WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.045
Volume 4, Issue 4, 173-186. Research Article ISSN 2277– 7105

H. PYLORI INFECTION ACCORDING TO ABO PHENOTYPE AND RH FACTOR AMONG IRAQI PATIENTS WITH PUD

Rana H. Kutaif[1*], Yassir M. Kamal Al Mulla Hummadi[2] and Akram A. Najeeb[3]

[1*]Department of Clinical Pharmacy/College of Pharmacy/Al-Mustansiriya University, Iraq.

[2]Department of Pharmacology and Toxicology/College of Pharmacy/ Al-Mustansiriya University, Iraq.

[3]Consultant gastroenterologist (FICMS GE), consultant physician (FICMS), Department of Medicine , Al kindey College of Medicine/ Baghdad University, Gastroenterology and Hepatology Unit. Medical City, Baghdad, Iraq.

Article Received on
20 Jan 2015,

Revised on 13 Feb 2015,
Accepted on 08 Mar 2015

***Correspondence for Author**
Dr. Rana H. Kutaif
Department of Clinical Pharmacy/College of Pharmacy/Al-Mustansiriya University, Iraq.

ABSTRACT

The correlation between *Helicobacter pylori* (*H. pylori*) infection and ABO phenotypes have been widely evaluated in peptic ulcer disease in the past. But data concerning the same evaluation are very limited in Iraq. The aim of this study was to determine the relationship between ABO blood groups and Rh factor and *H. pylori* in patients with peptic ulcer disease in Iraq. A prospective case controlled study was carried on 112 patients (45 female and 67 male; age range 15-77 years) who had peptic ulcer disease, 84 patients were positive for *H. pylori* infection confirmed by (histology and stool antigen test) while 28 patients were negative for *H. pylori*. Blood samples were used for ABO phenotyping and Rh factor. Biopsy for histopathology was taken from all patients. The results showed that patients with blood groups O were more prone to *H. pylori* infection than patients with other blood groups with high significant difference ($p< 0.01$), while patients with blood groups A had lower rate of infection compared to other blood groups with high significant difference ($p< 0.01$). The percentage of *H. pylori* positive in peptic ulcer disease patients was (96.43%) versus (3.57%) in Rh (+) and Rh (-) respectively. whereas the percentage of *H. pylori* negative was (92.86%) versus (7.14%) in Rh (+) and Rh (-) respectively without statistical difference ($P>0.05$). Males are more prone to *H. pylori* infection in all blood groups than females with highly significant ($P< 0.01$). On conclusion; the results of this study demonstrate that *H. pylori*

infection can be related to ABO blood group in peptic ulcer disease patients. People of blood group O are more prone to develop infection related ulcer. Male are more susceptible to infection than female in different ABO phenotypes.

KEYWORDS: *H. pylori*; peptic ulcer disease*;* duodenal ulcer; gastric ulcer; ABO blood groups; ABO phenotype; Rh factor.

INTRODUCTION

Peptic ulcer is the most common disease in the gastrointestinal tract with symptoms of nausea, vomiting, and abdominal pain, and sometimes causes bleeding and perforation with acute peritonitis.[1] Approximately 70% of gastric ulcer (GU) patients and 90% of duodenal ulcer (DU) patients are associated with *H. pylori* (*H. pylori*) infection.[1-3]

H. pylori infection is the most common chronic bacterial infection around the world.[4] It has been shown that 50% adult in developed countries and 90% adults in developing countries were positive of serum antibodies against *H. pylori*.[5] The critical period at which *H. pylori* is acquired, is during the childhood, especially in the developing countries and areas of overcrowding and socioeconomic deprivation.[6] In Iraq, the prevalence of this infection in adults has been reported to be approximately 74-77%.[7-8]

