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Original Article

Does the ABO blood group associate with peptic ulcer disease?

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ABSTRACT

Background: Peptic ulcer disease (PUD) is considered as an important cause of morbidity and mortality worldwide. Numerous studies have linked PUD with the ABO blood groups. However, such studies are lacking in Libya. This study aims to investigate the association between ABO blood groups and patients with PUD, and assess if sex and age are linked to the increased incidence of PUD. Further evaluation of the most prevalent type of peptic ulcer and determining the dominant blood group for each ulcer type are also objectives.

Materials and Methods: This study was conducted at Tripoli University Hospital. A total of 150 Libyan participants were divided into PUD patients (n=75) and controls (n=75). The slide agglutination method was employed for ABO blood grouping. Data were analyzed statistically using IBM SPSS version 26.

Results: Among PUD patients, 48% were between the ages of 16 and 30. 58.7% of patients were females, while 41.3% were males. A significant association between PUD and factors (gender and age) was observed when compared to controls (p<0.05). The distribution of ABO blood groups shows that blood group O is the most prevalent blood group among samples (51% in the PUD and 37% in controls), although was not statistically different (p=0.318). Gastric ulcer incidence was higher (64.0%) compared to duodenal ulcer (36.0%). However, no statistically significant relationship was observed between blood groups and ulcer types.

Conclusion: Although PUD was more common in patients with blood group O, this association was not statistically significant. Both gender and age are likely risk factors for PUD. These findings suggest no correlation between ABO blood group system and PUD.

Keywords: ABO, blood group, gastric ulcer, duodenal ulcer, peptic ulcer disease, PUD

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INTRODUCTION

Peptic ulcer disease (PUD) is a relatively common disease that affects approximately 5–10% of the population worldwide [1]. It is characterized by deep lesions in the mucosa that extend beyond the muscularis mucosa and the muscle layer [2]. There are two types of peptic ulcers, gastric and duodenal ulcers. Gastric ulcer refers to damage to the lining of the stomach, while duodenal ulcer is related to excessive acid secretion by the stomach [3]. Unfortunately, two-thirds of patients with PUD have no symptoms. However, in some cases, symptoms such as epigastric burning pain, dyspepsia, bloating, and nausea are commonly seen [4]. In fact, the etiology of PUD is not clear and is still under debate. Some studies have illustrated that the main causes of PUD could be due to an infection by *Helicobacter pylori* or by the use of non-steroidal anti-inflammatory drugs [5]. In contrast, other investigations demonstrated other risk factors associated with the disease, such as smoking and stress [6,7].

Different methods can be used to diagnose PUD. These include invasive (endoscopic-based) and non-invasive diagnostic methods. Histology, rapid urease testing, endoscopic images, molecular techniques, and culture are examples of invasive diagnostic procedures, whereas stool antigen testing, serological testing, urea breath testing, and molecular analysis are among the non-invasive diagnostic procedures [8]. A combination of invasive and non-invasive diagnostic methods can deliver a more comprehensive evaluation of the situation of the infection. However, these methods are quite expensive and often not available in public health center settings [9].

Previously, the relationship between ABO blood groups and certain diseases has been investigated by numerous studies [10]. Some ABO phenotype studies show that genetically determined human ABO blood groups are associated with an increased risk of various infectious diseases. For example, individuals with blood group B were found to have increased cases of hypertension [11]. Furthermore, individuals with blood group A were found to be more susceptible to gastric cancer, pancreatic cancer, ovarian cancer, and breast cancer [12]. Blood groups A, B, and AB were found to have an increased risk for venous thromboembolism compared to blood group O individuals [10].

