Prevalence and Sociodemographic Distribution of *Helicobacter pylori* Positivity in Türkiye: A Retrospective Analysis between 2018-2023 and Impact of COVID-19 Measures

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ABSTRACT

Aim: Helicobacter pylori is a gram-negative, multi-flagellated bacterium that resides in the gastric mucosa and is a significant cause of chronic antral gastritis, peptic ulcers, gastric lymphoma, and adenocarcinoma. Its prevalence is inversely related to socioeconomic development, with higher rates in developing countries. The bacterium is believed to spread primarily through fecal-oral and oral-oral routes, with an estimated global infection rate of around 50%.

Material and Methods: This study retrospectively examined the presence of H. pylori antigen in stool samples from 40784 patients admitted to our hospital between 2018 and 2023. The tests were performed using MICROCULT (Biotech, China) kits and the results were analysed according to age, sex and geographical regions.

Results: The overall positivity rate was found to be 14.47%. Female had a higher positivity rate (16.73%) compared to male (11.64%). The positivity rate was 6.46% in children and 16.77% in adults. The highest regional positivity was observed in the Southeastern Anatolia region (25.71%), while the lowest was in the Black Sea region (11.95%). In Ankara, Altındağ district had the highest positivity rate (17.09%), while Etimesgut had the lowest (8.79%).

Conclusion: The study highlights a decline in H. pylori prevalence in recent years, though higher rates persist in less developed regions, underscoring the need for improved infrastructure, hygiene, and targeted screening and treatment strategies.

Keywords: *Helicobacter pylori*; prevalence; diagnosis; COVID-19.

Türkiye'de Helicobacter pylori Pozitifliğinin Prevalansı ve Sosyodemografik Dağılımı: 2018-2023 Yılları Arasında Retrospektif Bir Analiz ve COVID-19 Tedbirlerinin Etkisi

ÖZ

Amaç: Helicobacter pylori, mide mukozasında yaşayan gram-negatif, çok kamçılı bir bakteridir ve kronik antral gastrit, peptik ülser, mide lenfoması ve mide adenokarsinomu gibi ciddi mide hastalıklarının oluşumuna katkıda bulunur. Bu bakterinin dünya genelindeki yaygınlığı ülkelerin gelişmişlik düzeyiyle ters orantılı olup, düşük sosyoekonomik koşullarda daha sık görülmektedir. Yayılma yolları kesin olarak bilinmemekle birlikte, fekal-oral ve oral-oral yollarla bulaştığı düşünülmektedir. Küresel enfeksiyon oranı %50 civarındadır.

Gereç ve Yöntemler: Bu çalışmada, 2018-2023 yılları arasında hastanemize başvuran 40784 hastadan alınan dışkı örneklerindeki H. pylori antijen varlığı retrospektif olarak incelenmiştir. Testler, MICROCULT (Biotech, China) kitleri kullanılarak gerçekleştirilmiş ve sonuçlar yaş, cinsiyet ve coğrafi bölgelere göre analiz edilmiştir.

Bulgular: Sonuçlara göre genel H. pylori pozitiflik oranı %14,47 olarak tespit edilmiştir. Kadınlarda (%16,73) pozitiflik oranı erkeklere (%11,64) göre daha yüksek bulunmuştur. Ayrıca çocuklarda pozitiflik oranı %6,46, yetişkinlerde ise %16,77 olarak kaydedilmiştir. Bölgesel analizde Güneydoğu Anadolu Bölgesi %25,71 ile en yüksek pozitiflik oranına sahipken, Karadeniz Bölgesi %11,95 ile en düşük orana sahip olmuştur. Ankara ilçelerinde Altındağ %17,09 ile en yüksek orana sahipken, Etimesgut %8,79 ile en düşük oranı göstermiştir.

