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Original article

Seasonal Variation in The Frequency of Helicobacter Pylori Infection in Tobruk City, Libya

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A B S T R A C T

Helicobacter pylori (*H, pylori*) is one of the most common pathogenic bacteria infections that presents a substantial concern due to its link with gastric cancer and peptic ulcer. The infected individual usually does not exhibit clinical symptoms; therefore, it is important to understand the risk factors associated with the infection to diagnose and treat it early. Among these risk factors, the association between *H pylori* infection and season variation is not well understood. The aim of this study is to understanding the prevalence of h pylori infection in Tobruk City, eastern Libya, and its interaction with association factors such as gender, age, and the seasonality of *H. pylori* this in turn, may lead to a better understanding of other health phenomena such as the seasonal variation of peptic ulcers, that has remained an unresolved mystery for more than 90 years. 2551 samples were processed, using the TECAN Fecal *H. pylori* Antigen ELISA for the quantitative and qualitative detection of *H. pylori* antigen in feces. Results show that 33.6% of the cases were positive, and the percentage of infected females (34.1%) was insignificantly greater than that of infected males (32.9%). 34.1% were female and 32.9% were male. The results showed significant (X2= 22.52; P<0.001) association between H. pylori infection and age of the patient, in which the results explained that the highest percentage of infected patients for those aged < 10 years (39.3%) followed by those aged between 31-40 years (33.6%), The results revealed a significant (X2= 100.00; P<0.001) association between *H. pylori* infection and season of the year in which the highest rate of the infected patient was found during spring season (41.9%), followed by those patients infected during winter (28.1%) and summer (28.1%), however those patients infected during autumn were reported that lowest percentage (11.1%). Further prospective studies are highly recommended to provide further evidence and a clearer picture of *H. pylori* transmission.

Introduction

Helicobacter pylori continues to be one of the most serious public health challenges, which affects 50% of the world population and the majority of cases are found in Latin America, Asia, and Africa and 50.8% of the infected individuals live in poor nations [14]. *H. pylori* is a complicated pathogen, that is closely associated with a vast range of gastrointestinal problems such as duodenal and gastric ulcers, gastric cancer. The bacterium infection contributes to approximately 80% of stomach ulcers and up to 90% of duodenal ulcers. in addition to that it is consider as the second leading cause of death related cancer the cancer worldwide [4,5]. Although WHO has taken various steps which lead to reduce the infectious rate, another public health hazard is arising which is some strain of *H. pylori* become clarithromycin-resistant [6].

The majority of infected cases will remain asymptomatic in early stages of bacterial infection, therefore, investigation of the associated risk factors of infection can enable to save time for diagnosis and treatment and prevent the Serious consequences of the infection. Huge number of studies and researches have been detected the common risk factors that associated with H pylori infection such as socioeconomic status, size of family, environmental condition, education level, life style, hygiene practice and source of water [7-11]. However, among these risk factors, the association between H pylori infection and season variation is not well understood and no conclusive evidence on this relationship exists yet. Studies on the prevalence of H. pylori infection in Libya are scarce. Therefore, the aim of this study to understanding the prevalence of H. *pylori* infection among Libyan population notably in the eastern region in Tobruk city and its interaction with association factors such as gender, age and the seasonality of *H. pylori* to develop effective public health measures and prevent the spread of infection caused by this bacterium.

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Methods

Study setting

The study was performed in Ibn Rushed center, Tobruk, Libya. During one-year months, from Jan 2023 to December 2023, a total of 2551 patients were included in this study. Among patients, there were 60.8% female and only 39.2% male patients, in different aged groups.