Although the etiology of peptic ulcers remains unclear. It was evident that the most common etiology of PUD is due to an infection with the superbug "*H. pylori*". In an interesting study by Vu C *et al.*, to evaluate the prevalence of *H. pylori* in peptic ulcer patients in a Singapore hospital, they found that prevalence was 68% among gastric ulcer patients, 85% among duodenal ulcer patients, and around 86% of people who had combined gastric and duodenal ulcers [13]. Another observation offered a substantial age-related prevalence, with people over 60 having high rates of approximately 60%, while people under 30 were found to have a lower incidence (10%) of *H. pylori* infection [14]. *H. pylori* usually infects the gastric epithelium and disturbs the epithelial junctions, causes DNA damage, apoptosis, and stimulates cytokine production [15]. Several virulence factors can contribute to further inflammation, such as urease, flagella, and blood group antigen-binding adhesin [16].

Studying the relationship between ABO blood groups and diseases such as PUD offers a significant clinical value, as it may help identify individuals at high risk for the condition and therefore help healthcare providers implement early diagnostic screenings [17]. This early detection could uncover mechanisms for preventing the development of disease or reducing its progression, ultimately reducing the overall burden, complication, and death rates linked to this condition [18].

Despite recent insights into the possible relationship between peptic ulcer disease and ABO blood groups worldwide, very limited studies have been established so far in Libya and those present are only focused on the prevalence of *H. pylori* infection among PUD patients. The aim of this study is to investigate the correlation between ABO blood groups and Libya patients with PUD, and assess if the increased incidence of PUD is influenced by other factors, such as sex and age. A second objective would be to determine the most prevalent type of peptic ulcer (gastric or duodenal) and evaluate the most common blood group in each type.

MATERIAL AND METHODS

Study subject and classification

A cross-sectional study was conducted in the period from August to September 2024 at Tripoli University Hospital, the faculty of medical laboratory technology at the University of Tripoli, and Almalath Laboratory.

A total of 150 participants were included in the study and divided into two groups; the first group (n=75) included PUD patients. The second group (n=75) included healthy individuals who served as the control group. Additional information was collected, such as age, sex, type of ulcer, and ABO blood group.

Population criteria

Inclusion criteria: confirmed PUD patients who had been diagnosed using endoscopy from both sexes aged 18-90.

Exclusion criteria: patients who had been diagnosed with other similar diseases, such as gastritis. Patients with esophageal ulcers were also excluded.

Sample collection and blood test

After receiving informed consent from participants, approximately 2 mL of venous blood was collected for each sample using vacutainer tubes containing ethylenediaminetetraacetic acid (EDTA) as an anticoagulant to maintain the integrity of the blood sample upon transportation to the laboratory unit. The blood group was determined using the slide agglutination method, where blood samples were collected and mixed with anti-A and anti-B monoclonal antibodies. If the agglutination reactions were observed in the "Anti-A" slide, this indicates blood type A. Blood group type B refers to agglutination in the "Anti-B" slide, and agglutination in both slides represents blood type AB. No agglutination in either slide indicates blood type O.

Data analysis

Data analysis was performed using IBM SPSS software (version 26.0). Descriptive statistics, including frequencies and percentages, were used to summarize the demographic characteristics of both patients and controls. Chi-square tests were conducted to assess associations between categorical variables such as gender, age group, and blood type distribution. The *p*-value of less than 0.05 was considered as statistically significant. Data entry and management were initially conducted using Microsoft Excel 2010 before being transferred to SPSS for statistical analysis.

RESULTS

A total of 150 participants that including 75 patients diagnosed with PUD and 75 healthy controls. Among the 75 enrolled patients, 58.7% were females and 41.3% were males, with an obvious preponderance of female subjects Figure 1. As for age groups, almost half (48.0%) of the patients fell within the 16 to 30-year age group Figure 2.

Notably, blood group O was the most prevalent blood group among patient samples at 50.7%, followed by group B at 22.7%, whereas the least prevalent blood group was group AB at 5.3% Figure 3.