Sonuç: Son yıllarda H. pylori prevalansında düşüş gözlenmiştir, ancak özellikle düşük sosyoekonomik bölgelerde enfeksiyon oranları yüksek seyretmektedir. Çalışma, altyapı, hijyen ve yaşam standartlarındaki iyileştirmelerin enfeksiyon oranlarını azaltmada önemli bir rol oynadığını göstermektedir. Ayrıca, kadınlarda ve yaş ilerledikçe pozitiflik oranlarının arttığı tespit edilmiştir. H. pylori'nin yaygınlığının azaltılması için yeni tanı ve tedavi stratejilerinin geliştirilmesine ihtiyaç duyulmaktadır.

Anahtar Kelimeler: *Helicobacter pylori*; prevalans; tanı; COVID-19.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is *Helicobacter pylori* is a gram-negative, multi-flagellated bacterium that appears as a spiral in tissue and as a bacillus or coccobacillus when grown in culture. It is biochemically, catalase, oxidase and urease are positive. It is one of the most common chronic pathogens around the world. Its prevalence is inversely proportional to the development levels of countries and varies between 18.9% and 87.7% globally (1). According to data published in 2017, this rate is 82.5% (2). Subsequently, another study conducted in 2020 showed that this rate was 75.7% (3).

H. pylori can only survive in the epithelial cells of the stomach that can secrete mucus. It is one of the causes of chronic antral gastritis and has also been shown to be associated with the pathogenesis of peptic ulcer, mucosa-associated lymphoid tissue (MALT) lymphoma seen in the gastric lymphoid tissue, and gastric adenocarcinoma (4-7). In 1994, the World Health Organization (WHO) stated that this bacterium is involved in the formation of gastric cancer. Since it was reported that it is an etiological agent of gastric cancer, all studies have focused on H. pylori (8). Subsequent studies have shown that *H. pylori* can cause not only diseases locally limited to the stomach, but also systemic diseases such as arthritis, anemia, atherosclerosis, and systemic diseases including Parkinson's and Alzheimer's (9,10).

Although the mode of transmission of *H. pylori* is not fully known, it is thought to be transmitted via fecal-oral and oral-oral routes, and it is estimated that almost 50% of the world's population is infected (11,12,13).

Invasive and non-invasive methods are available for diagnosis. While biopsy samples taken invasively by gastroscopy are examined with methods such as culture, histopathological microscopy and polymerase chain reaction (PCR), the presence of bacteria can be investigated without the need for an invasive intervention such as the stool antigen test, which is more commonly used microbiologically today, or the urea breath test, which can be applied in nuclear medicine clinics (11,14).

Today, in the diagnosis of *H. pylori* in microbiology laboratories, *H. pylori* stool antigen (HpSa) tests, which have high specificity and sensitivity, do not require invasive sampling, are safe, fast, inexpensive and reproducible, are mostly used (8,15). The sensitivity of the tests is approximately 96%. They are monoclonal antibody-based antigen tests and work on the principle of the immunochromatographic method (15,16). Especially in people with dyspepsia whose symptoms are not severe and who do not have a history of nonsteroidal anti-inflammatory drug use, non-invasive tests such as stool antigen detection tests should be used instead of gastroscopy for diagnosis and treatment follow-up, and there are studies that recommend this (17).

In the present study, the data concerning the stool sample results sent to our laboratory from patients who had applied to various clinics of our hospital with dyspeptic complaints to investigate the presence of *H. pylori* antigen were examined retrospectively. The objective of the present study is threefold: first, to determine the frequency of *H. pylori* positivity; second, to establish the distribution of positivity rates according to the sociodemographic status of the patients; and third, to present the current *H. pylori* prevalence in the context of the most recent six years of data in our country and province.

MATERIAL AND METHODS

Results of stool samples from 40784 patients who applied to our hospital from different parts of Türkiye between January 2018 and December 2023 were included in the study. In duplicate sample requests, only the first sample result of the patient is taken into account. Test results of sociodemographic data for each patients, such as age and gender, were also examined retrospectively. Incoming stool samples were analyzed using with the *H.pylori* Antigen Rapid Test (MICROCULT, Biotech, China) cassette test, which detects the presence of *H. pylori* antigen. The test was conducted in accordance with the manufacturer's recommendations. After the incoming sample was mixed vigorously with 50 mg of extraction buffer, 50μL of the resulting mixture was placed into the sample well. After the 10-minute incubation period was completed, color change in the test area indicated a positive result, while no change indicated a negative result. The control of the test is indicated by a colored control line on the kit. The specificity and sensitivity of the test were reported as 98.4% and >98.8%.

