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A statistical Study on the Effect of Stomach Bacteria and Diet on Human Health among Visitors to Alwatan Medical Laboratory

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دراسة إحصائية حول تأثير بكتيريا المعدة والنظام الغذائي على صحة الإنسان لدى زوار مختبر الوطن الطبي

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Abstract:
Helicobacter pylori (H. pylori) are a major cause of many gastrointestinal diseases, which can start with mild symptoms and develop into serious complications, including peptic ulcers and gastric cancer. Despite the widespread prevalence of this bacterium, especially in developing countries, public awareness of its true nature and health effects remains limited. This study aims to shed light on the prevalence of H. pylori and its impact on human health, focusing on diagnostic, treatment, and prevention methods, in addition to reviewing the latest research on antibiotic resistance. A statistical analytical study was conducted at Alwatan Medical Laboratory in Hun City, Libya, from March to June 2025. Data was collected from the laboratory records of 69 cases, 49.2% of whom were males and 50.8% females. The results showed that the prevalence of H. pylori among visitors was 92.8%, indicating a widespread presence of this bacterium in the region. The study also revealed that the age group most susceptible to infection was individuals over 50 years old (39.1%), followed by the 20-29 age group (24.6%). It was observed that the infection rate among females (50.8%) was slightly higher than among males (49.2%). These findings emphasize the importance of health awareness, early diagnosis, and effective treatment to limit the spread of this bacterium and its serious complications. The study also recommends improving health infrastructure, treating contaminated water sources, and promoting personal and public hygiene practices to prevent infection. The study highlights the challenges facing H. pylori treatment due to increasing antibiotic resistance and emphasizes the importance of continuous research to develop new therapeutic and preventive strategies, including effective vaccines, to ensure a healthy future free from the complications of this silent bacterium.

Keywords: Helicobacter pylori, Gastric cancer, Antibiotic resistance, Treatment, Prevention, Human health.

الملخص
تُعد بكتيريا المعدة (*H. pylori*) سببًا رئيسيًا للعديد من أمراض الجهاز الهضمي، والتي يمكن أن تبدأ بأعراض خفيفة وتتطور إلى مضاعفات خطيرة، بما في ذلك قرحة المعدة وسرطان المعدة. وعلى الرغم من انتشار هذه البكتيريا على نطاق واسع، وخاصة في البلدان النامية، إلا أن الوعي العام بطبيعتها الحقيقية وآثارها الصحية لا يزال محدودًا. تهدف هذه الدراسة إلى تسليط الضوء على انتشار بكتيريا الملوية البوابية وتأثيرها على صحة الإنسان، مع التركيز على طرق التشخيص والعلاج والوقاية، بالإضافة إلى مراجعة أحدث الأبحاث حول مقاومة المضادات الحيوية. أجريت دراسة تحليلية إحصائية في مختبر الوطن الطبي بمدينة هون، ليبيا، من مارس إلى يونيو 2025. تم جمع البيانات من السجلات المخبرية لـ 69

حالة، 49.2٪ منهم من الذكور و50.8٪ من الإناث. أظهرت النتائج أن معدل انتشار بكتيريا الملوية البوابية بين الزوار بلغ 92.8٪، مما يشير إلى انتشار واسع النطاق لهذه البكتيريا في المنطقة. وكشفت الدراسة أيضًا أن الفئة العمرية الأكثر عرضة للإصابة هي الأفراد الذين تزيد أعمارهم عن 50 عامًا (39.1٪)، تليها الفئة العمرية 20-29 عامًا (24.6٪). ولوحظ أن معدل الإصابة بين الإناث (50.8٪) كان أعلى قليلاً من الذكور (49.2٪). تؤكد هذه النتائج على أهمية التوعية الصحية والتشخيص المبكر والعلاج الفعال للحد من انتشار هذه البكتيريا ومضاعفاتها الخطيرة. كما توصي الدراسة بتحسين البنية التحتية الصحية ومعالجة مصادر المياه الملوثة وتعزيز ممارسات النظافة الشخصية والعامة للوقاية من العدوى. وتسلط الدراسة الضوء على التحديات التي تواجه علاج الملوية البوابية بسبب تزايد مقاومة المضادات الحيوية، وتؤكد على أهمية البحث المستمر لتطوير استراتيجيات علاجية ووقائية جديدة، بما في ذلك اللقاحات الفعالة، لضمان مستقبل صحي خالٍ من مضاعفات هذه البكتيريا الصامتة.