PATIENT SUBJECTS

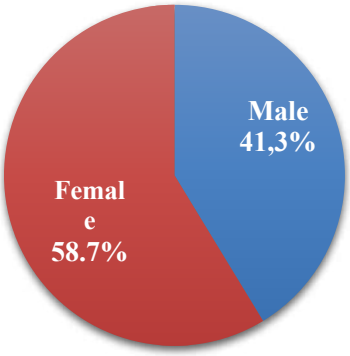

Figure 1: The distribution of gender in patient group

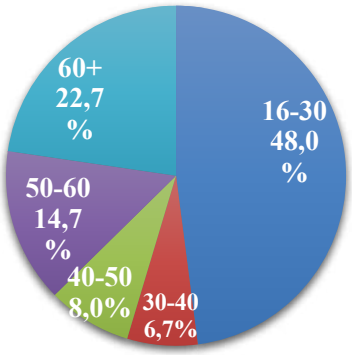

Figure 2: The distribution of age in patient group

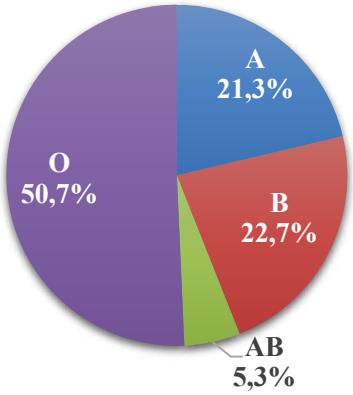

Figure 3: The distribution of the ABO blood groups in patient

On the other hand, the majorrity of the control group members were females (88.0%), whereas males were the least prevalent, at only 12.0% Figure 4.

Most of the controls were relatively younger, showing that 93.3% of them belonged to 16-30-year-olds Figure 5. Smaller percentages belonged to the other age groups Figure 5. Likewise, the highest number of samples belonged to blood group O (37.3%), followed by group A (33.3%). The blood group AB was the least frequent, with 5.3% Figure 6.

CONTROL SUBJECTS

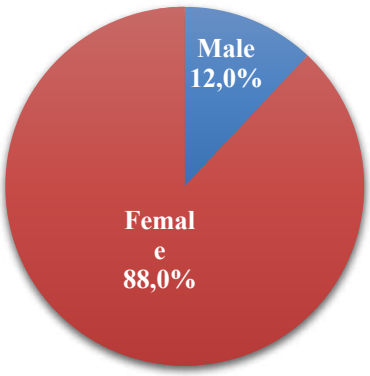

Figure 4: The distribution of gender in control group

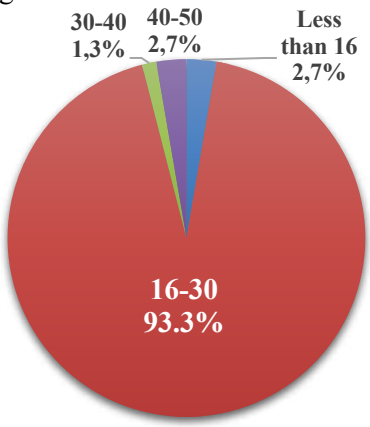

Figure 5: The distribution of age in control group

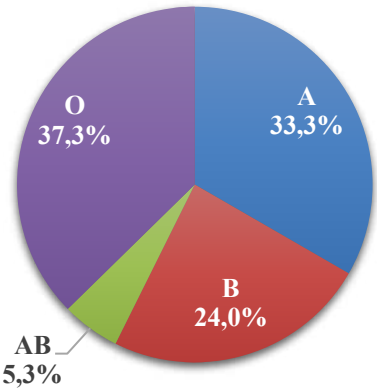

Figure 6: The distribution of the ABO blood groups in control group

In order to compare these percentages more precisely, a Chi-square test was applied. As shown in Table 1, a statistically significant difference was noted in the percentages of gender and age among patients and control subjects (p=0.000).