Patients were divided into two groups: children aged 0-17, adults aged 18 and over, and patients were classified by gender as male or female. The positivity rates in these groups were evaluated statistically. Moreover, while some of the patients who submitted applications to our hospital resided in disparate regions of our nation, they were referred to our hospital from their respective provinces because our hospital is a tertiary health center. By classifying all patients according to the provinces and districts they live in, we sought to ascertain the distribution of the *H. pylori* positivity rate by regions in Türkiye and by districts in Ankara.
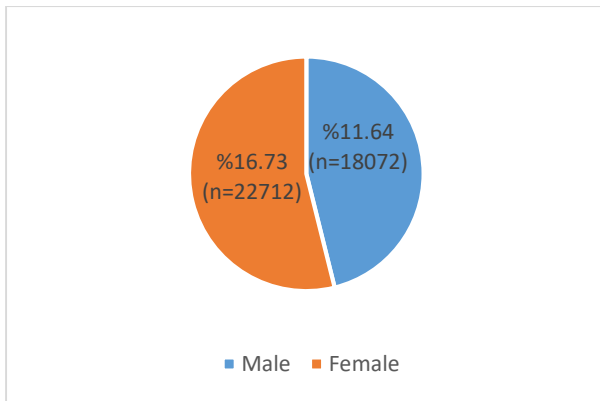
This research was approved by the Scientific Research Ethics Committee of our hospital (Decision No: 2023/369).

Statistical Analyses

Descriptive statistics are given as number (n) and percentage (%). Statistical analysis of the data was performed using the Chi-Square test, with a 95% confidence interval and a statistical significance limit of p<0.05.

RESULTS

Stool samples from 40,784 patients admitted to our hospital were tested in the medical microbiology laboratory. 18,072 (44.31%) of the patients were male and 22,712 (55.69%) were female. The average age of the patients was calculated as 44 (±19.18) years. 5,903 (14.47%) of the samples were found to be positive. The average age of patients with positive sample results was 45.08 (±16.97), while the average age of those with negative samples was 43.84 (±19.10). Considering all patient groups, the positivity rate in the female (16.73%) population was statistically significantly higher than that in the male (11.64%) population (p<0.001). Positivity rates by gender are shown in Figure 1.

Figure 1. Positivity rate by gender

Table 1. Distribution of *H. pylori* positivity rates in Türkiye by region

Region	Number (n)	Percentage (%)	*p* value
Central Anatolia	36806	14.16	
Black Sea	770	11.95	
Marmara	926	18.03	
Aegean	522	17.43	*p*<0.05
Mediterranean	514	17.90	
Eastern Anatolia	787	16.90	
Southeastern Anatolia	459	25.71	

Considering all age groups, the positivity rate in female (16.73% (n=22712)) was statistically significantly higher than male (11.64% (n= 18072)) (p<0.001). In the adult age group, the positivity rate of female (19.74% (n= 17468)) was statistically significantly higher than that of male (13.09% (n=14234)) (p<0.001). In this age group, the average age of positive patients was 43.63, while the average age of negative patients was 43.64. However, in the pediatric age group, the positivity rates of female (6.6% (n= 5224)) and male (6.28% (n=3883)) were close to each other and there was no statistically significant difference (p>0.05). Within this pediatric population, the average age was 10.96 years among positive cases and 11.62 years among negative ones.

