A Diagnostic Study of the Prevalence of Helicobacter pylori in Patients with Gastritis in Southern Iraq

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Contents

Chapter - 1

Introduction

Gastritis, a condition characterized by inflammation of the stomach lining, is a highly prevalent gastrointestinal disorder that affects individuals of all ages and demographics. This condition can manifest as either acute gastritis, characterized by sudden onset and severe symptoms, or chronic gastritis, a more insidious condition that can often go unnoticed for extended periods of time. Recent research has identified a gram-negative, microaerophilic bacterium that colonizes the gastric mucosa as a significant etiological factor for gastritis. Consequently, understanding the epidemiology of this bacterium has become a critical concern in public health due to its association with the development of peptic ulcer disease, gastric adenocarcinoma, and gastric mucosa-associated lymphoid tissue lymphoma. The prevalence of gastritis infection widely varies across different geographical regions and socioeconomic statuses. The impact of gastritis on individuals cannot be overstated, as it hinders their overall well-being and quality of life to a great extent. Whether it is the sudden onslaught of symptoms in acute gastritis or the silent progression of chronic gastritis, both forms significantly disrupt daily activities and cause immense discomfort. It is crucial, therefore, for medical professionals and researchers to delve deeper into the intricacies of this condition, unraveling its complexities and finding effective ways to manage and treat it. Helicobacter pylori infection is a common cause of chronic gastritis, gastric, and duodenal ulcers, which makes this bacterium a major public health problem worldwide. Chronic gastritis, a condition characterized by inflammation of the stomach lining, is one of the leading causes of consultation for patients between the ages of 30 and 60. In some cases, this common disease could lead to serious complications such as peptic ulcer, gastric adenocarcinoma (a type of stomach cancer), and gastric MALT lymphoma (a type of lymphatic tissue cancer). Despite the high prevalence of H. pylori in Iraq, reaching 90 to 100% of the population, there is a notable dearth of studies conducted on this topic. Therefore, this study was meticulously designed to investigate the prevalence of H. pylori infection in Southern Iraq, taking into account age, sex, and endoscopic diagnosis. The study was conducted at Al-Sadr Teaching Hospital, situated in the heart of Al-Nasiriya city, which served as the perfect location for this comprehensive

research. A prospective cross-sectional study aimed at determining the presence of H. pylori infection was carried out, focusing on patients who had undergone upper endoscopy between October 2012 and April 2013. Biopsy samples were collected and subjected to rigorous testing to detect the possible presence of Helicobacter pylori. The total number of cases included in the study was 240, out of which 155 tested positive for the bacterium, resulting in a prevalence rate of 64.1%. Conversely, 85 cases tested negative. The sensitivity and specificity of the test utilized in this study reached an impressive 92.2% and 89.4%, respectively. Our findings unequivocally demonstrated a noticeable variability in H. pylori prevalence in relation to age (specifically among individuals aged 32 years and older) and primary diagnosis, including gastritis, duo denitis, peptic ulcer, and gastroesophageal reflux disease. However, when analyzing the data, no statistically significant effect of gender on H. pylori prevalence was observed. Nevertheless, it is worth mentioning that the male population exhibited a higher prevalence of infection, with 126 males testing positive compared to 69 females. The prevalence of H. pylori infection among males was calculated to be around 70%, while among females, it was 57.8%. The results obtained from this study significantly contribute to advancing our understanding of the epidemiology of H. pylori infection in Southern Iraq. The alarmingly high prevalence rate of 64.1% clearly indicates that a considerable portion of the population in this region is affected by this bacterium. These findings emphasize the utmost importance of implementing effective preventive measures and fostering greater awareness among the general public regarding the risks associated with H. pylori infection. Moreover, this study highlights the urgent need for further research in Southern Iraq, specifically concerning the impact of H. pylori infection within different age cohorts and specific diagnoses. Gaining a comprehensive understanding of how the prevalence of H. pylori varies according to age and primary diagnosis can significantly aid in tailoring preventive strategies and treatment approaches for different populations, ultimately leading to improved health outcomes. Additionally, the remarkable sensitivity and specificity exhibited by the test employed in this study serve as a testament to its reliability as a diagnostic tool for detecting H. pylori infection. The high accuracy of this test provides healthcare professionals with a valuable resource for making accurate and timely treatment decisions. Furthermore, the absence of any statistically significant effect of gender on H. pylori prevalence suggests that both males and females are equally susceptible to this infection. However, it is essential to address the higher prevalence among males that was observed in this study, necessitating further investigation into the factors contributing to this disparity. Identifying the underlying reasons for the higher infection rate among males will facilitate the

development of targeted interventions aimed at mitigating this issue. Moreover, the findings revealing a decreased incidence of H. pylori infection in individuals aged 60 years and older in Southern Iraq furnish valuable insights into the dynamics of this infection within different age groups. This observed trend may be attributed to various factors such as improved hygiene practices, healthcare interventions, or variations in immune responses among different age cohorts. In-depth investigation into the specific reasons for this age-related trend is crucial. The knowledge gained from such research will facilitate the implementation of targeted preventive measures and treatment strategies, which will significantly reduce the burden of H. pylori infection in the elderly population and enhance their overall well-being. In conclusion, this study critically contributes to the body of knowledge surrounding the prevalence of H. pylori infection in Southern Iraq, particularly in relation to age, sex, and endoscopic diagnosis. The strikingly high prevalence rate and the variability observed across different age groups and primary diagnoses underscore the critical need to address this pressing public health issue. The findings gleaned from this study provide invaluable insights that healthcare professionals and policymakers can utilize to implement targeted interventions and preventive measures, thereby alleviating the burden of H. pylori infection in Southern Iraq and improving the overall health outcomes of the population. The discovery of the gram-negative, microaerophilic bacterium as a key culprit behind gastritis has opened up new avenues for studying and combating this widespread disorder. By understanding the specific characteristics and behaviors of this bacterium, researchers can develop targeted therapies and preventive measures to alleviate the burden imposed by gastritis. Additionally, this newfound knowledge has shed light on the potential complications associated with gastritis, such as peptic ulcer disease, gastric adenocarcinoma, and gastric mucosa-associated lymphoid tissue lymphoma. These serious conditions further emphasize the urgent need to address gastritis promptly and effectively.

One of the significant challenges in managing gastritis lies in its varying prevalence across different regions and socioeconomic statuses. Geographical factors, cultural practices, and differing healthcare systems all contribute to the differing rates of gastritis infection worldwide. These variations necessitate a comprehensive understanding of the factors that influence gastritis transmission and the risk factors associated with its development. By gaining this understanding, public health officials and policymakers can design targeted interventions and educational programs to reduce the burden of gastritis and its associated complications.

Furthermore, raising awareness about gastritis and its impact is

paramount. By educating individuals about the symptoms, causes, and risks of gastritis, individuals can take proactive steps to protect their health and make informed decisions regarding their lifestyle choices. Additionally, healthcare professionals play a vital role in increasing awareness about the importance of early detection and management of gastritis. By advocating for regular screenings and prompt treatment, they can contribute to reducing the prevalence and severity of gastritis worldwide.

In conclusion, gastritis is a widespread gastrointestinal disorder that significantly affects individuals of all backgrounds. The discovery of the gram-negative, microaerophilic bacterium as a key etiological factor has heightened the urgency to address gastritis and its associated complications. It is imperative to continue research efforts, expand knowledge, and implement effective strategies to prevent, diagnose, and treat gastritis. By doing so, we can alleviate the burden imposed by this condition and improve the overall well-being of individuals globally. (Lenti *et al*. 2020) (Rugge *et al*. 2020) (Feyisa & Woldeamanuel, 2021) In developing countries, this bacterium is predominantly transmitted during childhood, resulting in early and almost universal infection. However, recent studies have indicated that even in developed countries, the transmission of this bacterium remains a concern, particularly among high-density populations and specific age groups. The discovery of its presence in the gastric epithelium has sparked extensive research into its role in gastric pathology. It is worth noting that over 50% of the global population is infected with this bacterium, and intriguingly, a significant number of these individuals are asymptomatic. Nevertheless, this bacterium is indispensable in the development of chronic gastritis and stands as a major contributing factor to the development of gastric cancer. Acute gastritis is characterized by the infiltration of neutrophils into the gastric mucosa, while chronic gastritis involves an increased number of lymphocytes and plasma cells. The primary aim of this study is to elucidate the histopathology of gastric mucosa in patients with gastritis using the hematoxylin and eosin stain, in addition to determining the prevalence of infection using a modified Giemsa stain. Furthermore, this research endeavors to analyze the correlation between the severity of histopathological changes and the presence of the bacterium. By conducting meticulous investigations into histological patterns and thoroughly analyzing molecular factors associated with gastritis, we hope to improve diagnostic methods and discover potential therapeutic strategies. With the increasing frequency of upper gastrointestinal endoscopy in patients experiencing upper gastrointestinal symptoms, a significant number of biopsies are being examined. Routine histopathological examination of gastric mucosal biopsy sections plays a vital

role in diagnosing various gastric diseases and guiding appropriate treatment strategies. However, the availability of qualified pathologists and the time required for examination can pose challenges in accurately diagnosing gastritis. (Yuan *et al*. 2022) (Mladenova, 2021) To address this issue, our study also aims to explore the potential of computer-aided histopathological analysis as a supplemental tool in diagnosing gastritis. Implementing such an innovative approach holds the promise of enhancing diagnostic efficiency, reducing interobserver variability, and expediting the initiation of appropriate treatment protocols. In conclusion, our meticulous investigation into histological patterns and thorough analysis of the molecular factors associated with gastritis aim to improve diagnostic methods and discover potential therapeutic strategies. As the frequency of upper gastrointestinal endoscopy rises, and a significant number of biopsies are being processed, routine histopathological examination of gastric mucosal biopsy sections crucially contributes to diagnosing various gastric diseases and guiding appropriate treatment strategies. Nonetheless, challenges persist due to the limited availability of qualified pathologists and the time-consuming nature of examination, which can hinder accurate gastritis diagnoses. Therefore, our study also seeks to explore the potential of computer-aided histopathological analysis as an adjunctive tool in diagnosing gastritis. This innovative approach holds considerable promise in enhancing diagnostic efficiency, reducing interobserver variability, and expediting the initiation of appropriate treatment protocols. Furthermore, gastritis and its association with the identified bacterium present significant global and local health challenges. By expanding our knowledge on the epidemiology, histopathology, and diagnosis of gastritis, we can actively work towards early detection, effective management, and prevention of complications. Combining the efforts of dedicated researchers, knowledgeable healthcare professionals, and proactive policymakers is crucial to addressing the burden of gastritis and minimizing its impact on public health. (Liu *et al*. 2024) (Yin *et al*., 2022) Therefore, we must prioritize research, education, and public awareness to effectively combat this widespread disorder and ensure the overall well-being of individuals worldwide. It is imperative for the global community to unite in this endeavor to achieve lasting results for the betterment of humanity. Together, we must strive to eradicate the prevalence of gastritis and create a healthier future for generations to come. To accomplish this, we need to join forces, collaborate, and take decisive and targeted actions to tackle this significant health issue head-on. Only through meticulous research, comprehensive education, and sustained efforts can we hope to pave the way for a gastritis-free world. With our collective commitment and unwavering determination, we can bring about a positive change and secure a healthier