In terms of the distribution of the ABO blood groups, both PUD patients and controls had a majority of blood group O, 50.7% and 37.3% respectively. Despite this, no significant difference in blood group distribution was observed ($\chi^2 = 3.519$, p=0.318) Table 1.

Table 1: Comparison of gender, age group, and blood group distribution between patients and controls

Characteristic	Groups		Total	χ^2	P-value
	Patient	Control			
Gender					
Male	31 (41.3%)	9 (12.0%)	40 (26.7%)	16.500	**0.000***
Female	44 (58.7%)	66 (88.0%)	110 (73.3%)		
Age group					
Less than 16	0 (0.0%)	2 (2.7%)	2 (1.3%)	45.572	**0.000***
16-30	36 (48.0%)	70 (93.3%)	106 (70.7%)		
30-40	5 (6.7%)	1 (1.3%)	6 (4.0%)		
40-50	6 (8.0%)	2 (2.7%)	8 (5.3%)		
50-60	11 (14.7%)	0 (0.0%)	11 (7.3%)		
60 and above	17 (22.7%)	0 (0.0%)	17 (11.3%)		
Blood group					
A	16 (21.3%)	25 (33.3%)	41 (27.3%)	3.519	0.318
B	17 (22.7%)	18 (24.0%)	35 (23.3%)		
AB	4 (5.3%)	4 (5.3%)	8 (5.3%)		
O	38 (50.7%)	28 (37.3%)	66 (44.0%)		
Total	75 (50.0%)	75 (50.0%)	150 (100%)		

* $P < 0.05$ were considered as statistically significant.

Regarding the type of peptic ulcers, the majority of patients were diagnosed with gastric ulcers (64%), while 36.0% had duodenal ulcers, as shown in Figure 7.

In terms of blood group distribution for gastric ulcers Figure 8, blood group O was again the most prevalent, accounting for 45.8% of cases. Blood group B made up 25.0%, while blood group A accounted for 20.8%. A smaller percentage of gastric ulcer patients (8.3%) had blood group AB.

Similarly, for patients with duodenal ulcers Figure 9, blood group O was the most common, present in 59.3% of the patients. This was followed by blood group A at 22.2% and blood group B at 18.5%. Notably, none of the duodenal ulcer patients had blood group AB.