This bacterium is Gram-negative bacillus, spiral- shaped and flagellated that appears to inhabit the mucous layer overlying the gastric epithelial cells in humans.[9]. Chronic *H. pylori* infection may be associated with chronic gastritis, peptic ulcer disease (PUD), mucosal associated lymphoid tissue (MALT) lymphoma and gastric adenocarcinoma.[10]

The relationship between blood group antigens and PUD had been evaluated in the past.[11] It has been known that individuals with blood group O phenotype have higher risk of developing duodenal ulcers. Similarly, gastric carcinoma was found to be associated with blood group A, but no explanation for this condition was found.[4,11] In 1993, Boren *et al*. reported that people with blood group O had more *H. pylori* receptors, and Lewis b antigens mediated the attachment of *H. pylori* to the gastric mucosa.[12] On the other hand, in some studies was reported an absence of correlation between *H. pylori* infection and ABO blood groups.[13- 14]

1.1 Aim of the Study

To evaluate the relationship between ABO blood groups and Rh factor and *H. pylori* infection in patients with (PUD) in Iraq.

2. PATIENTS AND METHODS

2.1 Patients

This is a prospective case control study performed on newly diagnosed patients with PUD (male and female), who attended the Endoscopy Unit of Baghdad Teaching Hospital /Medical City from April 2013 to August 2014 and in clinic of gastroenterologist. Patients were selected by a consultant gastroenterologist**.** Patients were registered in the study after signing a written informed consent; the study was agreed by the Ethical Committee of the hospital. Data were collected through direct interview with the patient with the following inclusion criteria: patients aged 15-77 years, patients with peptic ulcer (DU or GU) confirmed by endoscopy and positive for *H. pylori* by (histological examination and stool antigen test). The exclusion criteria were smoking or history of smoking, alcohol consumption, nonsteroidal anti-inflammatory drugs (NSAIDs) use, gastric cancer, severe gastroesophageal reflux disease, or history of gastric operation and lactating or pregnant women. According to these criteria 112 patients who presented with symptoms of PUD and showed positive endoscopic examination of PUDs, 84 patients showed evidence of *H .pylori* by histology and stool antigen test (which used to specify the presence of *H. pylori*) and 28 patients were *H. pylori* negative confirmed by two methods (histological examination and stool antigen test).

Table (1): Chemicals, Drugs and their suppliers.

Chemicals	Suppliers
Nexieum® (Esomeprazole20mg)	AstraZeneca, Sweden
Amoxicillin + clavulanic acid (Co- amoxil 1g)	Mepha, Switzerland
Clarithromycin 500mg	Actavis, Uk
Anti ABO and Anti-D monoclonal kit	Spinreact, Spain
H. pylori Antigen rapid test device (feces)	ABON Biopharm (Hangzhou), China
Formalin (10%)	NTN-NEN-TKCH-LTD, Britin

Table (2): Instruments and Equipment used in this study and their suppliers.

Instruments	Suppliers
Endoscope and forceps	Olympus , Japan
Disposable syringes (2ml)	Bromed, U.S.A
Container 60 ml	Dolphi , Jordan
Plain tube 10ml	Plastic lab, Lebanon
Microscope slides	Sail brand, China

2.2 Diagnosis of *H. pylori* Infection (Sample Collection)

2.2.1 Diagnosis of peptic ulcer disease

The endoscopic examination was performed to verify the diagnosis of PUD; distinguish between the gastric ulcer and duodenal ulcer and to take a biopsy from the ulcer.

All participants were known cases of peptic ulcers with positive *H. Pylori* infection confirmed by histology[15-16] and stool antigen test.[17-18]. Patients were considered to be *H. pylori* infected if two tests were positive.

2.2.2 Sample collection

2.2.2.1 Biopsy samples

Three gastric antral biopsy specimens were taken from each patient because *H. pylori* is not evenly distributed throughout the gastric mucosa.[19] Biopsy specimen was fixed in 10% formalin for histopathological investigation.[20] Tissue samples were dehydrated, infiltrated then embedded in paraffin wax, sectioned and stained with haematoxylin and eosin (H×E). Modified Giemsa stain was used to identify *H. pylori*.[21-22] Sections were then examined by two experienced histopathologist in Baghdad Teaching Labs. The pathologist characterized the presence of spiral bacteria in the superficial mucous layer or along the luminal surface of the gastric epithelial cells as a positive test.