Specimen collection & storage

A fresh fecal sample should be collected into a stool sample collection container. It is required to collect a minimum of a 1-2 mL liquid stool sample or a 1-2 g solid stool sample. The collected fecal sample must be transported to the lab in a frozen condition (-20 o^C). If the stool sample is collected and tested on the same day, it is allowed to be stored at 2- 8 oC. In the present study, the instrument used was the TECAN Fecal H. pylori Antigen ELISA (RE58891) (IBL International GmbH D-22335 Hamburg, Germany). This microplate-based ELISA (enzyme linked immunosorbent assay) kit is intended for the quantitative and qualitative detection of H. pylori antigen in feces. The assay is a useful tool in the detection of active H. pylori infection. This kit is for in vitro diagnostic use only.

Statistical analysis

All the collected data was entered into Microsoft Excel and cross checked for the presence of any errors to maintain its accuracy. Descriptive statistics were applied to calculate proportions and frequencies and associations. Data were analyzed using IBM SPSS version 22, 7 (NY, USA).

Results

The results in table 1 showed that the total number of cases suspected to infected by H. pylori was 2551. Majority of cases reported in summer season (39.2%) followed by those cases recorded in spring (35.2%) while the winter and autumn season were found had the lowest frequency (16.1 and 9.6%; respectively).

Table 1. Distribution of cases among different months

Season	Frequency	Percent
Winter	410	16.1
Spring	897	35.2
Summer	1000	39.2
Autumn	244	9.6
Total	2551	100.0

The results in table 2 explained that the majority of cases that suspected to infected by H. pylori were females (60.8%), while males were only (39.2%).

Table 2. Distribution of cases according to gender of patient

Sex	Frequency	Percent
Female	1440	60.8
Male	929	39.2
Total	2369	100.0

The results of Table 3 revealed that the most cases that suspected to infected by H. pylori were patients aged > 40 years (24.1%), then those patients aged between 11-20 years (20.8 %) years 21-30 years (20.8 %), however those patients aged 31-40 and less than 10 years recorded the lowest frequency (17.9 and 16.5%; respectively).

Table 3. Distribution of case according to age group

Age group (years)	Frequency	Percent
< 10	420	16.5
11-20	530	20.8
21-30	530	20.8
31-40	455	17.9
> 40	613	24.1
Total	2548	100.0

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Table 3 shows the frequency of infection by H. pylori. The results revealed that 31.3% of cases were infected by H. pylori while 68.7% of them were not infected.

Table 4. Frequency of infected cases by H. pylori

H. pylori infection	Frequency	Percent
Not infected	1750	68.7
Infected	799	31.3
Total	2549	100.0

The association of H. pylori infection with season of year were shown Table 5. The results revealed a significant (X^2= 100.00; P<0.001) association between H. pylori infection and season of year. The significantly highest percentage of infected patient was found during spring season (41.9%), followed by those patients infected during winter (28.1%) and summer (28.1%), however those patients infected during autumn were reported that lowest percentage (11.1%),

Table 5. The association of H. pylori infection with season

Season		H. pylori infection	
		Not infected	Infected
Winter	N	294	115
	%	71.9%	28.1%
Spring	N	521	376
	%	58.1%	41.9%
Summer	N	718	281
	%	71.9%	28.1%
Autumn	N	217	27
	%	88.9%	11.1%
Total	N	1750	799
	%	68.7%	31.3%
X^2= 100.00; P<0.001			

Table 6. shows the association between H. pylori infection and gender of patient. The results explained insignificant (X^2= 0.40; P>0.05) association between H. pylori infection and gender of patient. However, the percentage of infected females (34.1%) was insignificantly greater than that of infected males (32.9%).

Table 6. The association between H. pylori infection and gender of patient

Gender		H. pylori infection	
		Not infected	Infected
Female	N	948	491
	%	65.9%	34.1%
Male	N	623	305
	%	67.1%	32.9%
Total	N	1571	796
	%	66.4%	33.6%
X^2= 0.40; P>0.05			

The association between *H. pylori* infection and age of patient was indicated in Table 7. The results showed significant (X^2= 22.52; P<0.001) association between *H. pylori* infection and age of patient. Moreover, the results explained that the highest percentage of infected patients for those aged < 10 years (39.3%) followed by those aged between 31-40 years (33.6%), then those aged > 40 years (30.6%) and those aged between 21-30 years (30.0%), while those patients aged between 11-20 years were significantly recorded the lowest percentage (25.5%).