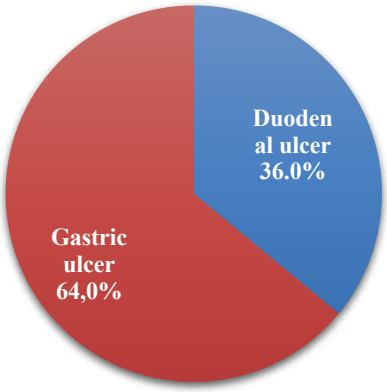

Figure 7: Distribution of ulcer types

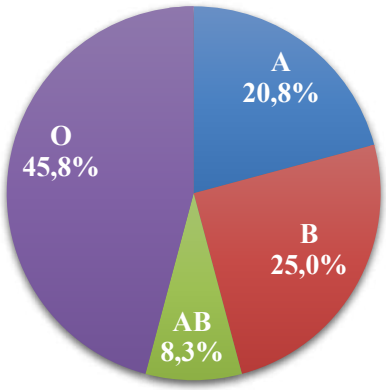

Figure 8: Distribution of blood types among gastric ulcer patients

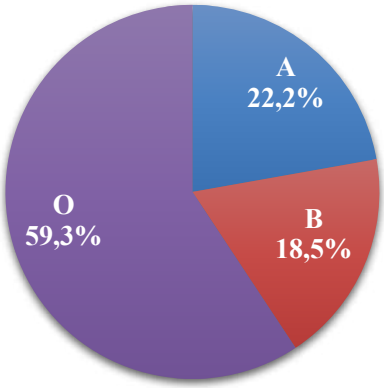

Figure 9: Distribution of blood types among duodenal ulcer patients

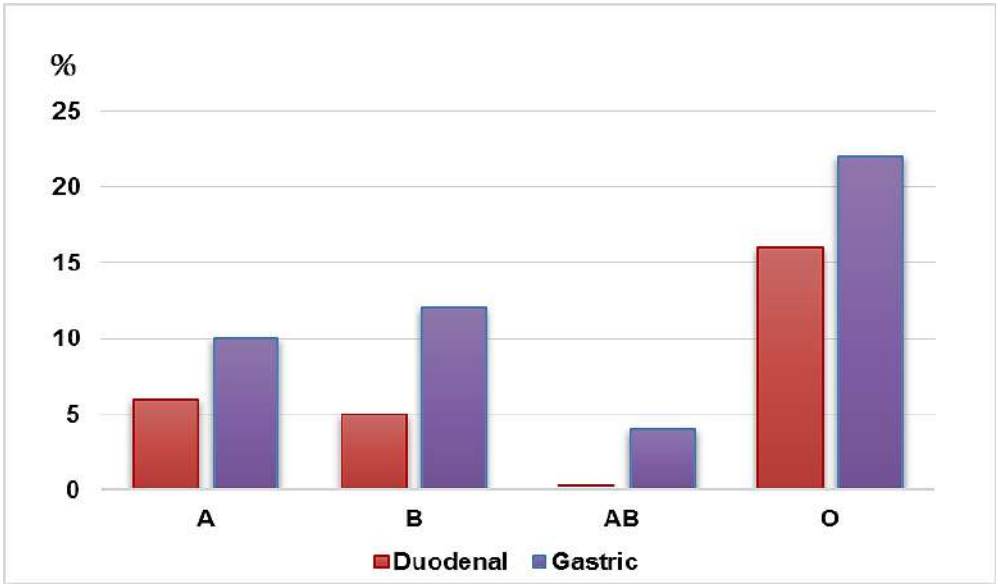

Figure 10: Comparison of blood group distribution by ulcer type (duodenal vs. gastric)

The blood group distribution for both gastric and duodenal ulcers was further displayed in Figure 10 as bar charts, confirming the prevalence of blood group O among gastric and duodenal patients. Precisely, the comparison between blood groups and ulcer types (gastric or duodenal) was analyzed by applying Chi-square tests Table 2. Unexpectedly, the chi-square test revealed no statistically significant relationship between blood groups and ulcer types (χ^2 = 3.201, p=0.362).

Table 2. Comparison of blood group distribution by ulcer types (gastric vs. duodenal)

Blood Groups	Type of ulcer		Total	χ^2	P-value
	Gastric	Duodenal			
A	10 (20.8%)	6 (22.2%)	16 (21.3%)	3.201	0.362
B	12 (25.0%)	5 (18.5%)	17 (22.7%)		
AB	4 8.3%)	0 (0.0%)	4 (5.3%)		
O	22 (45.8%)	16 (59.3%)	38 (50.7%)		
Total	48 (100.0%)	27 (100.0%)	75 (100.0%)		

DISCUSSION

The association between the ABO blood groups and PUD has been intensively investigated previously [10,12,19]. This study provides an evaluation of the extent of such associations in Libyan patients. In the present study, the distribution of ABO blood groups shows that blood group O (50.7%) was the most prevalent among patients with PUD Figure 3. However, this prevalence was not statistically significant when compared to controls (P=0.318) Table 1. Furthermore, our results showed a predominance of females in PUD patients (58.7%). Interestingly, most of the patients were between the ages of 16 and 30 years (48%). When these values were compared to controls, a significant correlation (p<0.05) was found between PUD and factors (gender and age) (Table 1). With regard to ulcer types, gastric ulcer was the most common type compared with duodenal ulcer, 64% and 36% respectively. In addition, the blood group O was the most prevalent in both types, with a percentage of 45.8% for gastric ulcer and 59.3% for duodenal ulcer Figure 10. Nevertheless, these frequencies between ABO blood groups and ulcer types showed no statistically significant difference (P=0.362) Table 2.