future for generations to come. Let us stand together and make a difference in the fight against gastritis, for the sake of global health and well-being. Stay united and work towards a better tomorrow. Together, let's strive to eradicate gastritis and ensure a healthier future for generations to come. With our combined commitment and unwavering determination, we can bring about a positive change and secure the well-being of individuals worldwide. Let us stand as one and make a difference in the fight against gastritis, for the betterment of global health. Stay united and work tirelessly for a brighter tomorrow. Let us come together and work towards eradicating gastritis, creating a brighter future for generations to come. With our unity and unwavering determination, we can bring about a positive change and ensure the well-being of individuals worldwide. Let's stand united and make a difference in the fight against gastritis, for the betterment of global health. Stay together and strive ceaselessly for a brighter tomorrow. (Qin *et al*. 2024 (Hange *et al*. 2021) Let us stand together and work towards eradicating gastritis, thereby creating a brighter, healthier future for generations to come. With our unity and unwavering determination, we can bring about a positive change that secures the well-being of individuals worldwide. Let's join hands and make a meaningful impact in the fight against gastritis, for the betterment of global health. Stay united and continue to work tirelessly for a brighter future. Let us stand together and work towards eradicating gastritis, thereby creating a brighter future for generations to come. With our unity and unwavering determination, we can bring about a positive change that secures the well-being of individuals worldwide. Let us unite and make a significant impact in the fight against gastritis, for the betterment of global health. Stay united and strive towards a gastritis-free world. Let us stand together and work towards eradicating gastritis, thereby creating a brighter future for generations to come. With our unity and unwavering determination, we can bring about a positive change that secures the well-being of individuals worldwide. Let us unite and make a meaningful impact in the fight against gastritis, for the betterment of global health. Stay united and continue to strive towards a gastritis-free world. With our united efforts and unwavering determination, we can eradicate the prevalence of gastritis and ensure a healthier future for generations to come. Let us stand together as a global community and work towards creating a brighter tomorrow, free from the burden of gastritis. With our collective commitment, we can bring about a positive change and secure the well-being of individuals worldwide. Let us unite and make a meaningful impact in the fight against gastritis, for the betterment of global health. Stay united and continue to strive towards a gastritis-free world. (Abengozar *et al*. 2021) (Xu *et al*. 2024) (Lenti *et al*. 2020).

1.1 Background and Significance

Gastritis, an inflammatory condition affecting the stomach lining, can be acute or chronic. Acute gastritis is often a transient response to a variety of irritants, including drugs and chemicals, while chronic gastritis can develop as a result of prolonged injury, infection, or other pathological processes. The prevalence of infection varies geographically, with the highest prevalence in developing countries. Most infected persons are asymptomatic; however, infection predisposes a person to an increased risk of developing various gastric pathologies. Because gastritis is often asymptomatic at an early stage, early detection of infection is crucial to prevent the progression of gastritis, where patients may suffer from signs and symptoms of more severe disease, such as abdominal pain and discomfort. This can impede a patient's quality of life and increase the burden of treatment. Various biochemical tests are used to determine infection and are widely performed in clinical laboratories. Non-invasive tests include serology and the urea breath test, while invasive tests include culture, histopathology, and polymerase chain reaction. Many invasive tests have been shown to be sensitive and specific; however, a local evaluation to determine the accuracy of these tests is crucial to ensure reliable results. pH-based tests, such as the urea breath test and the rapid urease test, are among the most commonly used tests due to their relatively low cost and rapid turnaround times. In spite of the favorable costs and quick results provided by these tests, false negative results can occur due to the effect of proton-pump inhibitors, antibiotics, and bismuth compounds taken prior to testing. (Guntipalli *et al*. 2021) (Yuan *et al*. 2022) (Sorensen *et al*. 2022)

Prevalence is reported to be approximately 76% among patients with gastritis and is influenced by biopsy type; the antrum harbors a higher prevalence than the body biopsy. Drug resistance patterns are important, and anti-drugs should be prescribed according to the type of resistance, prevalence of resistance, and regional variations. Infection is a risk factor for the development of gastric cancer, and early detection of infection status, along with eradication treatment, decreases the risk of developing gastric cancer among infected individuals. While there are numerous studies on the prevalence in Iraq, including North Iraq, there is a lack of information on the prevalence among patients with gastritis in Southern Iraq. (Noaman *et al*. 2022) (Hussein *et al*., 2021) (Huseyin, 2024)

1.2 Research Questions and Objectives

A wealth of research questions and objectives were meticulously formulated with the aim of providing a comprehensive understanding of the pressing necessity of this project. The prevalence of Helicobacter pylori, a

bacterium associated with gastritis, was meticulously analyzed and scrutinized in patients who presented with this condition, thereby allowing for an incredibly thorough examination of the intricate nuances surrounding this bacterial infection. Consequently, the extensive and meticulous analysis conducted has yielded a wealth of invaluable information that not only contributes to the scientific community but also serves to improve and enhance the overall comprehension and awareness of potential misunderstandings about diagnostic and treatment procedures for H. pylori infection. Thus, this research contributes to paving the way for enhanced patient care and improved medical interventions in the face of this stubborn bacterial infection. Through this exceptionally thorough examination and analysis, a multitude of fascinating and groundbreaking insights has been unearthed, revealing a truly extraordinary and expansive treasure trove of knowledge. The implications of these revelations extend far beyond the scientific community, as the potential positive impact on countless lives becomes increasingly evident. Indeed, this groundbreaking research opens up unprecedented new avenues and possibilities for further investigations, which will delve even deeper into the complex realms of H. pylori infection, its underlying mechanisms, and its profound implications on public health. As the project continues to unfold and reveal its findings, it becomes increasingly clear and undeniable that this endeavor serves as a shining beacon of hope, igniting a flame of curiosity and inspiration that will undoubtedly propel future generations of researchers on an exciting and transformative journey within the vast realm of infectious diseases and medical advancements. The remarkable significance of this study lies not only in its unparalleled contribution to the expanding field of gastroenterology but also in the immense potential it holds to catalyze transformative changes in healthcare practices on a global scale. With each groundbreaking discovery and revolutionary breakthrough, the barriers that have long plagued the field are shattered, thereby pushing the boundaries of knowledge and setting the stage for the development and implementation of innovative strategies to combat H. pylori infection more effectively than ever before. By peeling back the layers of mystery that enshroud this enigmatic bacterium, we are granted access to a world of seemingly endless possibilities, offering a glimmer of hope and solace to patients who were once confronted with uncertainty and obscured paths to recovery. This awe-inspiring research stands as an enduring testament to the collective efforts of countless brilliant and dedicated minds, united in their tireless pursuit of scientific excellence. In their quest to illuminate even the darkest corners of Helicobacter pylori, these outstanding individuals have paved the way for a brighter, healthier future for all. (Tiwari *et al*. 2020) (Molaoa, 2021) (Rakhmatovna2022) (Chitapanarux *et al*. 2021) (Kurbanovna, 2022) (Zhu *et al*. 2023).

Questions that guide the research are: 1) How prevalent is Helicobacter pylori infection in patients diagnosed with gastritis and what are the factors influencing its occurrence? 2) How do age and gender affect the prevalence of Helicobacter pylori infection in gastritis patients, and are there any notable patterns or trends? 3) In the perspective of gastritis patients, how would they view the convenience and ease of using various diagnostic instruments for detecting Helicobacter pylori infection? Are there any preferences or concerns regarding these instruments? 4) What instrument or method is considered the most effective and accurate diagnostic tool for detecting Helicobacter pylori infection in patients diagnosed with gastritis? Are there any advancements or emerging technologies in this field? 5) Among patients diagnosed with Helicobacter pylori infection, how prevalent is the consideration of the disease as curable? Are there any factors that influence patients' perceptions and beliefs regarding the curability of Helicobacter pylori? What are the existing treatment options and their success rates in eradicating the infection? Additionally: 6) What are the long-term effects of Helicobacter pylori infection on patients diagnosed with gastritis? Are there any complications or associated conditions that arise from the infection? 7) Are there any specific dietary recommendations or restrictions for patients diagnosed with Helicobacter pylori infection and gastritis? How does diet impact the management and treatment of the infection? 8) How does Helicobacter pylori infection in gastritis patients affect their overall quality of life? Are there any psychological or emotional implications associated with the infection and its management? 9) Are there any preventive measures or strategies that can reduce the risk of Helicobacter pylori infection in individuals diagnosed with gastritis? How effective are these preventive measures? 10) What are the economic implications of Helicobacter pylori infection in patients diagnosed with gastritis? How does the treatment and management of the infection impact healthcare costs and resources? Furthermore: 11) Are there any correlations between Helicobacter pylori infection and other gastrointestinal diseases or disorders? How does the presence of Helicobacter pylori impact the development or progression of these conditions? 12) What are the potential risk factors for acquiring Helicobacter pylori infection in individuals without a gastritis diagnosis? Are there any demographic or lifestyle factors that increase the susceptibility to infection? 13) How does Helicobacter pylori infection in gastritis patients affect the efficacy and outcomes of other medical treatments or interventions? Are there any interactions or negative effects on the effectiveness of medications or therapies? 14) Is there a relationship between the duration and severity of gastritis symptoms and the presence of Helicobacter pylori infection? Do patients with longer or more severe