According to age groups, patients are divided into two groups: children (0–17 years) and adults (≥18 years), and the positivity rates in the child and adult groups are summarized in Figure 2.
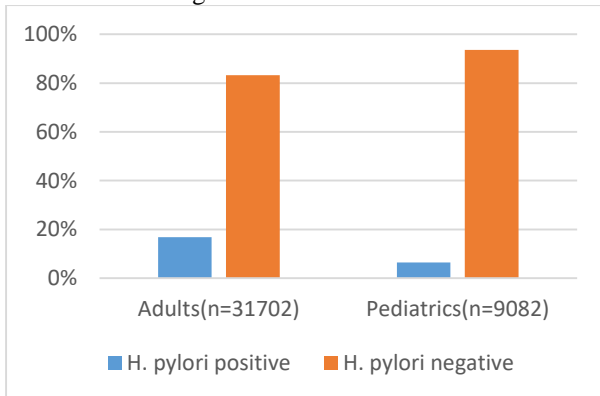

Figure 2. Positivity rates according to patient age groups

While the positivity rate in the adult age group is 16.77%, this rate is 6.46% in the childhood age group and this difference is statistically significant (p<0.05).

When the positivity rates of the patients whose samples were sent for *H. pylori* antigen positivity investigation were examined according to the provinces they lived in, the first three highest provinces were determined to be Bitlis (32.35%), Şanlıurfa (30%) and Kars (29.17%). When the positivity rates by region were examined, the Southeastern Anatolia Region had the highest rate with 25.71%, while the Black Sea Region was found to have the lowest rate with 11.95%, and this difference was statistically significant (p < 0.001). Based on the test results of the patients admitted to our hospital, the distribution of *H. pylori* positivity rates by province and region in Türkiye is summarized in Table 1 (Table 1).

In addition, when the positivity rates were evaluated according to the districts where the patients lived in Ankara, it was determined that the highest district was Altındağ (17.09%) and the lowest district was Etimesgut (8.79%), and this difference was statistically significant (p < 0.001). Positivity rates by Ankara's districts are summarized in Figure 3.
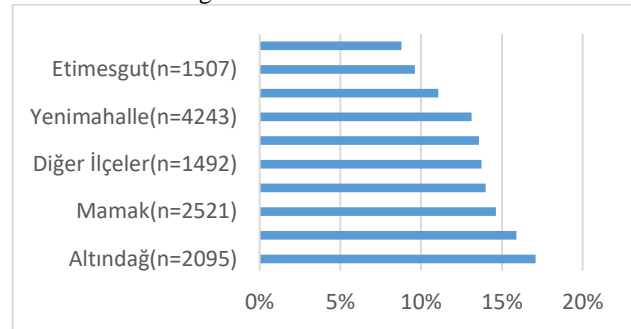
Figure 3. Positivity rates of Ankara districts (p < 0.001)

Other Districts: Akyurt, Ayaş, Bala, Beypazarı, Çamlıdere, Çubuk, Elmadağ, Güdül, Haymana, Kahramankazan, Kalecik, Kızılcahamam, Polatlı, Şereflikoçhisar, Evren, Nallıhan. These districts are located within the provincial borders of Ankara and are peripheral districts.

The change in *H. pylori* positivity rates over the years is divided into three as general, adult and child positivity rates. While an upward trend was observed in the rates for all three groups in 2021 and 2022, they decreased to the lowest rates in six years in 2023. While the change in general and adult positivity rates over the years was statistically significant (p<0.001), it was not statistically significant for child positivity rates (p>0.05). This course over the years is summarized in Figure 4.
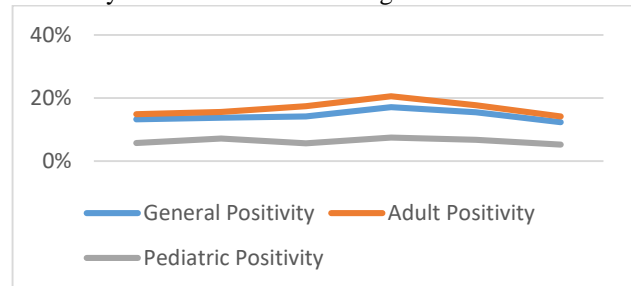
Figure 4. Change in *H. pylori* positivity rates over the years according to patient groups