2.2.2.2 Blood samples

Peripheral blood samples were collected from each patient after endoscopy. One milliliter of venous blood was drawn from the patients using 2mls syringe. ABO phenotypes and Rh factor evaluations were carried out by standard hemagglutination assays.[23- 24] Manufactured by Spinreact, Spain.

2.2.2.3 Stool sample

Fecal specimens were collected; in clean dry dish; from each patient before and after treatment. The test employs monoclonal antibodies specific for *H. pylori* antigens to

selectively distinguish *H. pylori* antigen in human fecal specimens, according to "the technique of *H. pylori* Antigen Test Device (feces)".[17,25] Manufactured by ABON Biopharm (Hangzhou), China.

2.2.3 Statistical Analysis

Data were analyzed using SAS 2012 (Statistical Analysis System), User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA. Chi-square test was utilized to compare between the results of the studied parameters among different patients groups. Values with $P<0.05$ were considered to be significant.

RESULTS AND DISCUSSION

In this study, the positivity for *H. pylori* infection was present in 84/112 (75%) and absent in 28/112 (25%) of PUD patients by (histological examination and stool antigen test).

3.1 Age distribution in peptic ulcer disease patients (*H. pylori* positive and negative) according to ABO phenotypes.

The mean age of *H. pylori* negative patients higher than the mean age *H. pylori* positive patients in different blood group, but there was no statistical significant difference, as shown in table (3) & figure (1). In spite of the small number of patients enrolled in this research, the result showed that the distribution of mean age in all blood groups is not affected by *H. pylori* infection. Comparable findings has been found by Bayan *et al.*(2009**)** on larger numbers of patients, suggesting that the distribution of the mean age of patients among different blood groups was similar in *H. pylori* infected PUD patients.[11]

Table (3): Age distribution in peptic ulcer disease patients (*H. pylori* positive and negative) according to ABO phenotypes.

ABO phenotypes	Age (years)		P-value
	H. pylori +ve	*H. pylori* -ve	
A	40.51±2.54	43.72 ± 2.19	0.266 NS
O	39.07±1.66	45.75 ± 3.47	0.137 NS
B	40.08±1.75	45.16 ± 2.07	0.238 NS
AB	37.24±2.14	40.33 ± 1.27	0.297 NS
Total	39.11±1.78	43.74 ± 2.62	0.297 NS

Data are presented as mean± SE: age; NS**:** Non-significant

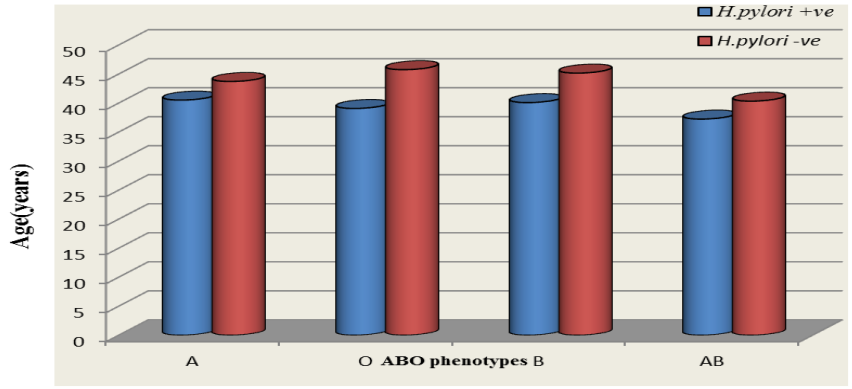


Figure 1: Age distribution in PUD patients (*H. pylori* positive and negative) according to ABO phenotypes

3.2 Gender distribution in peptic ulcer disease patients (*H. pylori* positive and negative) according to ABO phenotypes.

