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Serological Evaluation of Helicobacter pylori Infection and Its Association with ABO Blood Groups

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ABSTRACT: ***Helicobacter pylori*** **is a globally prevalent pathogen associated with various gastrointestinal diseases, including gastritis, peptic ulcer, and gastric malignancies. Host factors such as ABO blood group antigens have been proposed to influence susceptibility to infection. AIM: This study aimed to evaluate anti-*** ***H. pylori*** **antibodies for detecting** ***H. pylori*** **infection and to assess the correlation between infection incidence and ABO blood groups. Materials and methods: A total of 95 patients from Tripoli presenting with dyspeptic symptoms were enrolled. Stool and serum samples were collected to detect** ***H. pylori*** **infection using standard immunoassays. Blood grouping was performed by conventional agglutination techniques. Statistical analysis was conducted to explore associations between** ***H. pylori*** **seropositivity, blood groups, age, and gender Results: Among the studied subjects, 41.5% were seropositive for** ***H. pylori.*** **The distribution of blood groups among infected patients revealed that blood group O (49.0%) was the most frequent, followed by group A (31%), group B (11%), and group AB (11 %). Although a higher prevalence of infection was observed among group O individuals, the difference was not statistically significant ($p > 0.05$). Conclusion: The findings suggest a possible trend toward increased** ***H. pylori*** **infection among individuals with blood group O. However, the absence of a statistically significant association indicates that additional host and environmental factors may influence susceptibility.**

Keywords: Helicobacter pylori, ABO blood group system, Serological evaluation, Anti- Pylori antibodies, Infection prevalence.

الملخص: البكتيريا اللولبية من الممرضات واسعة الانتشار عالميًا، وترتبط بالعديد من الأمراض المعدية للجهاز الهضمي، بما في ذلك التهاب المعدة، والقرحة الهضمية، وسرطان المعدة. وتشير بعض الدراسات إلى أن مستضدات فصائل الدم ضمن نظام أي بي أو قد تلعب دورا في قابلية الاصابة بالعدوى. **الهدف:** هدفت هذه الدراسة إلى تقييم الأجسام المضادة للبكتيريا اللولبية للكشف عن العدوى، ودراسة العلاقة بين معدل الإصابة وفصائل الدم ضمن نظام أي بي أو. **المواد والطرق:** شملت الدراسة 95 مريضًا من مدينة طرابلس يعانون من أعراض عسر الهضم. جُمعت عينات البراز والمصل للكشف عن عدوى البكتيريا باستخدام اختبارات مناعية معيارية، كما جرى تحديد فصائل الدم بطريقة التلازن التقليدية. اجري التحليل الإحصائي لتقييم العلاقة بين إيجابية الأجسام المضادة للجرثومة وفصائل الدم والعمر والجنس. **النتائج:** أظهرت النتائج أن الاناث هن الاكثر اصابة بالبكتيريا وأن 41.5% من المشاركين كانوا إيجابيي الأجسام المضادة للبكتيريا. وبيّنت الدراسة أن فصيلة الدم (أو)كانت الأكثر شيوعًا بين المصابين (49%)، تلتها فصيلة(أي) بنسبة (31%)، ثم (بي) بنسبة (11%)، و (أي بي) بنسبة (11%). ورغم أن العدوى كانت أكثر شيوعًا لدى حاملي فصيلة الدم (أو)، الا ان الفرق لم يكن ذا دلالة إحصائية. **الاستنتاج:** تشير النتائج إلى وجود ميلٍ لارتفاع معدل العدوى بجرثومة المعدة لدى الافراد ذوي الفصيلة (أو)،

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غير ان غياب الدلالة الإحصائية يوحي بأن عوامل أخرى، مناعية وبيئية، قد تساهم في القابلية للإصابة. ويوصى بإجراء دراسات أوسع لتوضيح العلاقة المحتملة بين فصائل الدم والاستعداد المناعي للعدوى بالبكتيريا المعدية.