The prevalence of blood group type O among PUD patients in our study was consistent with other studies conducted by Teshome *et al.*, Almorish *et al.*, and Edgren *et al.* [19-21]. In fact, to our knowledge, we did not find any research that conflicted with our findings to date. Blood group O predominance may be explained due to the H type 2 antigen (which is the O blood group antigen) being an important receptor for *H. pylori*, according to Alkout *et al.* [22]. Other studies, however, suggested that the Lewis b antigen may also contribute to the attachment of *H. pylori*, as reported by Borén *et al.* [23]. This antigen in particular is highly expressed in the stomach lining of individuals of blood group O [24]. It was speculated that binding of H type 2 antigen to *H. pylori* can trigger the release of high levels of interleukin-6 (IL-6) and tumor necrosis factor (TNF)-α, thereby potentially increasing the risk of developing peptic ulceration [25].

In previous work conducted by Abdulridha M. K. in 2013, it was shown that blood group O is the most common among PUD, and this observation was statistically associated [26]. Conversely, our statistical analysis did not show a significant correlation between PUD and blood group O. Indeed, the conflicts with Abdulridha's data were envisaged to be attributed to the variation in sample size (150 vs 344) or sample type, as our control samples were collected from students of the school laboratory department.

For the distribution of subjects according to gender, our research showed a statistically significant association between gender and PUD Table 1. There was an increase in female PUD patients (59%) compared with male patients (41%), contradicting an earlier observation that found males were more prevalent among PUD [19]. This variation in results could be due to females are more vulnerable to peptic ulceration than males [27]. A previous study conducted by Kurata and his colleagues has given insight into the pattern of ulcer disease frequency in males and females, and showed ulcer prevalence rates for females have increased compared to males [28]. This may be attributed to females having a higher life expectancy, which as a consequences increase their chances of developing the disease [29].

As for age and its association with PUD, the present study revealed a significant association between age and PUD. Furthermore, we noticed that individuals aged 16 to 30 are more prone to PUD than the older age groups Table 1. This finding was actually inconsistent with Abdulridha's data, who showed that older patients were more susceptible [26]. It could be argued that the high frequency (48%) of PUD younger patients in our study could be explained by dietary practices that can increase the risk of ulceration; for example, the consumption of *H. pylori* contaminated fast food among Libyan young adults, and the increased rates of psychological stress among this age group.

Despite these observations, other studies have suggested that there was no significant difference in age proportions between PUD patients [20].

It has been speculated that there is a possible existence of a relationship between the types of peptic ulcer and ABO blood groups. Gastric ulcer was the most prevalent in our study, with a percentage of 64.0%, which was inconsistent with another study where duodenal ulcer was more prevalent [19]. This can be explained by the fact that different strains of *H. pylori* can cause different types of peptic ulcers [30]. In this study, although no statistical significance was noticed between both types of ulcers in respect to ABO blood group distribution (P=0.362), the blood group O clearly was the most common in both gastric and duodenal ulcers. Abdulridha Iraqi study was in agreement with our finding at this point [26], while another study showed no indication of any difference in ABO frequencies between gastric and duodenal ulcers [20].

CONCLUSION

Although PUD trended as more prevalent among patients with blood group type O, this study showed no significance of association between blood ABO blood group and PUD. Furthermore, no association was obtained between ABO blood group and ulcer types. However, we can conclude that both age and gender are probably risk factors for PUD. This finding highlights the alarming consumption of fast foods and low intake of fresh vegetables in our community, which may increase the chance of having *H. pylori* and enhance the severity of gastric ulceration. Further investigations are required to explore additional insight into the correlation between blood group antigens and PUD. For instance, the collection of much larger samples from different Libyan districts may be necessary to achieve a precise conclusion.

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