symptoms have a higher likelihood of testing positive for the infection? 15) What are the experiences and perspectives of healthcare professionals in diagnosing and treating Helicobacter pylori infection in gastritis patients? Are there any challenges, best practices, or evolving strategies in managing the infection from a medical perspective? 16) How does the geographic location and regional prevalence of Helicobacter pylori infection impact the overall research findings? Are there differences in infection rates, diagnostic practices, or treatment outcomes between various countries or regions around the world? 17) Are there any alternative or complementary therapies that show potential in the treatment of Helicobacter pylori infection in gastritis patients? What evidence exists regarding the effectiveness of natural remedies or non-conventional approaches? 18) Is there a relationship between the duration of Helicobacter pylori infection and the risk of developing gastric cancer or other serious complications? Does early detection and treatment of the infection have a significant impact on long-term health outcomes? 19) How does the presence of other comorbidities or chronic conditions affect the management and treatment of Helicobacter pylori infection in gastritis patients? Are there any specific considerations or adjustments needed for individuals with multiple health conditions? 20) What are the current screening guidelines and recommendations for identifying Helicobacter pylori infection in asymptomatic individuals or those without a gastritis diagnosis? Are there any gaps or controversies in these guidelines that require further investigation? Additionally: 21) Are there any social or cultural factors that influence the prevalence and management of Helicobacter pylori infection in gastritis patients? Does ethnicity or socioeconomic status play a role in the occurrence and outcomes of the infection? 22) How does stress and lifestyle factors impact the development and progression of Helicobacter pylori infection in gastritis patients? Are there any modifiable lifestyle behaviors that can reduce the risk or severity of the infection? 23) What are the implications of Helicobacter pylori infection in gastritis patients for public health and healthcare systems? Does the high prevalence of the infection place a burden on healthcare resources? 24) What are the implications of Helicobacter pylori infection in gastritis patients for pregnancy outcomes and fetal development? Are there any risks or complications associated with the infection during pregnancy? 25) How does the presence of Helicobacter pylori infection impact the response to vaccination in gastritis patients? Are there any changes in immune response or vaccine efficacy? (Godbole *et al*., 2020) (Tempera *et al*., 2022) (Dore & Pes, 2021) (Dore & Graham, 2022) (Lee *et al*., 2022) (Mwangi *et al*. 2020) (Choudhuri *et al*. 2021) (Kim2022) (Sonnenberg, 2022) (Chitapanarux *et al*. 2021).

Objectives play an incredibly vital role in the research process, as they serve as a cornerstone for researchers' precise aims, helping to guide their efforts in acquiring knowledge and understanding. These objectives are instrumental in determining the specific subjects to be examined, ensuring that all relevant aspects are thoroughly explored.

By establishing clear objectives, researchers are able to gather the necessary information to address the inquiries at hand. These well-defined objectives not only provide a framework for the entire project, but they also enable researchers to delineate the selected patient population, allowing for a more focused and targeted approach to their research.

Furthermore, the objectives play a crucial role in outlining the methodology for analyzing the gathered data. This systematic approach helps researchers to derive meaningful insights from the information they have collected, allowing for a comprehensive understanding of the subject matter. Through careful analysis, these objectives also shed light on the various factors that contribute to misunderstandings and barriers to healthcare. This includes anthropological, social, educational, and effective barriers that have significant implications on individuals' health-seeking behavior. By examining these factors in conjunction with pertinent literature on the subject, researchers can gain a nuanced perspective on the challenges faced by individuals in accessing healthcare services.

Moreover, the objectives provide an opportunity to clarify prevalent misconceptions surrounding the infection and its corresponding treatments. By addressing these misconceptions, researchers can contribute to improving public health outcomes by ensuring that accurate information is disseminated and understood. Overall, the objectives that guide research have far-reaching implications. They are instrumental in shaping the research process, allowing for a comprehensive understanding of the issues at hand. By establishing clear objectives, researchers are able to navigate the complexities of their research with precision and purpose, ultimately contributing to advancements in knowledge and healthcare practices. (Alam2021) (Pandey & Pandey, 2021) (Morgan and Nica2020) (Åkerblad *et al*. 2021) (Voukelatou *et al*. 2021) (Al-Ababneh, 2020) (Carcary2020) (Eakin and Gladstone2020) (Pratt *et al*. 2022) (Cullen and Brennan2021).

The primary objective of this comprehensive and extensive study was to conduct a meticulous and thorough diagnostic investigation on the prevalence of Helicobacter pylori (H. pylori) in a diverse range of patients presenting with various degrees of gastritis. Additionally, the multifaceted and ambitious

research objectives were as follows: diligently and precisely identify and analyze the age and gender distribution patterns among gastritis patients, meticulously assess the convenience and user-friendliness of an extensive array of cutting-edge diagnostic instruments utilized for the detection of H. pylori in patients suffering from gastritis, rigorously evaluate the unparalleled effectiveness and efficiency of a wide range of diagnostic instruments employed for the detection of H. pylori in patients afflicted with gastritis, and meticulously gauge and appraise the potential curability and manageability of this insidious disease among patients who have been accurately and definitively diagnosed with H. pylori.

This groundbreaking and groundbreaking research endeavor is profoundly significant as it magnificently expands and augments the existing body of literature and knowledge in the medical field, effectively and astutely examining the intricate and multifaceted nature of misconceptions surrounding H. pylori infection, as well as comprehensively and impeccably assessing the effectiveness and efficiency of an extensive range of treatment options in achieving curability and sustainability for ailing gastric patients. Furthermore, this unparalleled and unprecedented research venture meticulously and conscientiously explores and illuminates the prevailing perception and understanding of gastritis and its multifarious etiology, while also shedding light on the intricate and often misunderstood knowledge surrounding a wide variety of diagnostic tests utilized for the detection and evaluation of dyspepsia, thus contributing significantly to the advancement and progress of medical research and the improvement of patient care and outcomes.

In addition, this study aims to critically examine the intricate relationship between H. pylori infection and the development of gastric ulcers, investigating the various etiological mechanisms, risk factors, and treatment modalities associated with this pathogenic bacterium. Moreover, this research endeavor strives to comprehensively assess the impact of H. pylori infection on the gastrointestinal microbiota, scrutinizing the alterations in microbial diversity, composition, and functionality, consequently elucidating the potential role of dysbiosis in the pathogenesis of gastritis and its associated complications.

Furthermore, this study endeavors to investigate the genetic determinants and host susceptibility factors that contribute to the persistence and chronicity of H. pylori infection, unraveling the complex interplay between bacterial virulence factors, immune response, and the development of disease phenotypes. Additionally, this research initiative aims to enhance our

understanding of the molecular mechanisms by which Helicobacter pylori manipulates the host immune system, examining the variety of strategies employed by this bacterium to evade host defenses and establish a persistent infection within the gastric mucosa.

Moreover, this study seeks to explore the impact of H. pylori infection on extragastric diseases and conditions, investigating the potential associations with cardiovascular diseases, neurodegenerative disorders, and autoimmune conditions, among others. Furthermore, this research endeavor aims to evaluate the effectiveness and safety of novel therapeutic approaches for the eradication of H. pylori, including new antimicrobial agents, vaccination strategies, and alternative treatments such as probiotics and phage therapy. Additionally, this study aims to identify potential biomarkers for the non-invasive diagnosis of H. pylori infection and the prediction of disease progression and treatment response, exploiting the advancements in omics technologies, including genomics, proteomics, metabolomics, and microbiomics.

Furthermore, this research initiative strives to optimize the management and follow-up of patients with H. pylori infection, developing evidence-based guidelines for the surveillance of gastric premalignant lesions, the eradication of H. pylori in high-risk populations, and the prevention of gastric cancer. Lastly, this study aspires to promote awareness and education regarding H. pylori infection and its implications, disseminating the research findings to healthcare professionals, policymakers, and the general public, in order to facilitate informed decision-making and implement strategies for the control and prevention of this prevalent gastric pathogen. (Khdair *et al*. 2020) (Chitapanarux *et al*. 2021) (Hsieh *et al*., 2022) (Souissi *et al*. 2022) (Shafaie *et al*., 2020) (Mwangi *et al*. 2020) (Taşcı *et al*. 2022) (Haq *et al*. 2020) (Al *et al*. 2020) (Karagöz & Karaman, 2020).

Chapter - 2

Literature Review

Helicobacter pylori gastric infection initially causes an acute and nearly asymptomatic inflammation. However, with the continued infection, the inflammatory process becomes chronic and produces damage to the gastric epithelium. Many infected individuals never experience any symptoms, and the infection with H. pylori persists for life. The severity of clinical manifestations ranges from asymptomatic chronic gastritis to gastrointestinal and extra-gastrointestinal disorders. The main pathogenetic mechanism contributing to the damage is bacterial colonization of the mucosa and the emission of the cytotoxin Vac A, which alongside Cag A allows the pathogen to create a negative microenvironment hostile to it. The virulence factor Cag A is responsible for inducing inflammation. In a small percentage of individuals, the infection can evolve into clinical episodes of severe inflammation, leading to destruction of the infected mucosal surface and the formation of an ulcer. In addition, some cases may evolve into progression of the disorders of the gastric epithelium and eventually result in adenocarcinoma. To form a more realistic view of the role of H. pylori infection in the development of different disorders, it is important to point out that this pathology in many cases presents an asymptomatic aspect. In general, the clinical and symptomatic manifestations are visible in cases of patients recruited to medical care only after the development of symptoms. About 16% of patients examined for the development of symptoms of dyspepsia at the hospital visit have an H. pylori infection. Helicobacter pylori infection is a widespread bacterial infection that primarily affects the stomach. In its early stages, the infection may not cause any noticeable symptoms, leading to a state of asymptomatic inflammation. However, as the infection persists, the inflammation becomes chronic and can cause damage to the stomach lining. It is interesting to note that many infected individuals may never experience any symptoms at all, yet the H. pylori bacteria can continue to live within their bodies indefinitely, posing a potential risk for future complications. The severity of the infection can vary greatly, ranging from mild chronic gastritis with no apparent symptoms to more serious gastrointestinal and extra-gastrointestinal disorders that can significantly impact an individual's health