Table (4) showed a higher percentage of *H. pylori* positive than *H. pylori* negative among male patients in different ABO phenotypes, highly significant (P< 0.01) was found. This result is consistent with previous study by Jafarzadeh *et al.*(2007), who reported a significantly higher percentages of *H. pylori* positive in male with blood group A compared to females (p<0.05). The prevalence of *H. pylori* positive was also higher in male PUD patients with other blood groups O and B but was not significant compared to females.[26] These finding were also in agreement with that reported previously by Sasidharan *et al.* (2009), reported that chinese males with blood group B had a significantly higher prevalence than Chinese females of the same blood group (P= 0.03).[27] These observations may account for the higher prevalence of peptic ulcer in the male gender.[26] However, some studies have found a higher prevalence of *H. pylori* infection in males, which may be related to higher exposure to potential environmental sources of infection.[10]

Table (4):- Gender distribution in peptic ulcer disease patients (*H. pylori* positive and negative) according to ABO phenotypes.

ABO Gender phenotypes	*H. pylori* +ve n %	*H. pylori* –ve n %	Chi-square value- χ^2
F	8/24 (33.33)	6/11 (54.55)	9.347 **
A			
M	16/24 (66.67)	5/11 (45.45)	
F	12/32 (37.50)	4/8 (50.00)	8.281 **
O			

M	20/32 (62.50)	4/8 (50.00)	
F **B** **M**	6/16 (37.50) 10/16 (62.50)	3/6 (50.00) 3/6 (50.00)	9.693 **
F **AB** **M**	4/12 (33.33) 8/12 (66.67)	2/3 (66.67) 1/3 (33.33)	9.250 **
F **Total** **M**	30/84 (35.71) 54/84 (64.29)	15/28 (53.57) 13/28 (46.43)	8.410 **

Abbreviation F: female; M: male; Data presented as number and percentage (%);** high significant (P< 0.01).

3.3 Distribution of *H. pylori* positive and negative in patients with peptic ulcer disease according to ABO phenotypes.

The percentage of blood group O in the infected patients was higher than other blood groups and higher percentage of blood group A in the uninfected patients is high significant (P< 0.01) as shown in table (5) & figure (2). These finding was similar to that previously reported by Mattos *et al.*(2002); who demonstrated a higher prevalence of blood group A among the uninfected and blood group O in infected PUD patients in Brazil population.[28] A recent study of Ryberg *et al.* (2013), who found positive associations between the presence of blood group O and *H. pylori* infection in PUD in Swedish population.[29] Furthermore, these results may be reinforced by data obtained from other researchers showing a greater susceptibility of blood group O patients to *H. pylori* infection.[30-32,2] Pervious study by Lin et al. (1998), demonstrated a high frequency of infection with this bacteria in 90.3% of blood group O patients suffering from gastroduodenal diseases.[33]

Individuals with blood group O were found to be more susceptible to PUD for decades without known cause until the relationship between Lewis b antigens and the attachment of *H. pylori* to gastric mucosa was observed.[12] This evidence was further supported by Alkout *et al.*(2000), who demonstrated that H-antigen, expressed on the gastroduodenal cells, acted

as a receptor for *H. Pylori*.[34] This fucosylated antigen (H antigen) is not modified to A or B antigens in blood group O, which points to the fact that there is a positive correlation between blood group O and the infections caused by *H. Pylori*.[32]

