênese. **Revista Paraense de Medicina**, v. 22, n. 1, p. 33–38, 2008.

GUNALETCHUMY, S. P. et al. *Helicobacter pylori* genetic diversity and gastro-duodenal diseases in Malaysia. **Scientific Reports**, v. 4, n. 7431, p. 1–9, 2014.

HOOI, J. K. Y. et al. Global prevalence of *Helicobacter pylori* infection: systematic review and meta-analysis. **Gastroenterology**, v. 153, n. 2, p. 420–429, 2017.

IARC. Biological Agents. **IARC Monogr Eval Carcinog Risks Hum**, v. 100, p. 1–443, 2012.

IBGE, I. B. DE G. E E.-. **Pesquisa Nacional de Saúde 2013: Percepção do estado de saúde, estilos de vida e doenças crônicas.** Rio de Janeiro: [s.n.].

KOIVISTO, T. T.; VOUTILAINEN, M. E.; FÄRKILÄ, M. A. Effect of smoking on gastric

histology in *Helicobacter pylori*-positive gastritis. **Scandinavian Journal of Gastroenterology**, v. 43, n. 10, p. 1177–1183, 2008.

MESA-LAGO, C. O sistema de saúde brasileiro: seu impacto na pobreza e na desigualdade. **Nueva Sociedad. Especial em português**, n. 1992, p. 115–131, 2007.

MIERNYK, K. M. et al. Prevalence of *Helicobacter pylori* among Alaskans: Factors associated with infection and comparison of urea breath test and anti- *Helicobacter pylori* IgG antibodies. **Helicobacter**, p. 12482, 2018.

NIKNAM, R. et al. Prevalence of *Helicobacter pylori* in Patients With Dyspepsia. **Jundishapur J Microbiology**, v. 7, n. 10, p. 84–86, 2014.

PNUD. **Ranking IDH Global 2014**. Disponível em: <<http://www.br.undp.org/content/brazil/pt/home/idh0/rankings/idh-global.html>>. Acesso em: 18 out. 2018.

RASMUSSEN, L. T. et al. *Helicobacter pylori* detection in gastric biopsies, saliva and dental plaque of Brazilian dyspeptic patients. **Memórias do Instituto Oswaldo Cruz**, v. 105, n. 3, p. 326–330, 2010.

SARKER, S. A. et al. *Helicobacter pylori*: prevalence, transmission, and serum pepsinogen II concentrations in children of a poor periurban community in Bangladesh. **Clinical Infectious Diseases**, v. 25, n. 5, p. 990–995, 1997.

TOSCANO, E. P. et al. Epidemiological and Clinical-Pathological Aspects of *Helicobacter pylori* Infection in Brazilian Children and Adults. **Gastroenterology Research and Practice**, v. 2018, p. 1–8, 2018.

TSAY, F.; HSU, P. *H. pylori* infection and extra-gastrointestinal diseases. **Journal of Biomedical Science**, v. 25, n. 65, p. 1–8, 2018.

VINAGRE, R. M. D. F. et al. Role of *Helicobacter pylori* infection and lifestyle habits in the development of gastroduodenal diseases in a population from the Brazilian Amazon. **Arquivos de gastroenterologia**, v. 50, n. 3, p. 170–174, 2013.

YU, X. et al. Decreasing prevalence of *Helicobacter pylori* according to birth cohorts in urban China. **Turkish Journal of Gastroenterology**, v. 28, n. 2, p. 94–97, 2017.

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