Helicobacter pylori prevalence measured by breath test in patients under ambulatory care

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Abstract

Introduction: *Helicobacter pylori* is a highly prevalent bacteria worldwide, associated with various diseases. Its surveillance continues to be relevant for doctors and public health policies.

Objective: to determine the prevalence of *H. pylori* in a population of ambulatory patients seen by internal medicine in Envigado.

Design and method: this was an observational, descriptive, cross-sectional study carried out between December 2023 and June 2024 at an internal medicine office in Envigado. Intentional, non-probability sampling was employed. Patients of both sexes, over the age of 14, who attended outpatient appointments, were included. Those who could not perform the breath test were excluded. Urea-^{13}C was used, and data was collected on Microsoft Excel®, with statistical analysis using SPSS® version 18.

Results: the prevalence of *H. pylori* was 44.2%. The mean age of those infected was 48.4 years (SD 17.1), with a peak in the 50 – 59-year-old group. Infection was more common in men (47%). In those under the age of 35, the prevalence was 40.7%, and it was more common in young men (21.3 %).

Conclusions: the prevalence found was lower than reported in historic studies, but higher than recent figures. An unusual pattern was found, with a higher frequency of infection in young adults, surpassing what has been described in the literature. **(Acta Med Colomb 2025; 50. DOI: https://doi.org/10.36104/amc.2025.3263).**

Keywords: *Helicobacter pylori*, breath tests, diagnostic techniques, massive screening, *Helicobacter* infections.

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Introduction

More than a century ago, the gastric milieu was thought to be sterile until the presence of bacteria was reported in the human stomach (1). Furthermore, all bacteria were thought to be contaminants from digested food and not true gastric colonizers. However, more than 40 years ago, Barry Marshall and Robin Warren were able to successfully isolate and cultivate flagellated, spiral-shaped bacteria, initially termed *Campylobacter pylori*, and known today as *Helicobacter pylori* (1).

Marshall and Warren´s autoinoculation experiments (2), as well as subsequent studies with volunteers (3), showed that these bacteria can colonize the human stomach and cause inflammation of the gastric mucosa (4). Marshall developed transient gastritis after ingesting *H. pylori*, while Warren had more persistent gastritis that resolved with doxycycline and bismuth subsalicylate treatment (4). These findings spurred intensive research on these bacteria, showing that gastric colonization by *H. pylori* can lead to multiple upper gastrointestinal disorders like chronic gastritis, peptic ulcer, MALT lymphoma and gastric cancer (4).

Warren and Marshall´s work earned them the Nobel Prize in Medicine in 2005, for the discovery of *H. pylori* and its role in gastritis and peptic ulcers. Today, it is one of the most studied human pathogens and one of the first formally recognized carcinogenic bacteria. It is estimated that more than half of the world´s population is colonized by these bacteria (4, 5).

H. pylori is a Gram-negative, microaerophilic, curved and highly mobile bacterium, thanks to its rotating flagella that allow it to penetrate the mucosal layer (6). It remains in the gastric mucosa thanks to its protein filaments (flagellins) that evade innate toll-like receptor 5 (TLR-5) immune system activation due to specific adaptations in its amino acid sequence (6, 7). Chemotaxis controls the direction of its movement, allowing it to be oriented by pH gradients and bicarbonate in the gastric mucus (6, 8, 9). This motility can be inhibited in vitro through small molecules that reduce the density of colonization, which is being explored as a possible treatment approach (9, 10).

Compared to other pathogenic bacteria, it has a small genome (~1.6 Mbp) composed of a single circular chromosome

that codes for ~1,600 proteins (4, 8, 9, 11). The main genome consists of ~1,100 genes that are present in all strains, while the rest are accessory genes that vary from strain to strain, facilitating high rates of mutation and recombination (6, 7, 11).

These bacteria are believed to have been acquired by humans in Africa, possibly through a host jump from a yet unknown animal source approximately 100,000 years ago (11, 12). The oldest phytogeographic population is *hpAfrica*, predominant in southern Africa (12). Other important populations include *hpNEAfrica*, *hpEurope*, *hpEastAsia*, *hpAsia* and *hpSahul* (12, 13).

A key event in their evolution was the acquisition of the *cag* pathogenicity island (cagPAI) (13) that codes for the type IV secretion system (*CagT4SS*) (14): a protein complex that crosses the bacterial envelope and transfers effector molecules to the host cells after adhesion. The strains that have *CagT4SS* cause more inflammation than negative strains (8, 9, 12).