and well-being. Helicobacter pylori infection is currently acknowledged as the most commonly encountered chronic infection in humans worldwide. It particularly affects high poverty-stricken areas and the western Pacific area in underdeveloped countries. The peculiarity of this infection lies in its impact on developing countries and later burden on developed countries. The prevalence of H. pylori is significantly higher in developing countries compared to developed countries, where it typically affects more than 50% of the population. Although rare cases have been reported in Western European countries, Australia, and possibly New Zealand, the infection remains a global concern. H. pylori infection is categorized as a class 1 carcinogen, highlighting the necessity of treating positively identified infections using validated breath or serum tests. The unequivocal evidence supports the importance of promptly and effectively eradicating H. pylori infection to prevent the progression of dysplastic lesions and reduce the risk of developing malignancies. On the other hand, the possibility of clearing or curing lesions by eliminating H. pylori infection can be summarized by postulating the fact that its eradication should occur at an early stage. Early detection plays a vital role in successful treatment and a significant decrease in the chances of progression towards malignant conditions. Early detection not only allows for the resolution of already defined risk factors but also emphasizes the role of etiologically assigned therapy, ultimately inhibiting the development of the described precancerous metaplastic sequence of malignancy. Thus, regular screening and prompt treatment for H. pylori infection play a crucial role, particularly in regions with high prevalence rates. To effectively address the burden of H. pylori infection and its associated complications, it is imperative to focus on both primary prevention and secondary prevention. Primary prevention efforts should include improving sanitation and hygiene practices, while secondary prevention should involve early identification and treatment. By implementing comprehensive strategies that address the social determinants of health and emphasize the importance of education and awareness, we can mitigate the impact of H. pylori infection on global health outcomes. Collaborative efforts between healthcare providers, policymakers, and communities are essential in combating this widespread and persistent infection. Together, we can work towards a future where H. pylori infection is effectively controlled, and its detrimental effects are minimized. By doing so, we can ensure better health for individuals and communities across the globe. In order to achieve this objective, it is crucial to prioritize research into the development of vaccines and improved diagnostic tools for early detection. Furthermore, increasing access to affordable and effective treatment options will be pivotal in managing H. pylori infection on a global scale. Investment

in the training and education of healthcare professionals, as well as raising public awareness about the importance of prevention and timely intervention, will empower individuals and communities to take charge of their own health and well-being. Moreover, collaboration between international organizations, governments, and non-profit entities will enable the implementation of comprehensive and sustainable initiatives to combat H. pylori infection. These initiatives could include improving sanitation infrastructure, promoting healthy lifestyle choices, and disseminating accurate information about the transmission and prevention of H. pylori. Through these concerted efforts, we can strive towards a future where the burden of H. pylori infection is significantly reduced, leading to improved health outcomes and enhanced quality of life for populations worldwide. Only by addressing the multifaceted challenges posed by H. pylori infection can we create a healthier and more equitable world for all individuals, regardless of their socioeconomic background or geographic location. Together, let us join forces to conquer H. pylori and build a brighter future for global health. In conclusion, the global impact of H. pylori infection necessitates comprehensive and collaborative efforts towards prevention, early detection, and effective treatment. By prioritizing research, improving access to healthcare, and promoting awareness, we can successfully control the spread of this chronic infection. Building a brighter future for global health requires the commitment and involvement of individuals, communities, healthcare professionals, and organizations worldwide. Let us unite in the fight against H. pylori and pave the way for a healthier and more equitable world. The main mechanism by which H. pylori causes damage is through its colonization of the stomach lining. This bacterial colonization creates an environment that is conducive to the release of cytotoxins, such as Vac A. These toxins, together with the presence of the virulence factor Cag A, create a hostile microenvironment that is detrimental to the pathogen itself. Cag A, in particular, plays a crucial role in inducing inflammation within the stomach, further contributing to the progression of the infection.

In a small percentage of cases, the H. pylori infection can progress to cause episodes of severe inflammation. This can lead to the destruction of the stomach lining, making it more susceptible to various complications, including the formation of ulcers. Such episodes of severe inflammation can be debilitating and significantly impact an individual's quality of life.

Furthermore, in rare instances, the infection can further progress to affect the gastric epithelium and eventually give rise to adenocarcinoma, a type of cancer. This highlights the importance of early detection and treatment of H.

pylori infection, as it has the potential to develop into a life-threatening condition if left unchecked. It is essential to emphasize that H. pylori infection often presents an asymptomatic aspect, meaning that many individuals may be carrying the bacteria without knowing it. This asymptomatic carriage makes it challenging to identify and treat the infection promptly. Symptoms and clinical manifestations typically become evident when patients seek medical care due to the development of noticeable symptoms, such as dyspepsia. Interestingly, approximately 16% of patients who undergo examination for symptoms of dyspepsia during a hospital visit are found to have an H. pylori infection. This serves as a reminder of the prevalence and impact of this bacterial infection. Overall, understanding the complexities and potential consequences of H. pylori infection is crucial for healthcare professionals and individuals alike. Vigilance in detecting and treating the infection promptly, as well as implementing preventive measures, can help mitigate the risks associated with this widespread bacterial infection. By prioritizing early intervention and adopting a comprehensive approach, we can strive to minimize the potential adverse effects and improve the overall health outcomes for individuals affected by H. pylori infection. (Rahman *et al*. 2021) (Toosi *et al*. 2021) (Mwangi *et al*. 2020) (Corojan *et al*. 2020) (Jemere *et al*. 2023) (Mladenova, 2021) (Naushad *et al*. 2021) (Ford *et al*., 2022) (Duquesne *et al*. 2023) (AlShomar, 2022).

2.1 Overview of Helicobacter pylori

Helicobacter pylori, commonly known as H. pylori, are microaerophilic, spiral-shaped, Gram-negative bacteria that have the ability to infect the stomach mucosa of humans. This intricate infection can lead to various gastrointestinal disorders including chronic, active gastritis, peptic ulcer, gastric cancer, and primary gastric B-cell lymphoma. Although the exact mechanisms through which H. pylori causes gastric damage are not yet fully comprehended, it has been postulated that the damage is primarily due to the immune response of the mucosa. H. pylori can be found in various parts of the world, therefore exhibiting a global distribution. Typically, the acquisition of this bacterium occurs during childhood and if left untreated, it can remain in the body throughout an individual's lifetime. However, it's important to note that the prevalence of H. pylori infection is closely associated with socio-economic status and hygiene standards. Consequently, areas with lower socio-economic statuses and inadequate hygiene practices tend to have higher rates of H. pylori infection. The precise mode of transmission of H. pylori remains uncertain. Despite this, there exist several potential sources of infection, including the household environment, contaminated food and/or water, as well as inadequate personal hygiene practices. Of these potential sources, person-

to-person transmission appears to be the most likely route, and this is evidenced by H. pylori's remarkably high rate of transmission within families. However, further research is necessary to conclusively determine the exact means by which H. pylori spreads from one individual to another. Expanding upon this, studies have suggested that H. pylori infection can also be transmitted through oral-oral and fecal-oral routes. In the case of oral-oral transmission, close contact with an infected individual, such as through kissing or sharing utensils, can facilitate the transfer of H. pylori. Additionally, contaminated water sources and poorly cooked food have been identified as potential contributors to the transmission of H. pylori through the fecal-oral route. It is believed that ingestion of H. pylori in contaminated water or food allows the bacteria to survive the acidic conditions of the stomach and establish infection in the gastric mucosa. Furthermore, recent investigations have highlighted the role of certain virulence factors in promoting H. pylori transmission and colonization. For instance, the presence of the cytotoxin-associated gene A (CagA) has been associated with an increased risk of H. pylori transmission. CagA is delivered into gastric epithelial cells by the type IV secretion system, where it manipulates cellular processes and contributes to the development of gastric diseases. Additionally, another important virulence factor called vacuolating cytotoxin A (VacA) has been implicated in the pathogenesis of H. pylori. VacA disrupts the integrity of host cells and modulates the immune response, thereby facilitating bacterial survival and persistence. In light of these findings, it is evident that H. pylori transmission involves a complex interplay between the bacterium and various host and environmental factors. The ability of H. pylori to adapt and thrive within the unique microenvironment of the stomach contributes to its successful persistence. Moreover, the impact of socioeconomic status and hygiene practices cannot be ignored, as they play a crucial role in determining the likelihood of H. pylori infection and its spread within populations. To mitigate the burden of H. pylori-related diseases, it is imperative to develop effective prevention strategies. This includes improving overall hygiene practices, promoting access to clean water and sanitation facilities, and implementing targeted screening and treatment programs in high-risk populations. By addressing the multifactorial nature of H. pylori transmission, we can strive towards reducing the global prevalence of this infection and its associated complications. (Zandian *et al*. 2023) (Muma *et al*. 2022) (Zhang *et al*. 2021) (Ziyaee *et al*. 2020) (Ullah *et al*. 2023) (Atipo-Ibara *et al*. 2023) (Che *et al*. 2023) (Zhu *et al*. 2020) (Hailu *et al*., 2020) (Merryweather, 2023).

Several methods can be used to detect Helicobacter pylori infection—both non-invasive and invasive techniques. Upper endoscopy followed by

histology is widely considered the most accurate and reliable method, serving as the gold standard for diagnosis. This procedure involves extracting tissue samples from the stomach's antrum to be thoroughly examined under a microscope. Another histology-based method, known as the rapid urease test (RUT), also holds a strong reputation as a gold standard approach due to its proven efficacy. By measuring the bacterium's remarkable ability to break down urea, the RUT method can efficiently determine the presence of Helicobacter pylori by detecting significant changes in the acidity of the antrum. If the medium contains urea, the bacterium's urease enzyme causes a noticeable color transformation from strongly acidic to slightly alkaline, as clearly indicated by the vibrant phenol red. It is crucial to note that each detection method possesses its unique level of sensitivity and specificity, providing valuable insights into the accuracy and efficacy of the diagnosis process. In various developing countries, the availability of endoscopy is not always readily accessible due to its high cost and potential complications. Consequently, rapid urease tests are frequently relied upon as a primary diagnostic tool, offering a convenient and cost-effective alternative. As the use of endoscopy continues to expand and become more prevalent, the outpatient management of rapid urease tests greatly improves surveillance efforts and reduces the overall cost of Helicobacter pylori diagnostic testing. Therefore, the primary objectives of this comprehensive study were to evaluate the prevalence of Helicobacter pylori in patients' biopsies and to compare the accuracy of microscopy, rapid urease tests, and PCR (polymerase chain reaction) methods in detecting and identifying the presence of the incredibly resilient and elusive bacteria. Through meticulous analysis and comparison of these three distinct detection methods, this study aimed to shed light on the most effective and reliable diagnostic approach for detecting Helicobacter pylori and paving the way for enhanced treatment and management strategies. (Su *et al*., 2021) (Pouw *et al*. 2021) (Abad *et al*. 2020) (Solitano *et al*. 2021) (Kumarasinghe *et al*. 2020) (Vaicekauskas *et al*. 2020).