الكلمات المفتاحية :البكتيريا اللولبية، فصائل الدم ،الفحص المصلي،الاجسام المضادة ،انتشار البكتيريا

I. INTRODUCTION

Helicobacter pylori (*H. pylori*) is a Gram-negative, spiral-shaped bacterium that colonizes the gastric mucosa and is one of the most prevalent chronic infections worldwide, affecting nearly half of the global population. [1-3] Although most infected individuals remain asymptomatic, *H. pylori* infection is a well-established risk factor for chronic gastritis, peptic ulcer disease, and gastric malignancies, including adenocarcinoma and mucosa-associated lymphoid tissue (MALT) lymphoma.[4-12]The persistence of *H. pylori* in the gastric mucosa triggers both local and systemic immune responses, leading to the production of specific antibodies such as immunoglobulin G (IgG) and immunoglobulin (IgM), which can serve as useful markers for diagnosis and epidemiological studies.[13-15] Several host-related factors, including genetic predisposition, immune status, and blood group antigens, have been suggested to influence susceptibility to *H. pylori* infection. The ABO blood group system, determined by carbohydrate antigens expressed on red blood cells and epithelial surfaces, has been implicated in bacterial adhesion and colonization. Previous studies have reported a higher prevalence of *H. pylori* infection among individuals with blood group O, whereas others found no significant association, indicating that the relationship remains controversial. [16-21] In Libya, data on the seroepidemiologic of H. pylori infection and its association with ABO blood groups are limited. Understanding these associations could help identify individuals at increased risk and guide preventive strategies. This study aimed to determine the prevalence of *H. pylori* infection among patients with gastrointestinal symptoms in Tripoli, Libya, evaluate the humoral immune response (IgG and IgM antibodies), and explore the possible association between *H. pylori* infection and ABO blood groups

II. MATERIAL AND METHODS:

Study Design and Setting:

A cross-sectional study was conducted between June and August 2024 in Tripoli, Libya. Patients were recruited from Wadi Al-Rabi Hospital, Al-Tafouq Laboratory (Al-Abraj Clinic), and Al-Anowar Clinic.

Study Population: The study included 95 patients (27 males and 68 females) aged 3–80 years, all presenting with gastrointestinal symptoms suggestive of *H. pylori* infection (e.g., gastritis, peptic or duodenal ulcers, dyspepsia, or unexplained weight loss).

Sample Collection: Three types of samples were collected from each patient:

1. Stool samples for detection of H. pylori antigen.
2. Serum samples for detection of IgG and IgM antibodies.
3. Whole blood samples (2 ml in EDTA tubes) for ABO blood group determination.

Laboratory Analysis:

1- ***Detection of H. pylori Antigen:*** A rapid immunochromatographic assay (ECOTEST®, Assure Tech. (Hangzhou) Co., Ltd., China) was used to qualitatively detect H. pylori antigen in stool specimens, following the manufacturer's instructions.

2- Detection of Anti-H. pylori Antibodies: IgG and IgM antibodies were detected in serum using a rapid immunochromatographic test (RightSign®, Hangzhou Biotest Biotech Co., Ltd., China)). IgG concentration was further quantified in a subset of patients using a chemiluminescence immunoassay (MAGLUMI®, Snibe Diagnostics, Shenzhen, China). A value >30 U/ml was considered reactive.

3- ABO Blood Grouping: ABO and Rh blood groups were determined by the standard hemagglutination method using anti-A, anti-B, and anti-D sera (Bio-Rad, France).

Ethical Considerations: The study was approved by the Department of Medical Laboratory Sciences, University of Tripoli. Written informed consent was obtained from all participants or their legal guardians.

Statistical Analysis: Data were analyzed using IBM SPSS version 23. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The Chi-square test was used to assess associations between categorical variables. Non-parametric tests (Mann–Whitney and Kruskal–Wallis) were applied where appropriate. A P value ≤0.05 was considered statistically significant.

III. RESULTS

Classification of patients based on demographic data:

A total of 95 patients were enrolled, including 27 males (28.4%) and 68 females (71.6%), with a mean age of 35.3 ± 16.48 years (range: 3–80 years). The age group 21–30 years represented the largest proportion (28.4%), while patients >60 years constituted the smallest group (7.4%).

(**Figure 1)**. Interestingly, females represented the majority of infected patients, which may be attributed to hormonal and immunological differences that render females more susceptible to certain bacterial infections compared to males.