الكلمات المفتاحية: جرثومة الملوية البوابية، سرطان المعدة، مقاومة المضادات الحيوية، العلاج، الوقاية، صحة الإنسان.

Introduction

Helicobacter pylori (H. pylori) are a microorganism that infects the gastric mucosa and is considered one of the main causes of many common digestive diseases, such as chronic gastritis and peptic ulcers [1, 2]. This bacterium was first discovered in the early 1980s by Australian scientists Barry Marshall and Robin Warren in 1982. Their discovery revolutionized the understanding of gastrointestinal diseases, as the prevailing belief at the time was that stress and spicy food were the main causes of ulcers [3]. Marshall and Warren were awarded the Nobel Prize in Medicine in 2005 in recognition of their pioneering achievements in this field [3, 4].

H. pylorus is often transmitted through contaminated food or water or through direct contact with an infected person [1]. Once established in the stomach, the bacterium secretes substances that help it adapt to the harsh acidic environment of the stomach, leading to irritation of the stomach lining and the development of ulcers, and in some cases, it can lead to stomach cancer [5]. Despite advances in diagnostic and treatment methods, the prevalence of this bacterium remains high in some communities, especially in developing countries that suffer from poor public hygiene standards [6, 7]. Global statistics indicate that about half of the world's population is infected with H. pylori, whether they show symptoms or not [6].

This study is of great importance due to the widespread prevalence of H. pylori and its significant impact on human health. Those infected with this bacterium represent more than 80% of the world's population, making awareness of the importance of early diagnosis and effective treatment essential to prevent its spread and reduce the risks of infection [8, 9]. This study aims to assess the prevalence of H. pylori among visitors to Alwatan Medical Laboratory in Hun City, Libya, and to identify factors associated with the high infection rate, by analyzing available statistical data. The study will also address theoretical and practical aspects related to the bacterium, including its classification, history of discovery, associated symptoms, prevention and treatment methods, and antibiotic resistance, in addition to reviewing relevant previous studies [10, 11].

Literature Review and Previous Studies

Helicobacter pylori (H. pylori) are a Gram-negative, spiral-shaped microorganism classified under the genus Helicobacter. This bacterium is characterized by its ability to live in the acidic environment of the stomach, thanks to the urease enzyme that produces ammonia, which neutralizes the acidity around it and enables it to survive and grow [4]. H. pylori is considered the main cause of chronic gastritis, peptic ulcers (gastric ulcer and duodenal ulcer), and it is also classified as a class I carcinogen, as it significantly increases the risk of gastric cancer and mucosa-associated lymphoid tissue (MALT) lymphoma [3, 5].

➢ Classification and Characteristics of H. pylori

H. pylorus is classified as a spiral bacterium and was previously named "Campylobacter pyloridis" before being reclassified into the genus Helicobacter. It is characterized by the presence of flagella that enable it to move and penetrate through the gastric mucosal layer. This bacterium shows great genetic diversity, with different strains possessing various virulence factors, such as the CagA (Cytotoxin-associated gene A) and VacA (Vacuolating cytotoxin A) genes, which contribute to increasing the severity of the disease and complications associated with the infection [12,13]. For example, CagA strains produce the CagA protein, which is associated with an increased risk of gastric cancer and ulcers, while VacA strains produce toxins that cause the formation of vacuoles in gastric cells and their damage [14, 15].

➢ Modes of Transmission

H. pylori infection is primarily transmitted through oral-oral or fecal-oral routes, by consuming contaminated food or water, or through direct contact with the saliva or vomit of an infected person [1].