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Table 7. The association between H. pylori infection and age of patient

Age group (years)		H. pylori infection	
		Not infected	**Infected**
< 10	N	255	165
	%	60.7%	39.3%
11-20	N	395	135
	%	74.5%	25.5%
21-30	N	371	159
	%	70.0%	30.0%
31-40	N	302	153
	%	66.4%	33.6%
> 40	N	425	187
	%	69.4%	30.6%
Total	N	1748	799
	%	68.6%	31.4%
X^2= 22.52; P<0.001			

Discussion

The infection of *H. pylori* is now recognized as one of the most common bacterial infections in humans. In developing countries, it is estimated that approximately 3 billion people have been affected by *H. pylori* at some life stage, which represents roughly 50% of the global population. Of those infected, about 17% develop peptic ulcers, and about 1% progress to gastric cancer. The latter is responsible for over 700,000 deaths worldwide yearly [12,13]. While the exact transmission mode of *H. pylori* remains unidentified, studying its epidemiology within the Libyan population is crucial for public health due to its high prevalence and association with various gastrointestinal disorders [14]. This study was designed to notice the percentage of *H. pylori* infection and its relationship to each season, gender, and age group.

The results indicated that 31.3% of the cases studied were infected with H. pylori. This finding aligns with a study performed in Lebanon [15] which reported a 31% infection rate for *H. pylori*. However, the prevalence of H. pylori infection in our study was considerably lower compared to conclusions from other research. For instance, a study carried out in Sirte/ Libya, revealed a positive H. pylori infection in 50 out of 60 samples, resulting in an infection rate of 83% [16]. Similarly, a recent study in the United Arab Emirates in 2019 found the prevalence of *H. pylori* to be 41% [17]. The discrepancies between our results and those of other studies may be attributed to various factors, such as differences in study design. Epidemiological studies on the prevalence of *H. pylori* often yield heterogeneous outcomes based on the timing of the study, the specific region, and the diagnostic methods used. Additionally, the observed reduction in *H. pylori* infections in our study area may be linked to improved living conditions [18,19].

In the current study, the percentage of infected females (34.1%) was significantly higher than that of infected males (32.9%), indicating that females may be more susceptible to *H. pylori* infection than males. This finding aligns with previous studies conducted in Gharyan/Libya [20], and El-Beida City/Libya [21]. However, it contrasts with research conducted in Bani Waleed City/Libya [22], where males were found to be more susceptible to H. pylori infection than females, and a study in Mesllata/Libya [23], which found no significant correlation between gender or age and H. pylori infection. Several factors may influence the prevalence of *H. pylori* infection in relation to gender, including smoking habits, perceived stress, weekly frequency of physical activity, the duration of physical activity and consumption of stimulants.

The analysis of age-related factors revealed that patients younger than 10 years old were significantly more susceptible to *H. pylori* infection, with a prevalence rate of 39.3%. The high rate of infection in children suggests a potential increase in *H. pylori* prevalence among the Libyan population in the coming decades. This trend is concerning as it indicates poor socioeconomic conditions during childhood, which is a key risk factor for *H. pylori* infection. Although the exact mode of transmission remains unclear, interpersonal transmission appears to be the primary route, especially in developed countries. In Africa, the principal risk factors for *H. pylori* include poverty, the source of drinking water. Moreover, higher infection rates are observed in children from overcrowded households, which raises the likelihood of fecal-oral transmission. Inadequate sanitation facilities, such as traditional pits or the absence of toilets, significantly increase the risk of infection [24]. The results of this study are not consistent with previous research conducted in the

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Tripoli and Sabha regions of Libya, which showed a higher incidence of infection among individuals aged 25-35 years [25], Similarly, another study in Tripoli/ Libya reported a greater prevalence of *H. pylori* in patients aged 28-47 years [26]. The discrepancies between our findings and those of prior studies may be attributed to the types of tests used. In some cases, the bacteria may be present in small numbers or low activity levels that go undetected. It is also possible that the bacteria were present during childhood but became undetectable in older age due to unfavorable environmental conditions.