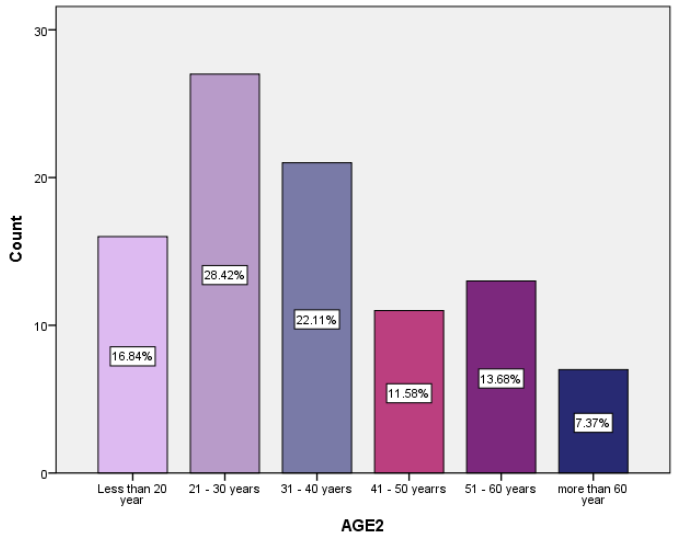

Fig.1: Distribution of patients according to age

ABO Blood Group Distribution:

The most frequent blood group among H. pylori-positive patients was O^+ (41.1%), followed by A^+ (29.5%), B^+ (10.5%), and AB^+ (8.4%). Rare blood groups included O^- (7.4%), AB^- (2.1%), and A^- (1.1%). No statistically significant association was found between ABO blood groups and H. pylori infection prevalence (P>0.05). (**Figure 2**)

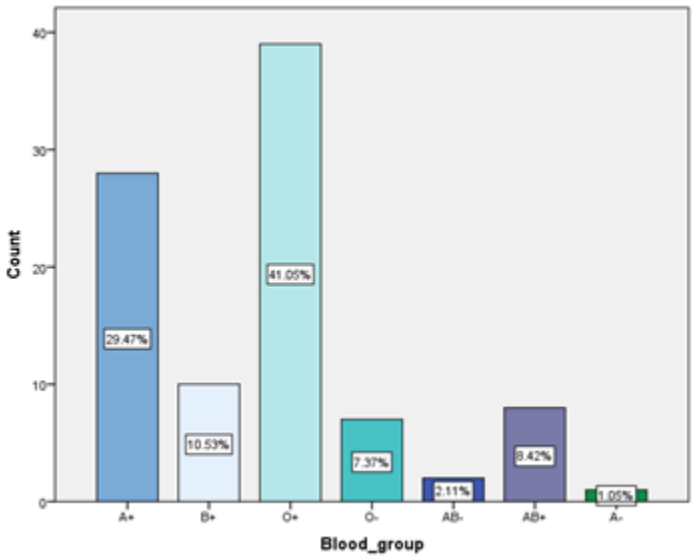

Fig.2: Distribution of patients according to blood group

Correlation between immune response and gender:

As shown in **Table 1**, there was no statistically significant difference between males and females regarding the seropositivity of both IgM and IgG antibodies (P = **0.162** and **0.821**,

respectively). IgM positivity was slightly higher among males (44.4%) compared to females (29.4%), whereas IgG positivity showed a comparable distribution between genders (48.1% in males vs. 45.6% in females).

Table.1: Correlation between immune response and gender

Variable	Gender	Negative (%)	Positive (N (%)	Total N (%)	P-value
IgM	Male	15 (55.6)	12 (44.4)	27 (100)	**0.162**
	Female	48 (70.6)	20 (29.4)	68 (100)	
IgG	Male	14 (51.9)	13 (48.1)	27 (100)	**0.821**
	Female	37 (54.4)	31 (45.6)	68 (100)	

Relationship Between Age Groups and antibody response:

As presented in **Table 2,** no statistically significant association was observed between age groups and the seropositivity rates of both IgM and IgG antibodies (P= **0.495** and **0.234** respectively). However, the highest IgM positivity was detected among patients aged 21-30 years (70.4%), followed by those <20 years (50%). Similarly, IgG positivity was more frequent in the 21-30 years group (59.3%) while patients over 60 years demonstrated the lowest rates of antibody positivity. This pattern may reflect a stronger humoral immune response or higher exposure rate to the pathogen among younger adults compared to older individuals.