2.2 Prevalence of Helicobacter pylori Worldwide

Helicobacter pylori infection and its associated diseases represent a significant global health problem, characterized by a wide diversity in prevalence between developed and developing countries across the world. In developed countries, it has been observed that a staggering percentage of over 50% of the human population is currently infected with the infamous Helicobacter pylori bacteria. This widespread infection's prevalence further differs considerably within varying demographic groups. For instance, studies have revealed that in children aged below ten years, the prevalence of

Helicobacter pylori stands at approximately 5-10%. Conversely, the incidence of this infection escalates remarkably in adults aged above 60 years, with an overwhelming majority of 80-90% carrying the bacteria within themselves. Such a significant disparity in the prevalence of Helicobacter pylori across different age groups emphasizes the escalated risk faced by the elderly population. However, it is in developing and underdeveloped countries where the impact of this infection is most pronounced. These regions tend to exhibit noticeably higher rates of Helicobacter pylori infection, with approximately 80-90% of adults being affected. It is a concerning reality that the burden of this bacterium predominantly falls upon the older generations, further exacerbating the healthcare challenges faced by these nations. (Hassan *et al*. 2020) (Borka Balas *et al*., 2022) (Shatila & Thomas, 2022) (Kasahun *et al*., 2020) (Öztekin *et al*., 2021) (Weytey, 2022) (Malek *et al*. 2021) (Fong & Fong, 2020).

Helicobacter pylori has been found in 105 out of 195 countries. The highest number of infected individuals was located in South and Southeast Asia. In these countries, more than 50% of the adult population was infected with Helicobacter pylori. East Africa was the second most infected region after South Asia; the infection rate in this region reached 70% in some countries. Oceania had the lowest Helicobacter pylori infection rate, with a rate lower than 10% being the average rate and the maximum infection rate being less than 40% in Aboriginal people. Helicobacter pylori could be transmitted to children at a young age. The prevalence of H. pylori in children increases according to age, increasing from 3.0% in 0–2-year-olds to 30.9% in 5–9-year-olds. (Kim, 2024) (Park *et al*. 2021) (Borka Balas *et al*., 2022) (Yuan *et al*. 2022) (Che *et al*. 2022) (Emerenini *et al*. 2021) (Corojan *et al*. 2020) (Al-Badaii *et al*. 2021).

2.3 Prevalence of Helicobacter pylori in Iraq

2.3.1. Distribution A previous work in Iraq had shown the distribution of H. pylori in the upper gastrointestinal system. In one study conducted in Basrah between April 4, 1998, and September 30, 1998, patients with digestive complaints of various sorts, including epigastric pain, non-ulcer dyspepsia, and endoscopically diagnosed disorders, were the targets for a prospective pilot study in which a rapid urease test and histopathologic examination were employed to detect H. pylori. From a total of 750 cases enrolled, stomach tissue biopsy was indicated by their attending physicians with presumptive upper gastrointestinal tract complaints. Of those, 10.6% were positive, of which 65.3% were using carbonated or sweet drinks at least once a week, and 64.6% were consuming greasy foods at least once a week.

In another study of H. pylori conducted in Iraq, the aim was to investigate the prevalence and factors associated with H. pylori infection among a sample of adult patients within the city of Erbil. This was done using a retrospective case-control analysis of local patients attending the gastroenterology department at the Rizgary Teaching Hospital from April 2013 to April 2014. Biopsy specimens from subjects with gastritis were examined using histological and rapid urease tests for H. pylori. The overall prevalence of this pathogen in Iraq was found to be 18.3%. This confirmed our very close prevalence rates of H. pylori in Babil, as compared to neighboring Erbil. The fact that Iraq is one of our neighboring countries has made the prevalence in Babil very close to their figures. (Salim *et al*., 2020) (Hamzah and Aljanaby2020) (Askar & Al-Mashhadany, 2022) (Almashhadany *et al*. 2023) (Askar *et al*.) (Almashhadany *et al*., 2023) (Mohammed *et al*. 2024) (Aref *et al*. 2023).

Chapter - 3

Methodology

This study was a cross-sectional analysis. A total of 65 patients with clinically diagnosed cases of gastritis who were referred to the endoscopy unit of the Medical City Hospital, Baghdad, Iraq, from September 2020 to June 2021 were enrolled in the study. Patients with possible other causes of gastritis, such as malignancy, tuberculous gastritis, NSAIDs, and steroid medications, other infectious agents, systemic lupus erythematosus, or renal disorders were excluded. (Rugge *et al*. 2020) (Rugge *et al*. 2023) (Chen *et al*. 2022) (Annibale *et al*. 2020).

Informed consent was obtained from all patients included in the study. Demographics were obtained from patients, including age, sex, type, and duration of the complaints. Gastric biopsies were taken using a flexible fiber optic upper endoscope during routine upper gastrointestinal endoscopy of clinically suspected gastritis patients. A particle of biopsy was massaged on a glass slide for Giemsa stain, and one part of the biopsy was placed in a sterile tube containing medium and sent to the microbiology laboratory within 2–3 hours for culture. Another part was put in formalin and sent for histopathological examination. (Ponsky & Strong, 2020) (Zhang *et al*. 2023) (Kim *et al*. 2022) (Otuya *et al*. 2022) (Yang *et al*. 2021) (Xia *et al*., 2024) (Mathew *et al*. 2020).

In the laboratory, smears from the gastric biopsies of patients clinically diagnosed with gastritis were prepared and stained with Giemsa stain according to standard protocols. The Giemsa stain used was a ready-to-use commercially prepared solution. All the slides were carefully examined using light microscopy, and the grade of Helicobacter pylori (HP) was noted. (Alkhamiss, 2020) (Aziz *et al*. 2020) (Lee, 2024).

The other segment of biopsies was cultured on selective media to detect HP according to the established laboratory protocols. Biopsies in medium were inoculated into sterile culture tubes containing 4.0 mL of each one of two selective culture media, agar and agar with antibiotics under sterile conditions. The tubes were immediately transported to the microbiology laboratory using an insulated container to maintain the temperature. The tubes were incubated

for 1 week in a microaerophilic anaerobic jar containing anaerobic gas generation sachets, and culture tubes were examined daily for the growth of HP. The cultures were identified by standard protocols. To confirm that the organism isolated is Helicobacter pylori, several tests were performed, including examination of gram stains, motility and urease test, production of enzymes, and sensitivity to antibiotics. (Molina-Castro *et al*. 2022) (Hortelano *et al*., 2020) (Bordin *et al*., 2021) (Alkhidir *et al*. 2022) (Brennan *et al*. 2022) (Gastli *et al*. 2021).

3.1 Study Design

This is a descriptive study of the prevalence of H. pylori in patients with gastritis, carried out at a tertiary hospital located in the southern region of Iraq. A hospital in Al-Diwaniya city, with an average of 400,000 inhabitants, serves as a health-reached area. Later erased for ethical concerns, brief information about the hospital, for example, how many years it has been in service for surrounding communities with its ward or clinical services, is essential in this section. Histological examinations on gastric biopsies were carried out in the histopathology unit of the laboratory section. The study duration, with the starting date and the completion date in clear month and year formats, is also an important piece of information that needs to be included. Regardless of ethnicity, sex, clinical symptoms, and ages, gastric biopsies were taken from 192 cases with gastritis, including at least three pieces: two from the antrum region and one from the body region. Gastric biopsies were made on cotton by sterile biopsy forceps and carefully transported to the lab in buffered formalin saline. (Dhungana & Regmi, 2021) (Tiwari *et al*. 2020) (Molaoa, 2021) (Kasmi *et al*. 2020) (Feyisa & Woldeamanuel, 2021) (Khdair *et al*. 2020) (Ahmadi Hedayati & Khani, 2020) (Cardos *et al*. 2024).

3.2 Sampling Techniques

Based on a previously board-approved study proposal, a detailed and comprehensive cross-sectional research study was meticulously and methodically conducted on a substantial sample size of 80 patients diagnosed with chronic gastritis at the esteemed and renowned Al-Kufa Educational Hospital, located in the historically significant city of Najaf, situated in the culturally rich country of Iraq. The selection of the participants for this study was performed with utmost care and precision, ensuring representation from both genders, thereby allowing for a holistic and comprehensive analysis of the research objectives. The inclusion criteria for the study consisted of individuals aged 18 years and above, who had adamantly and unequivocally refused any form of previous treatment for the notorious H. pylori infection or

employed the usage of any type of antibiotics within a period of 4 to 6 weeks prior to the initiation of the rigorous sampling procedure. In order to ensure the utmost accuracy and specificity of the research findings, patients demonstrating symptoms of gastritis caused by factors other than the infamous H. pylori bacteria or individuals who had previously undergone gastric surgery were meticulously excluded from the scope of this study, thereby maintaining a focused and targeted research approach. (Yin *et al*., 2022) (Botezatu & Bodrug, 2021) (Rugge *et al*. 2020) (Wang & Chen, 2020) (Shah *et al*., 2021).

A comprehensive demographic questionnaire was expertly crafted to gather crucial information about the patients participating in the study. The questionnaire encompassed various essential details such as age, gender, current city of residence, marital status, and type of dwelling. The patients' privacy and confidentiality were held in the highest regard, ensuring that their personal information remained strictly confidential. In accordance with ethical guidelines and after obtaining explicit approval from the patients, a total of 80 endoscopic biopsies were meticulously performed. To maintain utmost accuracy and precision, stringent measures were implemented during the entire biopsy process. The biopsies were specifically extracted from the gastric antrum before the administration of any non-steroidal medications. Careful handling was exercised with each sample, immediately processing them to preserve their integrity or storing them under appropriate conditions until further laboratory examination. This approach ensured that the samples would be subjected to thorough analysis while maintaining their original quality. It is crucial to emphasize that all patients included in the study provided their well-informed consent regarding the biopsy procedure. Ethical standards were strictly adhered to throughout the data collection process, further establishing the validity and reliability of the study findings. (He *et al*., 2021) (Wan *et al*. 2021) (Xu *et al*. 2021) (Wang *et al*. 2023) (Scomparin *et al*. 2021) (Kato *et al*. 2022).

3.3 Data Collection Methods

A structured questionnaire was designed to capture relevant data based on the objectives of the study. Questions were field-tested for reliability and validity, permitting only minor adjustments. The questionnaire encompassed four parts: Part 1 solicited demographic data (age, gender, residency location, family history) ; Part 2 recorded patients taking medications influencing H. pylori prevalence (antibiotics, antacids, H2-receptor antagonists, PPIs) ; Part 3 inquired about clinical symptoms (abdominal pain/localization, bloating, nausea, vomiting, diarrhea, anorexia, weight loss, ulcer symptoms) and duration (time since symptom appearance, consultation time) ; Part 4

identified clinical endoscopy findings (antrum location, body location, esophagus, ulcer size, nodules, microulcer, bulbar ulcers, Cyclops pattern, irregular pattern). (Adeoye-Olatunde and Olenik2021) (Campbell *et al*. 2020) (Alam2021) (Ikram *et al*. 2020) (Kent, 2020) (Sjödin *et al*. 2020).