While H. pylori positivity showed a slight increasing trend in the general population from the beginning of 2018 (13.22%) to 2019 (13.71%), by 2020, it started to decrease

in the pediatric patient group (2019; 7.21%, 2020; 5.60%), while in the adult group (2019;%) 15.62, 2020; 17.36%), the increasing trend continued to increase. In 2021, an increase was seen in all groups (2020; 14.17%, 2021; 17.06%), and a sharp decreasing trend was entered towards 2023 (2021; 17.06%, 2023; 12.36%).

DISCUSSION

The prevalence of *H. pylori* can reach up to 90% in developing countries (18). *H. pylori* is endemic in these countries, including Türkiye, due to inappropriate use of tap water, crowded living conditions, poor hygiene, poor sanitation and the low socioeconomic status of the citizens. Humans are usually infected by bacteria in childhood, and its prevalence increases with age (11).

Tests used for the diagnosis of *H. pylori* can be divided into invasive and non-invasive tests. While invasive tests are performed on biopsy material obtained through endoscopy, they are expensive and difficult to implement. In developing countries, non-invasive tests are preferred as diagnostic tests to investigate the presence of *H. pylori* infection. These tests are monoclonal antibody-based antigen tests and both stool and serum samples be used. In our country, cassette tests are mostly used to detect stool *H. pylori* antigen, based on the principle of the immunochromatographic method. These tests are cheaper than the other non-invasive test, the Urea Breath Test, and are also suitable for use in small health centers. Moreover, studies have shown that the specificity and sensitivity of immunochromatographic cassette tests were found to be quite high compared to the gold standard test method (19,20). In a meta-analysis study comparing the results of 48 studies on cassette tests, the specificity and sensitivity were respectively; calculated between 94-98% and 95-98%. The specificity and sensitivity of the test we used in our study were stated by the manufacturer as 98.4% and >98.8%.

Although it varies within a wide range, in a meta-analysis study conducted with studies published from 62 countries, the global prevalence of *H. pylori* was found to be 48.5%, and in another meta-analysis study including 73 countries, it was found to be 44.3% (1,21). In a study conducted in European countries the study showed that the prevalence of *H. pylori* varied between 11% and 84% (22). It is noteworthy that the prevalence of *H. pylori* varied greatly in the different regions examined in these studies (1,21,22).

Although it varies between societies and age groups, the prevalence of *H. pylori* is lower in developed countries and societies. In addition, it has been shown that the prevalence reaches up to 70% in developing countries due to low socioeconomic conditions, unhealthy nutrition, poor infrastructure and hygiene conditions (23).

Recent studies on the prevalence of *H. pylori* in our country have reported that this rate varies between 8.9-41%. The prevalence of Helicobacter pylori varies between geographical regions and patient age groups. Moreover, recent years have seen a decline in the prevalence of the bacterium (24, 25). In our study, the prevalence between 2018-2023. It was determined as 14.47%. In two comprehensive studies conducted in our country; While 82.5% *H. pylori* positivity was detected in 2013, it was calculated as 75.7% in the study conducted in 2017(2,26). In the study conducted in 2017, the distribution of *H. pylori* prevalence by regions was 88.7% in the Southeastern Anatolia region, 83.8% in the Eastern Anatolia region, and 85.6% in the Mediterranean region. It was reported as 80.9% in the Central Anatolia region, 66.7% in the Black Sea region, 68.5% in the Aegean region and 71.8% in the Marmara region (2). In our study, the distribution by region is 25.71% in the Southeastern Anatolia region, 16.90% in the Eastern Anatolia region, 17.90% in the Mediterranean region, and 14.16% in the Central Anatolia region. It was determined as 14.16%, 11.95% in the Black Sea region, 17.43% in the Aegean region and 18.03% in the Marmara region (p<0.05). In our study, the city with the highest prevalence was determined to be Bitlis with 32.35%. In addition, in our study, patients living in Ankara were divided into groups according to districts, and it was determined that the highest prevalence was observed in Altındağ (17.09%) and the lowest prevalence was observed in Etimesgut (8.79%). While Altındağ is one of the oldest settlements in Ankara and has negative factors such as infrastructure problems and migration, Etimesgut is a district that has been under construction in the last 20 years, has no infrastructure problems and has a relatively higher socioeconomic level. Considering the situation of the regions throughout the country and the districts in Ankara specifically, these data; It supports that the prevalence of *H. pylori* is inversely proportional to the level of development.