Poor sanitary conditions, such as lack of personal hygiene and poor sanitation, are major factors contributing to the spread of infection, especially in developing countries [1].

- **Diseases Associated with H. pylori Infection**

H. pylori infection causes a wide range of diseases, including:

Chronic Gastritis: This is an inflammation of the stomach lining that may not cause symptoms initially but can progress to atrophy of the gastric mucosa [16].

- **Peptic Ulcer:** H. pylori are the main cause of gastric and duodenal ulcers, which cause severe abdominal pain, nausea, vomiting, and loss of appetite [17].
- **Gastric Cancer:** H. pylori are classified as a human carcinogen, as chronic infection increases the risk of gastric cancer, especially adenocarcinoma [18, 19].
- **Iron Deficiency Anemia:** In some cases, H. pylori infection can cause unexplained iron deficiency anemia [20, 21].

- **Diagnosis of H. pylori Infection**

Several methods are available for diagnosing H. pylori infection, divided into invasive and non-invasive methods.

Non-invasive Methods:

- **Urea Breath Test (UBT):** This is one of the most accurate tests, measuring radioactive carbon dioxide produced by the bacteria after the patient ingests radioactive urea [19].
- **Stool Antigen Test (SAT):** Detects the presence of bacterial antigens in a stool sample [22].
- **Blood Test:** Detects the presence of antibodies to the bacteria in the blood, but it does not differentiate between active and past infection [23, 24].

Invasive Methods:

- **Upper Endoscopy with Biopsy:** A sample of the gastric mucosa is taken during endoscopy, then examined microscopically or used in a Rapid Urease Test (RUT) or bacterial culture [25].

- **Treatment of H. pylori Infection and Antibiotic Resistance**

The treatment of H. pylori infection primarily relies on triple or quadruple therapy, which usually includes proton pump inhibitors (PPIs) with two or more antibiotics, such as amoxicillin, clarithromycin, metronidazole, tetracycline, and bismuth [26, 27]. However, antibiotic resistance poses a significant challenge in the treatment of H. pylori, as some strains have become resistant to common antibiotics, reducing treatment effectiveness and increasing failure rates [28, 29]. Recent studies indicate increasing H. pylori resistance to clarithromycin and metronidazole, necessitating the development of new treatment protocols based on antibiotic susceptibility testing before initiating treatment [30, 31].

- **Prevention of H. pylori Infection**

Prevention strategies focus on improving general health conditions, including providing clean drinking water, improving sanitation, and promoting personal hygiene. Research is also being conducted to develop effective vaccines against H. pylori, which may contribute to reducing the spread of infection in the future [32].

Materials and Methodology

- **Study Type and Data Source**

This study represents an analytical statistical research based on secondary data extracted from the archives of Alwatan Medical Laboratory in Hun City, Libya. The necessary permission to collect data was obtained from the administration of Alwatan Medical Laboratory, in coordination with the Higher Institute of Medical Sciences and Technologies in Hun.

- **Study Sample**

The study sample consisted of 69 cases of visitors to Alwatan Medical Laboratory in Hun City, who were diagnosed with the presence or absence of Helicobacter pylori bacteria. The sample included 49.2% males and 50.8% females, reflecting a balanced representation of both genders in the study.

- **Study Timeframe and Location**

The study data was collected from Alwatan Medical Laboratory in Hun City, Libya, which is located on the main road at the intersection of Al-Fateh Street and Al-Biaa Street. The data collection period extended from March 2025 to June 2025.

- **Data Analysis**

The collected data was analyzed using Microsoft Office Excel. The statistical analysis included calculating prevalence rates and distributing cases by age groups and gender, to identify demographic factors associated with H. pylori infection.

Results

These results present a statistical analysis of the prevalence of Helicobacter pylori (H. pylori) among visitors to Alwatan Medical Laboratory in Hun City, Libya, during the period from March to June 2025. Data was collected from the laboratory records of 69 cases and analyzed using Microsoft Office Excel.