Our examination of seasonal variations revealed a significant association between H. pylori infection rates and different seasons. The highest percentage of infections appeared in spring, followed by winter and summer, while autumn registered the lowest infection rates. This finding contrasts with many previous studies, such as [27], which reported no significant seasonal differences. The observed increase in H. pylori infections during spring in our study may be attributed to diverse environmental factors, particularly those related to drinking water sources and climate. Research reveals that H. pylori is often found in drinking water, with a notable prevalence during late winter and spring. This means that seasonal changes may enhance the transmission routes of the bacterium [28]. Furthermore, this may contribute to variations in infection rates by season, especially if participants do not use tap water pipes as their source of drinking water.

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Conflicts of Interest
All other authors declared no conflict of interest.

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المستخلص

تعد الاصابه ببكتيريا البوابية الملتويه (الجرثومة الحلزونية)واحدة من أكثر أنواع العدوى البكتيرية الممرضة شيوعًا والتي تمثل مصدر قلق كبير بسبب ارتباطها بسرطان المعدة وقرحة المعدة. لا تظهر على الأفراد المصابين عادةً أعراض سريرية؛ لذلك، من المهم فهم عوامل الخطر المرتبطة بالعدوى لتشخيص العدوى وعلاجها في وقت مبكر. ومن بين هذه العوامل، فإن العلاقة بين عدوي البكتيريا االحلزونيه وتغيرات الموسم ليست مفهومة بشكل جيد. تهدف هذه الدراسة إلى فهم انتشار عدوى الحلزونيه في مدينة طبرق، شرق ليبيا وتفاعلها مع عوامل الارتباط مثل الجنس والعمر وموسمية لهذه البكتيريا، وهذا بدوره قد يؤدي إلى فهم أفضل لظواهر صحية أخرى مثل التباين الموسمي لقرحة المعدة، والتي ظلت لغزًا لم يتم حله لأكثر من 90 عامًا. تمت معالجة 2551 عينة باستخدام مستضد الملوية البوابية في البراز TECAN للكشف الكمي والنوعي عن مستضد الملوية البوابية في البراز. وأظهرت النتائج أن 33.6% من الحالات كانت إيجابية، وكانت نسبة الإناث المصابات (34.1%) أكبر بشكل طفيف من نسبة الذكور المصابين (32.9%). حيث كانت نسبة الإناث 34.1% والذكور 32.9%. وأظهرت النتائج ارتباطاً معنوياً22.52 =X2) ؛ (P<0.001 بين الإصابة بالجرثومة الحلزونية وعمر المريض، حيث أوضحت النتائج أن أعلى نسبة من المرضى المصابين كانت لمن هم أقل من 10 سنوات (39.3%) يليهم من هم في الفئة العمرية 31-40 سنة (33.6%)، كما كشفت النتائج عن وجود ارتباط معنوي100.00 =X2) ؛ (P<0.001 بين الإصابة بالجرثومة الحلزونية وموسم السنة حيث وجد أعلى معدل من المرضى المصابين خلال فصل الربيع (41.9%) يليه المرضى المصابين خلال فصل الشتاء (28.1%) والصيف (28.1%)، أما المرضى المصابين خلال فصل الخريف فقد سجلوا أقل نسبة (11.1%). ويوصى بشدة بإجراء المزيد من الدراسات المستقبلية لتوفير المزيد من الأدلة وصورة أكثر وضوحًا لانتقال بكتيريا البوابيه الملتويه.

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