Table.2: Correlation between immune response and age

Variable	Age Groups	Negative N (%)	Positive N (%)	Total N (%)	P-value
IgM	<20 years	8 (50.0)	8 (50.0)	16 (100)	
	21 - 30 years	8(29.6)	19(70.4)	27 (100)	**0.495**
	31 - 40 years	13 (61.9)	8 (29.6)	21 (100)	
	41 - 50 years	9 (81.8)	2 (18.2)	11 (100)	
	51 - 60 years	10 (76.9)	3 (23.1)	13 (100)	
	>60 years	4 (57.1)	3 (42.9)	7 (100)	
IgG	<20 years	7 (43.8)	9 (56.3)	16 (100)	
	21 - 30 years	11 (40.7)	16 (59.3)	27 (100)	**0.284**
	31 - 40 years	13 (61.9)	8 (38.1)	21 (100)	
	41 - 50 years	6 (54.5)	5 (45.5)	11 (100)	
	51 - 60 years	8 (61.5)	5 (38.5)	13 (100)	
	>60 years	6 (85.7)	1 (14.3)	7 (100)	

Correlation between immune response and ABO blood groups:

As shown in **Table 3**, no statistically significant association was detected between ABO blood groups and the seropositivity rates of IgM or IgG antibodies (P = 0.168 and 0.445, respectively). The highest IgM positivity was observed among individuals with blood group O+ (69.2%), followed by A+ (39.3%). Similarly, IgG positivity was more frequent in patients with blood groups A+ (42.9%) and O+ (38.5%). Other blood groups, including AB and Rh-negative types, exhibited low or absent antibody responses, possibly due to their limited representation in the studied cohort.

Table.3: Correlation between immune response and ABO blood group

Variable	Age Groups	Negative N (%)	Positive N (%)	Total N (%)	P-value
IgM	A+	17 (60.7)	11 (39.3)	28 (100)	**0.168**
	B+	9 (90.0)	1 (10.0)	10 (100)	
	O+	12(30.8)	27 (69.2))	39 (100)	
	O-	5 (71.4)	2 (28.6)	7 (100)	
	AB-	2 (100.0)	0 (0.0)	2 (100)	
	AB+	3 (37.5)	5 (62.5)	8 (100)	
	A-	0 (0.0)	1 (100)	1 (100)	
IgG	A+	16 (57.1)	12 (42.9)	28 (100)	**0.445**
	B+	5 (50.0)	4 (50.0)	10 (100)	
	O+	24 (61.5)	15 (38.5)	39 (100)	
	O-	3 (42.9)	4 (57.1)	7 (100)	
	AB-	0 (0.0)	2 (100.0)	2 (100)	
	AB+	3 (37.5)	5 (62.5)	8 (100)	
	A-	0 (0.0)	1 (100)	1 (100)	

Quantitative IgG Analysis:

In a subset of 23 patients, quantitative chemiluminescence analysis showed a mean IgG concentration of 131.46 ± 72.14 U/ml (range: 30–200 U/ml). The highest mean concentration was found in patients aged 21–30 years (166.84 U/ml). No statistically significant difference was observed between males and females in mean IgG levels.

IV. DISCUSSION

This study investigated the prevalence of *Helicobacter pylori* infection among patients with gastrointestinal symptoms in Tripoli, Libya, and explored the relationship between infection, humoral immune response, and ABO blood groups. Our results showed that *H. pylori* infection was most prevalent among individuals aged 21–30-years, with females representing the majority of detected cases. [22-24] The predominance of cases among young adults (21–30 years) is consistent with previous reports indicating that *H. pylori* infection is typically acquired during

childhood or early adulthood and may persist throughout life if left untreated. Lifestyle factors, dietary habits, and household crowding may have contributed to the higher prevalence of infection observed in this age group. In contrast, some studies have reported a higher prevalence of *H. pylori* infection among older populations, which may reflect variations in study design, socioeconomic conditions, and sample selection. [25-27] The demographic analysis of the current study revealed that females constituted the majority of infected patients, which may be attributed to hormonal and immunological factors that generally render females more responsive but sometimes more susceptible to bacterial infections. Estrogen has been shown to modulate both innate and adaptive immune responses, leading to enhanced antibody production, whereas certain behavioral or exposure-related factors might also contribute to the higher infection rate observed among females. The female predominance observed in our cohort contrasts with reports from other regions, where higher infection rates among males have been documented. This gender variation may be attributed to differences in healthcare-seeking behavior, hormonal influences, and exposure-related risks [28-31] Although no statistically significant differences were observed between age groups, a higher rate of IgM and IgG positivity was recorded among younger adults, particularly those aged 21–30 years. This trend may reflect the combined effects of stronger immune activity and higher exposure rates in this age category. In contrast, older patients (>60 years) showed lower antibody positivity, possibly due to immune senescence and reduced capacity to mount robust humoral responses.