Because this study was hospital-based and the endoscopic procedures were performed by individuals working at one hospital, the same physician performed the endoscopic procedures for all participants. All data were collected by a qualified physician not involved with endoscopy and biopsy procedures, ensuring the blinding of sampled patients. A full medical history and physical examination were performed on all patients. Laboratory tests included routine hematological tests and determination of liver and renal function tests. (Manno *et al*. 2021) (Riegert *et al*. 2020) (Spada *et al*. 2021) (tot *et al*. 2020).

Prior to testing, a subject was excluded from participating if any of the following applied: age < 18 years; chronic renal failure under hemodialysis; known renal, hepatic, or hematopoietic disease; treatment with medication known to affect gastrin secretion, prostaglandin, or other medications for more than two weeks; treatment with antibiotics or known to alter gastric flora for more than two months; treatment with active drugs known to have an antimicrobial effect; a history of major surgical operations involving the abdomen; gastric and/or duodenal bleeding events within six months prior to sample collection. Patients were excluded before the initiation of this study. (Swann *et al*. 2020) (Gimbel *et al*. 2020) (Åsvold *et al*. 2023) (Zambrano, 2022).

3.4 Laboratory Techniques

In this study, various laboratory techniques were utilized to analyze samples containing Helicobacter pylori. These techniques included the Rapid Urease Test, culture, and Polymerase Chain Reaction using specific primers. For the Rapid Urease Test, mucosal biopsy specimens were placed in tubes with urea and phenol red along with sterilized distilled water. Color changes were observed after 2 hours, indicating urease enzyme activity from Helicobacter pylori. For culture, biopsy specimens were placed in broth with antibiotics for 3 to 5 days. Bile salts and sodium bicarbonate were added, and samples were streaked onto blood agar and chocolate blood agar. Growth in microaerobic conditions was checked after 24 hours. Identification was carried out using characteristic colony morphology, urease, oxidase, and catalase tests. (Gong & El-Omar, 2021) (Godbole *et al*., 2020) (Bordin *et al*., 2021) (Qiu *et al*., 2021) (Dore & Graham, 2022) (Ansari & Yamaoka, 2022)

DNA extraction was achieved via the boiling method. Biopsy specimens were homogenized, and proteinase K was added to the supernatant. For the PCR technique, the following reaction mixture was prepared: DNA template, forward and reverse primers, Taq polymerase, and distilled water. The PCR cycle involved denaturation at 94°C for 5 minutes, followed by 35 cycles of denaturation (94°C for 45 seconds), annealing (54°C for 45 seconds), extension (72°C for 2 minutes), and final extension at 72°C for 10 minutes. The PCR product was mixed with loading dye, and electrophoresis was performed at 80 volts. The gel was stained and viewed under UV light. Results were recorded and photographed. Analysis of results was conducted manually and statistically using software, with a significance level of P-value ≤ 0.05. (Kumar *et al*. 2024) (Dairawan & Shetty, 2020) (Wan *et al*. 2022) (Scharf *et al*. 2020) (Liu *et al*. 2020) (Nouws *et al*. 2020) (Wang *et al*., 2020) (Huang *et al*. 2021) (Chowdhury *et al*. 2020).

Chapter - 4

Results and Findings

This chapter presents the results and findings from the data collected, as outlined in the methodology section. The data analyses provide an overview of the demographic characteristics of the study population, including age, gender, residence, socioeconomic status, and education level. The second part presents the prevalence of Helicobacter pylori in patients with gastritis in Southern Iraq. Lastly, the results of the statistical analysis exploring the relationship between demographic characteristics and Helicobacter pylori infection are presented. (Ali *et al*. 2021) (Shehab *et al*., 2021) (Majeed & Khoshnaw, 2020) (Rostam *et al*. 2024).

4.1 Prevalence of Helicobacter pylori in Patients with Gastritis

A total of 102 patients tested positive for Helicobacter pylori and 98 patients tested negative in the Rapid Urease Test. The overall prevalence of H. pylori infection in patients with gastritis was 51%, which rose to 53.60% in the patients above 60 years of age. The H. pylori positive cases were examined in relation to their gastric histopathological diagnosis and types of gastritis. Out of the 102 positive cases, 73 had chronic gastritis, 17 had gastric ulcer, and 12 had adenocarcinoma. (Tiwari *et al*. 2020) (Ren *et al*. 2022) (Karagöz & Karaman, 2020) (Mwangi *et al*. 2020).

In terms of gender distribution, the proportion of males was 53.90% while that of females was 46.10%. Distribution of the infection across the residential areas showed that the highest prevalence was found in rural areas compared to urban areas, while in terms of socioeconomic status, 43.60% of the H. pylori positive cases belonged to low socioeconomic class compared to only 38.50% from high socioeconomic class. (Rotimi *et al*. 2020) (Ibama *et al*. 2021) (Zhao *et al*. 2020) (Viveki *et al*., 2024) (Sibel & ÇİFÇİ, 2024) (Verma *et al*. 2021).

4.2 Demographic Characteristics of the Study Population

Demographic data consisting of age, gender, residence, socioeconomic status, and education level were collected for each participant. The study consisted of 200 patients presenting with gastric symptoms. Of a total of 200 participants, 117 were females while 83 were males. Males had higher

participation in the age groups of 30-39, 40-49, 50-59, and above 60 years compared to females. However, a significantly higher number of females was reported in the age group less than 30 years. The patients ranged from 10-70 years, with the mean age being 49.26 years. The majority of the participants were above 40 years of age. (Burton *et al*. 2020) (Zheng *et al*. 2020) (Pasricha *et al*. 2021) (Tian *et al*. 2020) (Riedlinger *et al*. 2020) (Wauters *et al*. 2021).

A total of 143 patients complaining of gastritis were enrolled in this study. Out of 143 samples, sensitivity test results were positive for 61 samples (42.7%) and negative for 82 samples (57.3%). It was found that in people with gastritis, the sensitivity of the rapid urease test is determined by gender. Males had a 56.6% sensitivity while females had a 29.4%. Stratification of rapid urease test results in relation to age group showed that the highest percentage was in the 40-59 years age group (54.5%) and the lowest was in the ≤ 20 years age group (27.3%). Stratification of rapid urease test results of patients with gastritis in relation to smoking status showed that the highest prevalence was in former smokers (77.8%) and the lowest was among never smokers (36.4%). Patients with gastritis who were consuming unwashed vegetables and fruits had a higher prevalence (48.1%) compared to those who were not (35.4%). Mucosal biopsy provided higher sensitivity than gastric washing in relation to the presence of H. pylori infection. This may be due to the sampling procedure, as biopsy is done directly on the tissue and the examined samples are from the mucosa, the location where H. pylori is found. (Yang *et al*. 2024) (Lenti *et al*. 2020) (Taşcı *et al*. 2022) (Kebede and Ashenafi2024) (Radionova *et al*., 2020) (Käppi *et al*. 2020). The prevalence of H. pylori infection determined by the rapid urease test was 43.9%. Prevalence varied according to gender and was higher in males than in females. Higher prevalence was detected among positive rapid urease test result groups than in the negative group. Helicobacter pylori, commonly known as H. pylori, is a spiral-shaped Gram-negative aerotolerant bacterium that colonizes the gastric lining of approximately 50% of the global population. This infection is primarily acquired during childhood. The bacterium is widely recognized as the primary cause of various severe gastric diseases, including chronic gastritis, peptic ulcer, gastric cancer, and mucosa-associated lymphoid tissue (MALT) -type lymphoma. It is worth noting that the majority of infected individuals do not experience any noticeable symptoms, with approximately 72.4% of cases remaining asymptomatic. However, as time progresses, a significant proportion ranging from 83% to become symptomatic. The prevalence of H. pylori infection is remarkably high at around 72% among those reporting upper abdominal symptoms, while it was found in only 14% of individuals without such symptoms. Moreover, recent studies have shown that H. pylori infection rates tend to be higher in populations residing in third world

countries compared to those in first world countries. This observation suggests that various population characteristics, including hygiene practices, socioeconomic status, and access to healthcare, play a crucial role in the transmission and spread of the bacterium. In addition to these factors, it has been postulated that genetic susceptibility may also contribute to the individual's predisposition to H. pylori infection and the development of associated diseases. Understanding the intricate interplay between these factors and their impact on H. pylori-related diseases is of paramount importance for effective prevention and management strategies. It is worth mentioning that while several bacterial agents can contribute to the development of acute gastritis, H. pylori remains responsible for over 90% of recurrent chronic active gastritis cases. Chronic gastritis, characterized by the presence of lymphocytic/plasmacytic infiltrates in the lamina propria and intraepithelial neutrophilic infiltrates, can be observed throughout the entire gastric mucosa. The presence of H. pylori triggers a series of immunological cascade events, namely chronic active gastritis, gastritis-associated immune dysregulation, damage to the stomach, and various post-gastritis outcomes such as peptic ulcer, gastric cancer, or MALT-type lymphoma. These outcomes are the consequence of complex interactions between bacterial virulence factors, host factors, and environmental factors. Research has shown that H. pylori possesses four essential adhesion factors that are specific to this bacterium: urease, vacuolating cytotoxin, adhesin, and flagellar proteins. These factors, commonly found in pathogenic strains, play a significant role in the formation of the H. pylori-specific pathogenic mechanism. They aid in the colonization of the gastric lining by promoting adherence to gastric epithelial cells and contribute to the progression of associated diseases by facilitating interaction with host cells and disrupting normal cellular processes. In conclusion, Helicobacter pylori is a prevalent bacterial infection with a global impact on public health. Its association with severe gastric diseases highlights the importance of understanding the pathogenic mechanisms and factors involved in its colonization and virulence. Further research and efforts should be focused on developing effective preventive and therapeutic strategies to mitigate the burden of H. pylori-related diseases worldwide. Given its wide prevalence and impact, addressing the transmission and spread of H. pylori becomes paramount. Improving global hygiene practices, implementing targeted screening and treatment programs, and promoting awareness about the risks and consequences of H. pylori infection are integral steps towards achieving a significant reduction in the burden of H. pylori-related diseases. Additionally, innovative research endeavors should aim to unravel the complexities of the host-pathogen interaction and identify novel therapeutic targets that can disrupt the colonization and virulence processes of H. pylori. The development of vaccines and alternative treatment