Finally, genetic polymorphisms of the host and gastric acid secretion largely determine *H. pylori´s ability to colonize the mucosa*. Virulence factors like *CagA* and the vacuolating cytotoxin *VacA* modulate the immune system and facilitate colonization (4). The host´s immune response starts with polymorphonuclear infiltration, followed by activation of the innate and adaptive immune systems, in which *T helper 1 (TH1)*, *T helper 17 (TH17)* and *T regulator (Treg) cells participate*, among others (6, 9).

In adults, acute infection is generally asymptomatic, although it may be accompanied by hypochlorhydria, epigastric pain and mild to moderate dyspeptic symptoms, as has been described in case studies and challenge studies in volunteers with *H. pylori, for vaccine development* (15-17). On the other hand, most infected children remain asymptomatic, and complications are rare (9, 16). The prevalence varies significantly by age, ethnic origin, associated diseases, geographic regions, socioeconomic level and hygienic conditions (12, 18-20).

There are multiple indications for *H. pylori* screening, such as the presence of epigastric pain, hypochlorhydria or dyspepsia. These also include a history of peptic ulcer disease (21); low-grade MALT lymphoma (17); prior endoscopic resection of early gastric cancer (22, 23); unstudied dyspepsia in patients <50 years old with no warning symptoms (21); functional dyspepsia (21); first-degree relatives with gastric cancer (21, 23); immigrants from high prevalence areas (21); unexplained iron deficiency anemia (21, 24); adult immune thrombocytopenia (21); prolonged proton pump inhibitor (PPI), nonsteroidal anti-inflammatory drug (NSAID) or aspirin use, as well as individual risk factors (24).

Invasive tests require biopsy through upper gastrointestinal endoscopy (EGD) (25) and include the rapid urease test (RUT), histology, bacterial culture and PCR or fluorescence in situ hybridization (26). Noninvasive tests include the carbon-13 urea breath test (UBT), serology, stool antigen test (SAT) and stool PCR (26, 27). The UBT and SAT are recommended for primary diagnosis (9, 16, 19, 20, 26). Serology is useful for initial screening and epidemiological studies, although it has lower sensitivity and specificity (53 and 74%) (26). Histology helps evaluate inflammation and precancerous lesions (28). Culture is reserved for antibiotic sensitivity tests (10, 29).

The UBT uses carbon-13 marked urea ingested with citric acid, which is hydrolyzed by bacterial urease, releasing CO_2 and ammonia (26). It has high sensitivity and specificity (95 and 100%) (9, 26), with no side effects and good tolerance, unlike EGD (9, 15, 20, 26, 28).

H. pylori infection can increase the risk of gastric cancer by up to 10 times (27, 30-32). This cancer has the fourth highest incidence in Colombia (33-37) and one of the highest mortality rates (27, 32, 34). Therefore, reducing the prevalence of *H. pylori* could reduce its burden (30).

Helicobacter pylori has a high global prevalence (8.1%). In 2015, there were an estimated 4.4 billion infected people (16, 33). Once people are infected with *H. pylori*, the pathogen generally persists throughout their lives (16). However, a retrospective cohort study described spontaneous clearing in nine out of 58 children (15.5%) over 20 years of follow-up in 2002 (18), due to improved socioeconomic status and hygiene conditions (19).

Nevertheless, the global prevalence in children remained at up to 34% from 2014 - 2020 (33,37) and decreased in adults from 55 - 43% during the same period (33), mainly attributed to improved socioeconomic status, standard of living and hygiene conditions (9, 19, 38, 39). Increased antibiotic use, including adjunct eradication therapies, could be another contributing factor (9, 39, 40). Prevalence is reportedly higher in adults than in children (25), although a recent body of evidence suggests the contrary (20, 37, 40-45), and it is also higher in rural than urban areas (16).

Studies have been conducted in Colombia since 1987. In 2003, Bravo et al. reported the years with the highest prevalence: Bogotá (1996, 97.4%), Medellín (1989, 67.1%), Cali (1987, 72.2%), Cartagena (1994, 100%), Pasto (1989, 85.5%) and Popayán (1991, 30%) (40). In 2016, a study in 16 cities found a national prevalence of 69.1% (36), with local differences: Medellín (36.4%) (35), and Cali (63.1%) (36).

The epidemiology has been described in national and international studies; however, no reports have been found on the prevalence of this infection in the city of Envigado (40-42). The prevalence of this infection and its related diseases varies in the literature (16). Thus, it is important to be aware of the local epidemiology to determine the need for changes in the detection process, propose eradication strategies, and lower the burden of disease in the population (41-42). The purpose of this study was to measure the prevalence of *H. pylori* in consecutive patients undergoing urea breath tests for different reasons, as they can silently progress to various associated diseases.