➢ **H. pylori Prevalence Rate**

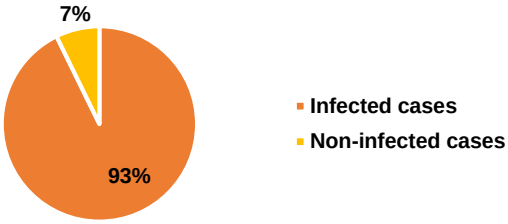

Figure 1: Prevalence of stomach bacteria in cases

The results showed that the prevalence rate of H. pylori among the study sample was very high, reaching 92.8% (64 out of 69 cases). In contrast, the percentage of uninfected cases was 7.2% (5 cases). This high rate indicates that H. pylori constitute a significant public health problem in the region where the study was conducted.

➢ **Distribution of Infection by Age Group**

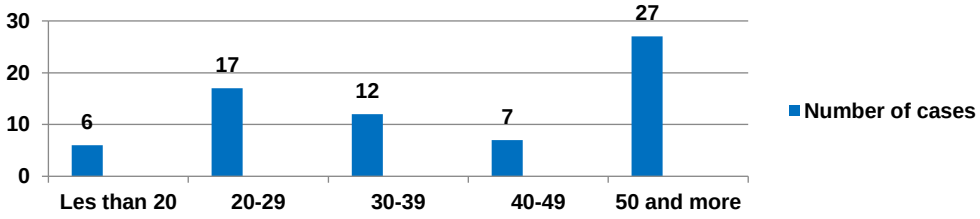

Figure 2: Age-group statistics for people infected with stomach bacteria

The results indicate that the age group most susceptible to H. pylori infection is individuals over 50 years old, with an infection rate of 39.1% (27 cases). This is followed by the 20-29 age group with 24.6% (17 cases), then the 30-39 age group with 17.4% (12 cases). As for the age groups under 20 and 40-50, they recorded lower infection rates of 8.7% (6 cases) and 10.2% (7 cases) respectively. These results suggest that older adults are more susceptible to infection, which may be attributed to accumulated exposure to the bacteria over the years or a weakened immune system.

➢ **Distribution of Infection by Gender**

Regarding the distribution of infection by gender, it was observed that the infection rate among females was slightly higher than among males. The infection rate among females was 50.8% (32 cases), while among males it was 49.2% (31 cases). Although the difference is not significant, it may indicate the presence of environmental or behavioral factors contributing to a slight increase in the infection rate among females in this region.

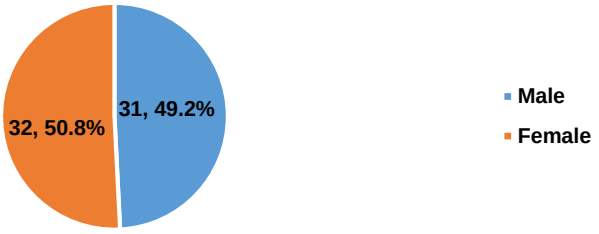

Figure 3: Percentage and number of infected cases by gender

➢ **Comparison of H. pylori Prevalence with Other Diseases**

The prevalence of H. pylori was compared with the prevalence of other diseases in the laboratory during the years 2023, 2024, and the period from January to March 2025. The results showed that the percentage of H. pylori cases was relatively low compared to other diseases, reaching 1.6% in 2023, 2.9% in 2024, and 1.9% in the mentioned period of 2025. However, these numbers do not diminish the importance of the problem, given the serious long-term complications that H. pylori can cause. To clarify, these results were extracted based on the data provided in the original document. For a deeper analysis, additional studies involving a larger sample and more detailed statistical analysis may be required.