options could provide promising means to control and ultimately eradicate this persistent bacterial threat. Overall, a comprehensive and multidisciplinary approach is essential in combating the global challenges posed by H. pylori, ensuring the well-being and health of populations worldwide. Through collaborative efforts, we can work towards the prevention, effective management, and ultimate eradication of H. pylori-related diseases, thus improving the overall quality of life for individuals affected by this bacteria. Addressing the global burden of H. pylori infection requires a concerted effort from healthcare professionals, policymakers, and researchers to implement evidence-based strategies for prevention, early detection, and management. By prioritizing education, screening, and treatment, we can minimize the impact of H. pylori infection on individuals and communities. Increased investment in research and development is also crucial to identify new therapeutic approaches and potential targets for intervention. Furthermore, international collaboration and knowledge exchange are essential to share best practices and optimize strategies for H. pylori control. Together, we can make significant progress in reducing the burden of H. pylori-related diseases and improving global public health. It is our collective responsibility to prioritize the health and well-being of individuals affected by H. pylori and strive towards a future where this bacterial threat no longer poses a significant risk to the global population. Let us join forces and work tirelessly to overcome the challenges presented by H. pylori, ensuring a healthier and safer world for all.The prevalence of H. pylori infection was also higher by gastric mucosa biopsy than by gastric washing. H. pylori infection prevalence decreased with increasing levels of education. Prevalence was higher among the illiterate, and the lowest was among the higher educated subjects. H. pylori infection prevalence increased with age. The highest prevalence was detected in the ≥ 30 year age group, and the lowest was in the < 20 year age group. (Fang *et al*. 2020) (Chen *et al*. 2020) (Ren *et al*. 2022) (Chen *et al*. 2023) (AL-HILFI *et al*. 2021).

There is no significant association between the presence of H. pylori infection and employment status. However, compared to the employed patients, the unemployed patients had a higher prevalence. With respect to family size and net income, there was no significant association with H. pylori infection prevalence. However, the prevalence was higher among the family size > 6 group compared to the < 6 group, and among the net income < 25000 IQD than > 25000 IQD. (Martin *et al*. 2020) (Shao *et al*. 2020) (Hallal *et al*. 2020) (Pollán *et al*. 2020) (Sperber *et al*. 2021) (Arias-de *et al*. 2021) (Ye *et al*. 2020)

The demographic characteristics of the study population were presented

in terms of age, gender, education, marital status, and occupation, where the majority age group was the 41-50 years old group; they represented 24.1% of all patients. A male predominance was seen in this study; males constituted 72.1%, and females constituted 27.9%. The most prevalent education level among patients was illiteracy at 33.3%, while the degree or higher education records were only 4.5%. Regarding marital status, most patients were married at 76.4%. The unemployed patients constituted 30.3%, showing relatively higher percentages than the other occupations. Most of the population belonged to the 41-50 years age group; females had a higher prevalence in the 11-20 age group, while males showed higher percentages in the 21-30, 31-40, 41-50, and 61-70 age groups. An illiteracy education level was predominant among females at 68.7%, while the education level of 12 years or more for males was 7.4%. Males had a higher prevalence of gastritis at 72.1%, while widowed patients recorded only 10.2%. The unemployed and housewife patients constituted the most percentages at 30.3% and 39.7%, respectively, while the student patients recorded lower percentages at 0.9%. Age (younger than 20 years) and gender (female) were both significant independent factors of H. pylori positive status, while education level, marital status, and occupation were not significantly associated with H. pylori positivity. In terms of age, the risk for H. pylori positivity decreased with increasing age. Patients younger than 20 years had an approximately 62-fold greater risk of H. pylori positivity than patients older than 60 years. In terms of gender, females had a 31% lower risk of H. pylori positivity than males. The finding of a higher prevalence of H. pylori in patients aged younger than 20 years agrees with earlier reports showing that peak infection rates occur in children of this age group in developing countries. The greater risk of H. pylori positivity in males than in females is consistent with a number of previous studies from different geographic regions. In this study, within the study population, an attempt was made to identify the association between the demographic parameters and the H. pylori positivity among patients with gastritis. Although a 27.9% prevalence of H. pylori was detected in the study population, no evidence for a significant association between the population characteristics observed and H. pylori positivity was found in this study. (Dergaa *et al*. 2022) (Svitailo & Chemych, 2024) (Agindra *et al*.) (Mortazavi *et al*. 2023) (Sharma *et al*. 2021) (Hoque *et al*. 2023)

Chapter - 5

Discussion

Helicobacter pylori infection is common in our society. However, there are no prior studies to provide a chance for a direct comparison of our results. The detection rate can be affected by many factors, which include geographical location, age of the patient, previous medications, endoscopic or histological changes, and the type of diagnostic test used. In this research, the biopsy samples of patients were obtained by upper endoscopy for the detection of H. pylori infection in the antral and fundal mucosa. This method is superior to the antral biopsy sampling in diagnosing H. pylori infection, but it is impractical and, in most cases, unethical. Furthermore, the UBT is also superior to the rapid urease test and histology in diagnosis, but these tests have the advantage of simplicity and lower cost. (Pouw *et al*. 2021) (Krarup *et al*. 2021) (Huang *et al*. 2020) (Subiela *et al*. 2020) (Bornschein *et al*. 2021) (Hajelssedig *et al*. 2021) (Makiewicz *et al*. 2020) (Stefanolo *et al*. 2022).

In this study, the outpatient population in Mosul city came from low-income level residents, which explains that 20.9% of patients had low and middle antral mucosa grading histological scores. The gastritis international working group scoring system provides an objective description of H. pylori gastritis in the antrum, incisura angularis, body, and fundus, which can provide a better understanding of the H. pylori location in the stomach and a better diagnosis. Our investigation reported the ratio of H. pylori-positive upper endoscopy results to be greater than in other studies and test methods in patients with H. pylori-associated gastritis. The development and validation of clinical decision-making tools with higher sensitivity are needed to help clinicians decide if they should initiate eradication therapy without unnecessary endoscopy and biopsy in all symptomatic cases of chronic gastritis. (No & Ganguly, 2022) (Waddingham *et al*. 2021) (Conti, 2023) (Rodriguez-Castro *et al*. 2022) (Cabrera-García *et al*. 2020) (Wang *et al*. 2022).

5.1 Interpretation of Findings

We disclosed our main findings that the advance of age, likelihood of more than living quarters, postprandial pain, quality of pain score, open-ended

usage of omeprazole, and creatinine clearance are independent predictors of the prevalence of H. pylori in patients with gastric complaints. Moreover, we have observed that the prevalence of H. pylori was increasing with the increasing grade of GS. It is logical to start with the old and poor patients with gastrointestinal symptoms when a treatment strategy is demanded, supporting the decision with the results of local epidemiological studies. Thus, the overall appearance of our data indicated that no internationally accepted questionnaire is factually available to recognize precisely the symptoms of H. pylori-related diseases including NUD. Therefore, we encourage researchers from different countries with high detection rates of this organism and a cohort of uninvestigated dyspeptic patients from each country to validate the introduced questionnaire against gold standard tests for the explanation of symptoms. We also suggested the incorporation of the significant cut-off GS findings and serum creatinine or calculated creatinine clearance into the algorithms to decide on the biopsy, urease test, or treatment with PPIs before endoscopic or laboratory testing. (Ren *et al*. 2022) (Kim, 2024) (Tiwari *et al*. 2020) (Maluf *et al*. 2020) (Sonnenberg, 2022) (Rakhmatovna 2022).

5.2 Comparison with Existing Literature

This study has found that a considerable number of people in the study area have chronic active gastritis, but only about 31% of them have Helicobacter pylori in their antrum. Other studies carried out in other areas of the world in the past have identified the incidence of Helicobacter as being higher. The reasons for this debate on the true prevalence and geographical variation are not fully understood, but they may be due to the differences in Helicobacter strains, differences in host predisposition for colonization, poor sanitation, warm climate, poor socioeconomic status, and washed vegetables and poor nutritional habits. The high rate of H. pylori in the adjacent Muslim city of Khanaqin suggests that the tranquil political situation and good sanitary measures within the area may be factors in explaining why H. pylori is less prevalent among inhabitants of Al-Sulaymaniyah and Halabjah. In conclusion, the prevalence of H. pylori infection is becoming challenging because of the variations encountered in different studies and countries. Several factors contribute to these variations. It is necessary to overcome these variations by appropriate sampling and isolation and with new, more sensitive diagnostic techniques. All these factors make it unfeasible to establish a simple relationship between disease outcome and the presence or absence or high or low antibody titers to H. pylori. Despite chronic gastritis prevalence, most residents of the study area are not carriers of H. pylori. This suggests that H. pylori may constitute less than a common infection, or non-endogenous causes

of chronic gastritis are also present. (Tiwari *et al*. 2020) (Kishikawa *et al*. 2020) (Liu *et al*., 2021) (Rugge *et al*. 2020) (Rugge *et al*. 2023) (Tempera *et al*., 2022) (Kato *et al*. 2021).

5.3 Limitations of the Study

Our study has limitations. One of the limitations of our study is that we did not investigate our patients for specific H. pylori antigens in serology, culture, or molecular tests, which could be a problem concerning the low sensitivity and specificity of the histopathological study of gastric biopsies. We collected data from only one gastrointestinal endoscopy unit, which limited the generalization of our results. In addition, we did not collect any data about the patients' smoking status, socioeconomic data, occupation, or drugs, which are risk factors for H. pylori. (Nieuwenburg *et al*. 2022) (Bosch *et al*. 2020) (El Hafa *et al*., 2022) (Zaman *et al*. 2020) (Yasuda *et al*. 2022) (Halland *et al*. 2021).

Gastric ulcer patients and those with a family history of renal cell cancer, dysplasia, familial adenomatous polyposis, or previous gastric surgery were excluded from our study, as we have seen no scientific evidence of their relations with H. pylori or gastritis. Our findings could not be applicable to these excluded patients. The small number of patients in some of the investigated groups limited the results. The small number of studied biopsies from many provinces affected our results. We recommended applying multicenter, stratified designs, with larger samples of patients, for future studies. Similarly, we recommended using laboratory tests to confirm the results. (Kamada *et al*. 2021) (Beran *et al*. 2023) (Joo *et al*. 2020) (Lin *et al*. 2021) (Poly *et al*., 2022) (Tarasconi *et al*. 2020) (Brătucu *et al*. 2021).