Method

This was a cross-sectional descriptive observational study aimed at determining the prevalence of *Helicobacter pylori*

infection in patients being followed by internal medicine as outpatients in a medical office in the city of Envigado from December 2023 to June 2024. Patients of both sexes, over the age of 14, who underwent a urea breath test were included. Patients who met the selection criteria were enrolled consecutively until the sample size was complete. Those who were unable to perform the test due to their health condition were excluded.

The required patient data was collected from the electronic medical chart, recorded in a technological database. The breath test results were described by professional laboratory staff and recorded in the procedural report, from which the information of interest for the study was extracted. The collected data was transcribed in duplicate in a database, and the two versions were subsequently compared using Microsoft Excel Compare® software.

Purposive nonprobability sampling was used to calculate a population size according to local data, obtaining a sample of 505 patients. One patient was excluded because he did not meet the selected parameters.

SPSS® 18 (IBM, Armonk, New York) software was used for data analysis. Descriptive statistics provided frequencies, averages and standard deviation. Spearman´s coefficient was used for correlations between ordinal variables, and chi^2 or Fischer´s exact test for associations between categorical variables.

Results

A total of 505 patients were found for the urea breath test, 504 of whom met the selection criteria and were included in the analysis. The reasons for selection included the following: living patients with a medical chart recorded in the database, individuals of both sexes over the age of 14, patients who were seen and were registered in the Envigado medical office's database.

A total of 504 samples from an equal number of patients were analyzed, 268 (53.2%) of whom were females and 236 (46.8%) males. The mean age was 48.2 years (SD 14.4). Table 1 shows the distribution of the analyzed breath tests by age groups.

There were 223 positive tests, amounting to 44.2% of the sample. The prevalence of *H. pylori* by sex was 41.8% for females and 47% for males. The average age of the patients with *H. pylori* was 48.3 years (SD 14.2); 49.8 years for males and 48.2 years for females. The distribution of *H. pylori* by age group and sex can be found in Figures 1 and 2, respectively.

Discussion

Helicobacter pylori infection has been found worldwide and affects all population groups; it is estimated that more than half of the world´s population is infected (16). The infection was found in 44.2% of the tests in this study.

A comparison of the results indicates that the prevalence is low compared to the initial studies, but high compared to more recent research (16, 30, 41). In Colombia in 2003, the prevalence of *H. pylori* was estimated to be 69.1%, based on 8,652 patients from 16 cities throughout the country (40). In this same study, Medellín had a reported prevalence of 65%. Another study published by García et al. in 2016 found a prevalence of 36.4% in 986 samples (35). Thus, this indicates that, despite a reduction compared to 2003 (69.1% vs. 44.2%), there has been an increase compared to 2016 (36.4 vs. 44.2%), which should be studied in patients with risk factors. It should also be noted that the prevalence in the

Table 1. *Analysis of the results.*

Variables	n	Positive test [% (95% CI)]	Negative test [% (95% CI)]
Total	**504**	**44.2 (40.0 - 48.6)**	**55.8 (51.4 – 60.0)**
Sex [%(95% CI)]			
Male	236	47 (40.8 – 53.4)	53 (46.6 – 59.2)
Female	268	41.8 (36 – 47.8)	58.2 (52.2 - 64)
Age (years) [%(95% CI)]			
≤ 35	108	40.7 (31.9 – 50.2)	59.3 (49.8 – 68.1)
>35	396	45.2 (40.4 – 50.1)	54.8 (49.9 – 59.6)

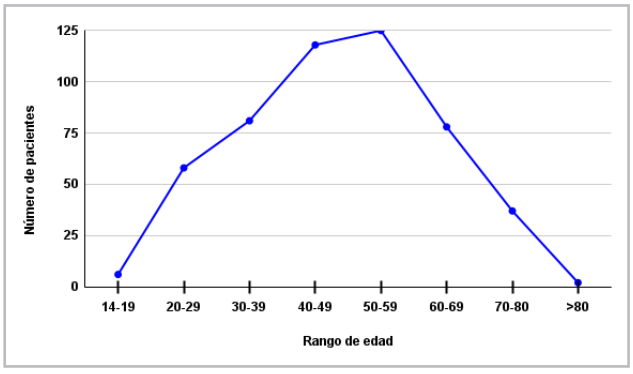

Figure 1. *Patient distribution by age group.*

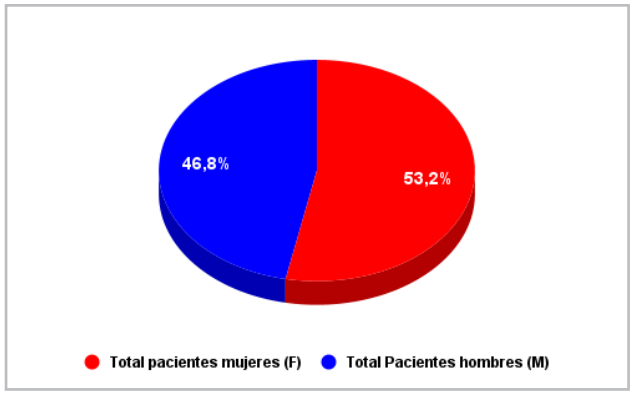

Figure 2. *Patient distribution by sex.*

city of Envigado had never been described, and therefore this study is a starting point for local epidemiology.