Discussion

This study provides an in-depth look at the prevalence of Helicobacter pylori (H. pylori) in Hun City, Libya, and highlights the demographic factors associated with the infection. The results indicate that the prevalence rate of H. pylori in the study sample is remarkably high, reaching 92.8%. This rate is significantly higher than the reported global averages, which are estimated at about 50% of the world's population [33, 34]. This increase can be explained by several factors, including health and environmental conditions in the region, such as drinking water quality, sanitation practices, and the general level of health awareness. Many studies indicate that developing countries suffering from weak health infrastructure record higher prevalence rates of H. pylori [35, 36].

The results show that the age group over 50 years old is the most susceptible to infection, which is consistent with scientific literature indicating that accumulated exposure to the bacteria over the years increases the risk of infection, in addition to a weakened immune system associated with aging [37, 38]. The 20-29 ages group also shows a relatively high infection rate, which may indicate that this age group may be more susceptible to infection due to lifestyle patterns or social factors.

Regarding the distribution of infection by gender, the study indicates that females show a slightly higher infection rate than males (50.8% versus 49.2%). Although this difference is not significant, it may warrant further research to determine if there are biological, behavioral, or social factors contributing to this difference. Some studies suggest that differences in personal hygiene practices or exposure to contaminated sources may explain these gender differences.

Comparing the prevalence of H. pylori with other diseases in the laboratory shows that the percentage of H. pylori cases was relatively low. However, this result should be interpreted with caution. H. pylori infection is often silent and does not cause obvious symptoms in many cases, which may reduce the number of cases diagnosed in the laboratory compared to other diseases that cause acute symptoms and require immediate medical intervention [39, 40]. In addition, serious complications of H. pylori, such as gastric cancer, may not appear until many years after the initial infection, making it difficult to directly link them to the infection in short-term statistics.

This study emphasizes the importance of early diagnosis and effective treatment of H. pylori, especially in areas with high prevalence rates. Early treatment can reduce the risk of developing serious complications such as ulcers and gastric cancer [41]. The study also highlights the challenges facing H. pylori treatment due to increasing antibiotic resistance, necessitating the development of new treatment protocols based on antibiotic susceptibility testing and the development of effective vaccines [42].

The study recommends strengthening health awareness programs about H. pylori, improving drinking water quality, developing sanitation systems, and promoting personal and public hygiene practices to limit the spread of infection. It also emphasizes the importance of conducting more extensive epidemiological studies in the region to identify the precise factors contributing to high prevalence rates and to develop effective preventive and therapeutic strategies.

Conclusions and Recommendations

This study shows that Helicobacter pylori (H. pylori) constitute a significant public health problem in Hun City, Libya, with a remarkably high prevalence rate among visitors to Alwatan Medical Laboratory. The results confirm the importance of demographic factors, such as age, in determining the extent of exposure to infection, as older age groups are more susceptible. The study also highlights the ongoing challenges in combating this infection, especially regarding antibiotic resistance. Based on the results and discussion, the study provides the following recommendations:

Strengthen Health Awareness Programs: Public awareness campaigns about H. pylori, its transmission methods, symptoms, and serious complications should be intensified, with a focus on the importance of early diagnosis and effective treatment.

1. **Improve Health Infrastructure:** It is necessary to improve the quality of drinking water and develop sanitation systems in affected areas, as these factors are among the main causes of infection spread.
2. **Promote Personal and Public Hygiene Practices:** Awareness of the importance of regular handwashing, especially before eating and after using restrooms, and promoting hygiene in food preparation should be enhanced.
3. **Develop Effective Treatment Protocols:** Due to increasing antibiotic resistance, it is recommended to conduct antibiotic susceptibility tests before initiating treatment, and to develop new treatment protocols based on the latest research and international recommendations.
4. **Conduct More Epidemiological Studies:** It is necessary to conduct extensive epidemiological studies in the region to identify the precise factors contributing to high prevalence rates, and to evaluate the effectiveness of preventive and therapeutic interventions.

5. **Research and Development:** Support should be provided for research aimed at developing effective vaccines against H. pylori, in addition to exploring alternative treatments to reduce reliance on antibiotics.

These recommendations contribute to developing comprehensive strategies to combat H. pylori infection and reduce its impact on community health in Hun City and similar regions.

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