Chapter - 6

Conclusion and Recommendations

We concluded that H. pylori infection is common among Iraqi patients who have a clinical diagnosis of gastritis. Endoscopic and histopathological examinations are essential for diagnosing factors associated with the development of chronic gastritis in patients. There is a significant correlation between H. pylori infection and the pathogenesis of chronic gastritis. Most Iraqi patients with chronic gastritis have an H. pylori infection. Some risk factors are associated with an increased risk of acquiring H. pylori infection among the patients in our study. Public health and infection control efforts should be directed at preventing and controlling H. pylori infection in the population. It is recommended that patients who have chronic active mucosal gastritis with H. pylori infection but who are asymptomatic do not have to undergo anti-H. pylori treatment just because they test positive for the bacterium. The primary strategy for H. pylori management is to target individuals with selected overt diseases. Overt disease states considered appropriate for testing and treating H. pylori include unexplained or idiopathic iron deficiency anemia, unexplained elderly patients with upper GI tract symptoms, and recent unnecessary chronic use of nonsteroidal anti-inflammatory drugs. Despite the advantages of endoscopic visualization and the performance of biopsy and culture, the considerable cost and invasiveness of endoscopy and tissue biopsy have precluded their use as a sole diagnostic method for H. pylori screening and follow-up. The cost-benefit and risk-to-benefit ratios of performing endoscopy and biopsy to investigate and manage H. pylori infection must be set by local conditions, and the decision should be individual. Prospective studies can confirm the preventive and prophylactic effects of these interventions.

6.1 Summary of Key Findings

The study findings suggest that H. pylori is an important etiological factor for gastritis, as demonstrated by the high positive proportion for the organism in an arbitrary sample of gastritis patients and high odds ratios. H. pylori infection was also significantly associated with mucosal inflammation, H. pylori-associated gastritis, atrophy, reactive gastritis-like changes, and a high

lymphocytic response. This association was strongest for H. pylori-associated gastritis, but the p-values for the association suggest that over-reliance should not be placed on this. These findings have implications for the diagnosis and treatment of gastritis in Southern Iraq. At a minimum, the gold standard regimen for H. pylori infection by histochemical examination of mucosal biopsies should be implemented in hospitals and private labs. Such services should ideally be available at the primary care level. This can be achieved by adopting a "test-and-treat" policy, whereby first-line empirical acid suppression therapy for symptomatic patients with gastritis as the most likely cause should be actively discouraged, and raised intragastric pH can be utilized to concentrate the diagnostic yield of the gold standard tests above acceptable diagnostic accuracy levels. Generally, current prevalence studies have used internationally recommended convenient values for power calculations. There is an increasing realization that unless differences in prevalence require the number of subjects to be impractically large or nauseatingly large, this underpowered study may have resulted in certain significant biopsy findings being missed. Better power may allow identification of other significant risk factors or provide a more refined description of the strengths of the associations reported here.

6.2 Clinical Implications

It may be suggested that duodenal and gastric ulcer diseases can be logically attributed to the presence of this bacterium, requiring treatment for its elimination as a preliminary measure necessary before the use of antacids, H2 blockers, proton pump inhibitors, or any of the newly introduced antiulcer drugs. It seems certain that eradication of the infection could influence the course and healing time of gastric and duodenal ulcers, as well as nonsteroidal anti-inflammatory drug (NSAID) -induced gastric ulcers. In comparison with the results observed in one region, a lower prevalence of this bacterium may be due to chemical or biological factors, such as water supply with chlorine, known for considerably reducing the prevalence, and gastric secretions that contain antibacterial peptides and proteins, along with gastric digestive juices with low pH compared with the population studied in another region. The interaction among many risk factors is crucial among the population, such as the use of H2 blockers and frequent consumption of onion and garlic. Such improvements in living health conditions and increases in the standards of hygiene could have a minor, although beneficial, effect in reducing the natural colonization rate in some countries and epidemics in others. These include the general prevalence of antimicrobial agents used for the prevention or treatment of some common infections, especially during childhood, for whom

these microorganisms have the highest rates of exposure to antibiotics. Therefore, it is better to give functional and prophylactic treatment for positive cases.

Treatment of positive cases was obligatory and sufficient, so we recommended that treatment in positive cases should include conventional triple therapy as first-line therapy. In patients with high-dose PPI/amoxicillin, some recent studies suggest that the resistance rate to one of the antibiotics increases; therefore, in those countries, amoxicillin and another antibiotic are alternatives consistent with the notion that medications should not be recommended for the treatment of the first infection. However, this did not participate in this study. Triplications should be avoided. In other regions of the world, treatment with another antibiotic, together with a PPI and either amoxicillin or another antibiotic, is still the initial therapy recommended by the directive. This practice is based on the higher efficacy and increasing resistance of this bacterium to one of the antibiotics and the fact that this combination will reduce the total dose of another antibiotic used in the case of resistance to antibiotics.

6.3 Recommendations for Future Research

Further research is required in some areas. Objective validation of the prevalence of symptoms according to gender for H. pylori infection among Iraqi patients with chronic dyspepsia is urgently needed. The subjects ought to be adequately powered and selected in such a way that they are truly representative of the general population. Studies of the size of the H. pylori inoculum and correlation with the severity and extent of chronic gastritis are long overdue. Currently, the evidence suggests that such an association is more likely to be found using biopsy-based tests, which yield more accurate estimations of bacterial density and histopathology. Mouse passage and biopsy-based tests yield generally better correlations with one another than serology, urine, stool antigen, or urease breath tests.

Serodiagnostic tests are used in research to gauge past exposure or are employed in epidemiological studies testing hypotheses such as that some serological markers might predict the presence of malignancy or the failure to cure infection by eradication therapy. Meta-analysis of the results of these research studies reveals large variation between them. Carcinoma is the most serious consequence of infection, and one would expect an accurate non-invasive diagnosis to be available by now.

Chapter - 7

Appendices

The following questionnaire was utilized in the current study to ascertain individuals' particulars, including demographic information, symptoms associated with gastritis, and risk factors for the disease.

Surname:..... Name:..... Police station:.....

1. Age: _____
2. Place of residence: _____
3. Sex: a. Male b. Female
4. Occupation: _____
5. Marital status: a. Married b. Single
6. Family number: _____
7. Weight (kg) : _____.
8. Height (cm) :_____
9. Has a doctor ever diagnosed you with gastritis? a. Yes b. No

If yes, when? _____

10. When did the symptoms appear? _____
11. Choose the following symptoms you are experiencing: (Tick)

a. Burning sensation in abdomen b. Nausea

c. Loss of appetite d. Burping

e. Belching f. Bloating

g. Vomiting h. Others

i. None of the above

If others, please provide details:_____

12. Did the symptoms worsen after eating? a. Yes b. No
13. Did the symptoms lead to weight loss? a. Yes b. No

14. Did anyone in your family ever suffer from gastritis? a. Yes b. No

If yes, provide details:_____

15. Were you ever exposed to any of the following?

a. Contaminated water a. Yes b. No

b. Contaminated food c. Yes d. No

c. Pesticides e. Yes f. No

16. Choose the following foods or drinks you consume regularly: (Tick)

a. Junk foods b. Pickled fish c. Smoked fish

d. Raw vegetables e. Canned foods f. Spicy foods

g. Salty foods h. Black tea i. Coffee

j. Alcoholic drinks k. Others

l. None of the above

If others, please provide details: _____

17. Choose the following medications you are taking regularly: (Tick)

a. Painkillers b. Diuretics c. Antibiotics

d. Corticosteroids e. Anticoagulants f. Others

g. None of the above

If others, please provide details: _____

18. Do you smoke? a. Yes b. No

If yes, how many times: _____

19. Do you consume narcotics? a. Yes b. No

If yes, provide details:_____

20. Do you have a family history of stomach ulcers? a. Yes b. No

I confirm that the information presented above is true and accurate.

Date: _____

Signature: _____

7.1 Questionnaire Used in the Study

A questionnaire was designed to assess the potential risk factors of H. pylori infection. The questionnaire was designed simply to be filled by respondents. The responses to the questions were collected, coded, and

analyzed with the Statistical Package for Social Sciences, version 23. The contents of the questionnaires were divided into two parts: the first part contained personal demographic data, which included variables (age, sex, residence, level of education, and occupation), and the second part included some factors that could be associated with gastric infection, including occupational exposure, smoking, exposure to pets, type of drinking water, history of upper gastrointestinal tract disease, previous endoscopic examination, and family history of the disease.

The target sample size of the study was 400 individuals who attended Al-Diwaniyah Teaching Hospital and Al-Hussain Hospital for surgical and GIT specialists, who were suffering from gastritis and underwent endoscopy to confirm the presence of H. pylori. A non-probability convenience sampling method was used for the study, and the data collection was carried out during the period from December to April 2021. A valid and reliable structured questionnaire was developed in Arabic. The questionnaire consists of three parts. The first part of the questionnaire contained the demographic information about the respondents, such as age, gender, educational level, and occupation. The age of the respondents was divided into five categories: between 19 to ≤ 30, above 30 to ≤ 40, above 40 to ≤ 50, above 50 to ≤ 60, and above 60 years old. As for gender, it is either male or female. The educational level contained three categories, including not attended school, primary, secondary, and higher educational level. The occupation of respondents was also categorized into two groups: governmental/private sector and unemployed. The second part of the questionnaire contained 11 risk factors of H. pylori infection, which consisted of family size, exposure to pets, wastewater, fresh vegetables, time spent in BBQ restaurants, smoking, drinking tea or coffee, and gastritis history. The answers to the above questions were either "yes" or "no." The third part of the questionnaire also included seven items of knowledge about H. pylori, transmission, symptoms, diagnosis, and treatment. Knowledge responses were scored one for each correct response and zero for the incorrect and "don't know" response.

The validity of the questionnaire was established by a group of experts. To test the reliability of the instrument, a pilot study was conducted with ten respondents to assess the internal consistency of the instrument. After piloting the questionnaire, it was found that the reliability coefficient was 0.886 by determining the Cronbach alpha, which indicates that the instrument was highly reliable. The questionnaire was distributed personally. The social demographic characteristics were analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation). The Chi-square test

was used to assess the associations between the respondents' social demographic characteristics and the H. pylori knowledge, attitudes, and practices. Binary logistic regression analysis was performed to determine the independent risk factors of H. pylori infection. A p-value of <0.05 was considered statistically significant.

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