Other Colombian cities have conducted prevalence studies (35-37, 41). For example, a study in Cali by Fundación Valle de Lili in 2020 (43) found a prevalence of 38.5% in 1,105 samples. One hundred sixty patients at Clínica Colsanitas in Bogotá were evaluated in 2022, finding a prevalence of 37.5% (36). Despite the existing body of evidence, recent studies in other Colombian cities have not been found. The latest available prevalence rates, reported more than a decade ago, are from the study by Bravo et al. in 2003, who reported rates of 99.1% in Tunja, 86.5% in Popayán and 85.5% in Manizales (41).

It has been reported that, in developing countries, more than 50% of the population is infected before the age of 10 (20), with a peak prevalence of 80% just before age 50 (16). This evidence is supported by a study conducted in Bogotá in 2020, which found a prevalence of 54.5% in 128 children (37). Our study showed a similar behavior, finding a peak prevalence of 53.3% before the age of 50. On the other hand, in developed countries, only 10% of the population is infected before the age of 10 (40), and the prevalence increases from 10% between the ages of 18 and 30 to 50% in those over the age of 60 (44). Our study found a 40.7% prevalence of infection in those under the age of 35, and 45.2% in those over the age of 35.

Torres et al. found a relationship between infection and overcrowding [OR = 1.4 (95% CI: 1.23-1.60)], a low educational level [OR = 2.42 (95% CI: 1.71-3.44)], and a low socioeconomic status [OR = 1.43 (95% CI: 1.26-1.63)] (19). This could partially explain the low prevalence of *H. pylori* found in our study, as the population seen in the medical office is predominantly middle and upper class. Other factors associated with higher rates of infection include the number of children, shared beds and the quality of the water (19). Furthermore, it has been proposed that a reduced prevalence of infection is related to an improved economy, according to a Japanese study that analyzed the prevalence during periods of war (45); this could explain the reduction found between the prevalence in 2003 (65%) and the current prevalence (44.2%).

The prevalence of infection has conventionally been reported to increase with age. Thus, in a study conducted in different regions, Pounder et al. divided the countries into two groups (46): Group 1, in which most people are infected in childhood and infection persists throughout adulthood; and Group 2, in which only a few are infected in childhood, but the prevalence increases with age. In our study, prevalence had an unusual behavior: it was higher in the 50-59-year age group and then gradually decreased in the following age groups, both in the overall population as well as in males and females. Men had a higher prevalence than women (47 vs. 41.8%, respectively), which concurs with what was reported by Dorji et al. (46).

The histopathological findings associated with *H. pylori* have also been described, with gastritis being the most frequent condition, occurring in more than 90% of patients worldwide, with a mean age of 51 years (44). In Medellín, the histological studies are controversial, as only 36.4% of gastritis cases had *H. pylori* infection (35), which does not concur with what is reported in the literature, in which this bacterium is considered one of the main causes of the disease (43). Bravo et al. found a gastritis prevalence of 83.6% (40), while it was significantly lower in Medellín (73.7%) (35). In our study, the breath test was used for diagnosis, finding that the age group with the highest absolute number of cases was the 50-59-year group, which is similar to the results reported in the literature.

It should be noted that in this, as well as many other studies of the prevalence of *H. pylori*, the presence of the bacteria is not always associated with dyspeptic symptoms (9), as most infected people have asymptomatic colonization. However, all the patients evaluated in our study had dyspeptic symptoms. We believe that the universality of dyspeptic symptoms cannot be attributed to *H. pylori*, as the bacteria were only detected in 44.2% of the cases.

Conclusion

The prevalence of *H. pylori* infection in this study is low compared to other studies, but high compared to the most recent studies. In addition, there was unusual behavior in the age groups described, including significant data for young people.

Some of the abnormalities caused by these bacteria are correlated with each other and can be precursors of cancer (47), especially adenocarcinomas (49) and MALT lymphoma (48-51), which are significant causes of morbidity and mortality (15-20). Early detection and treatment of precursor lesions could have a significant impact on these outcomes (22), which is why screening should be promoted for patients with risk factors.

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