While the prevalence of *H. pylori* was stated as 68% in a 2007 study conducted in Ankara, this rate was calculated as 14.29% in our study (27). When the positivity rates are examined according to the years in our study, it is seen that the period between 2020 and 2022 coincides with the COVID-19 pandemic. Various measures have been taken in our country during the COVID-19 pandemic, such as lockdown and the use of masks (28). This is particularly pertinent given that H. pylori is transmitted through the fecal-oral route, and the increase in cases observed between 2020-2021 can be attributed to the lockdown measures implemented during this period. We think it is due to the increase in contamination. With the end of the lockdown measures, it is seen that the prevalence of *H. pylori* has decreased between 2021 and 2023. Although there was an increase due to the effect of pandemic measures, the statistically significant decrease in its prevalence in 2018 (13.22%) and 2023 (12.36%) supports the fact that *H. pylori* positivity has decreased over the years (p < 0.05).

There are studies showing that there is no statistically significant difference in H. pylori positivity between male and female when all age groups are considered together (21). There are also studies that show a significant difference between gender groups (29). While some studies found high positivity rates in male, it is higher in female than male. The majority of studies show that *H. pylori* positivity is detected (24,25). In our study, *H. pylori* is statistically significantly higher in female (16.64%, 19.77%) than in male (11.73%, 13.09%) in all age groups and in the adult age group. It was found to be positive (p<0.05). In the child age group, no statistically significant difference was detected between the female (6.60%) and male (6.28%) groups (p>0.05).

It is thought that *H. pylori* is acquired in childhood and remains positive as long as it is not treated (30). The higher rate of *H. pylori* positivity in adults than in children is explained by the increased risk of exposure to the agent with age (22). In our study, there was a statistically significant increase with age. Higher *H. pylori* positivity rates were found in the adult (16.77%) age group than in the child (6.46%) age group (p<0.05).

In our study, 40,784 patient samples were examined between 2018 and 2023. This number is the highest sample group conducted in our country to date and is one of the strengths of our study. The present study is subject to certain limitations. Firstly, it was conducted in a single centre, which restricts the generalisability of the results. Secondly, it was not possible to compare the results with those obtained from other tests that screen for H. pylori antigen positivity.

CONCLUSION

As a result, the prevalence of *H. pylori* was found to be lower in our study compared to studies conducted in recent years, and it was observed that it increased with age and was detected more frequently in female gender in the general population evaluation. When we compare our data with previous studies conducted in our country and Ankara; Although the decline in recent years is pleasing, the increase observed in districts such as Altındağ and Pursaklar in Ankara and in the Southeastern Anatolia region of our country shows that we have much more to do. Given the inverse correlation between the prevalence of *H. pylori* and the level of development, it is evident that significant improvements are required in several domains, including infrastructure, hygiene conditions, and socioeconomic conditions, within our nation. Furthermore, given the fact that *H. pylori* is a primary cause of dyspeptic complaints, there is an urgent need to develop new *H. pylori* diagnosis, screening and treatment strategies.

Authors's Contributions: Idea/Concept: İ.S.A.; Design: İ.S.A.; Data Collection and/or Processing: İ.S.A.; Analysis and/or Interpretation: İ.S.A.; Literature Review: İ.S.A., S.K., K.K.; Writing the Article: İ.S.A., S.K., K.K.; Critical Review: İ.S.A., S. K., K.K.

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