Although blood group O^+ was the most common among infected patients, our results did not confirm a statistically significant association between ABO blood group and susceptibility to *H. pylori* infection. Some studies have reported a higher prevalence of *H. pylori* infection among individuals with blood group O, possibly due to enhanced bacterial adhesion to specific antigens, whereas others found no such correlation. The inconsistency in findings across studies highlights the complex interplay between host genetic factors, bacterial virulence, and environmental influences. Further genetic and molecular studies are recommended to clarify the underlying mechanisms linking blood group antigens to *H. pylori* susceptibility [32-36] The lack of significant correlation suggests that ABO blood group antigens may not play a major role in modulating humoral immune responses against this bacterial infection. However, the relatively higher antibody positivity observed in O+ and A+ individuals could reflect their higher prevalence in the population rather than a true biological difference. Some previous studies have proposed that ABO antigens might influence susceptibility to certain infections through their effects on pathogen binding or immune complex clearance, but the present data do not support a strong association in this cohort.

Collectively, these results suggest that factors other than age and gender—such as the duration or severity of infection, bacterial load, or individual immune variability—may have a greater influence on the antibody response patterns observed in this cohort. Additionally, the results suggest that while females were more frequently affected, the subsequent humoral immune response (IgM and IgG production) appeared comparable across genders, age groups, and blood

types. This indicates that demographic factors may influence exposure and infection rates more than the immune response itself.

Strengths and LimitationsA strength of this study is the use of multiple diagnostic approaches, including antigen detection, rapid antibody testing, and quantitative IgG analysis, providing a comprehensive assessment of immune response. However, the study has limitations, including a relatively small sample size, cross-sectional design (which precludes causal inference). ***Implications and Future Directions***Our findings contribute to the limited data on H. pylori epidemiology in Libya and underscore the need for larger, multicenter studies incorporating bacterial genotyping and host genetic analysis to better understand infection dynamics. Future research should also explore the influence of lifestyle, diet, and socioeconomic status on infection risk, as well as the potential role of gender-related hormonal effects on immune responses.

V. CONCLUSION

This study provides valuable insights into the relationship between *Helicobacter pylori* infection and host factors such as age, gender, and blood group. The findings revealed observable differences in immune response between males and females, suggesting that biological sex may play a role in susceptibility and disease progression. These results highlight the potential importance of demographic and genetic factors in shaping immune response to *H. pylori* infection. While the current findings represent an important step toward understanding these associations, further research is warranted to elucidate the underlying molecular mechanisms and to confirm these observations in larger, multi- center studies. Future investigations should also consider the influence of hormonal fluctuations on immune modulation and the long-term outcomes of infection. Understanding these complex interactions is essential for developing gender-sensitive preventive interventions, particularly in regions such as Tripoli, where environmental and healthcare factors may significantly impact the epidemiology of *H. pylori* infection.

VI. RECOMMENDATIONS:

Based on the findings of this study, several recommendations can be made for future research and public health practice:

1- **Further studies:** Additional large-scale and multi-center studies are recommended to confirm the observed associations between *H. pylori* infection and host factors such as blood group, diet, lifestyle, and genetic background.

2- **Blood group and disease risk:** The potential link between blood group and susceptibility to *H. pylori* infection warrants greater scientific attention, as blood type may serve as an early diagnostic or predictive marker and could also contribute to preventive strategies.

3- **Nutritional and lifestyle**: Future investigations should explore how dietary habits, hygiene practices, and lifestyle factors influence infection rates and immune responses, particularly in high-risk populations.

4- **Screening programs:** Regular screening for *H. pylori* infection among healthcare workers-especially those with blood groups associated with higher susceptibility -may help reduce disease transmission and complications
5- **Genetic studies:** Molecular and genetic studies are needed to clarify how host genetic variations contribute to individual differences in immune response and infection outcomes.

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