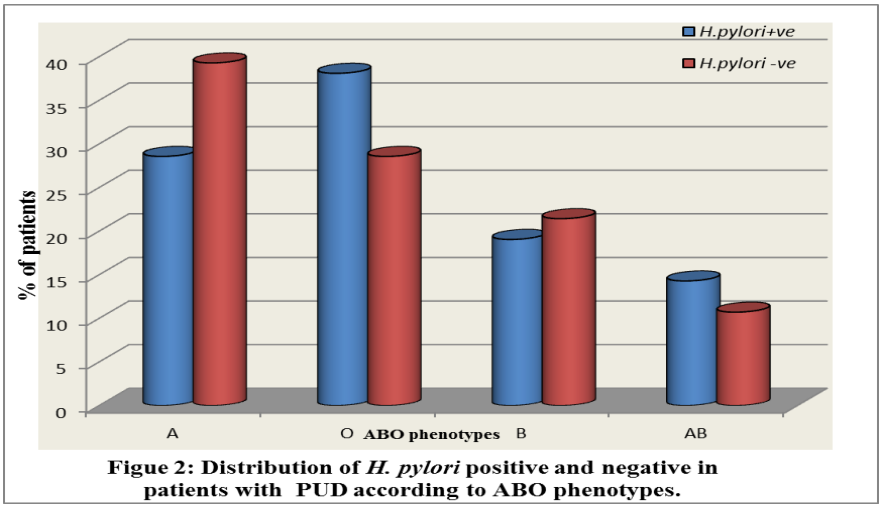
The increased susceptibility of blood group O persons to peptic ulcer[34] might be partly due to blood group O individuals express a higher inflammatory responses to *H. pylori* with higher levels of lymphocyte infiltration in the gastrointestinal mucosa[35], a lower level of Von Willebrand's factor (VWF)[36], higher density of colonized *H. pylori*[37], and a higher frequency of secretor status.[35] All these together, may explain these individuals' increased susceptibility to peptic ulceration. However, Bhuiyan *et al.* (2009) also showed that blood group A is found to be related with *H. Pylori* infection.[38] Kanbay *et al.* (2005), have earlier demonstrated that *H. Pylori* infection is related to both O and A blood group type, and a negative relation with AB group.[4] On the contrary, only few studies have demonstrated that blood group O do not represent a risk factor for *H. pylori* infection.[13-14]

Table (5):- Distribution of *H. pylori* positive and negative in patients with peptic ulcer disease according to ABO phenotypes.

	ABO phenotypes					
H. pylori	**A n %**	**O n %**	**B n %**	**AB n %**	**Total n %**	**Chi-square value- χ^2**
***H. pylori* +ve**	24 (28.57)	32 (38.10)	16 (19.04)	12 (14.29)	84 (75.00)	9.462 **
***H. pylori* -ve**	11 (39.29)	8 (28.57)	6 (21.43)	3 (10.71)	28 (25.00)	9.462 **

Data presented as n: number and percentage (%); ** ($p < 0.01$) high significant

**H. pylori* documented according to (histology and stool antigen).



Figue 2: Distribution of *H. pylori* positive and negative in patients with PUD according to ABO phenotypes.

3.4 Distribution of *H. pylori* positive and negative in peptic ulcer disease patients according to Rh factor.

Besides, Rhesus (Rh) positivity was seen in (96.43%) of patient with *H. pylori* positive group and (92.86%) of patients with *H. pylori* negative group. Rh positivity was also higher in the patient *H. pylori* positive group than in negative group but the results showed no significant correlation of Rh factor with *H. pylori* infection as shown in table (6) & figure (3). This finding agree with recent study of Valliani *et al.*(2013), who demonstrated that the presence of *H. pylori* did not correlate to the Rh factor in Pakistani population.[32] Similar results were also reported by other studies.[11, 31, 14]

Table (6):- Distribution of *H. pylori* positive and negative in peptic ulcer disease patients according to Rh factor

Rh factor	*H. pylori* +ve n %	*H. pylori* –ve n %	Chi-square value- χ^2
Rh+	81 (96.43)	26 (92.86)	0.872 NS
Rh-	3 (3.57)	2 (7.14)	0.872 NS
Total	84	28	----

Data presented as number and percentage (%); NS**:** Non-significant.

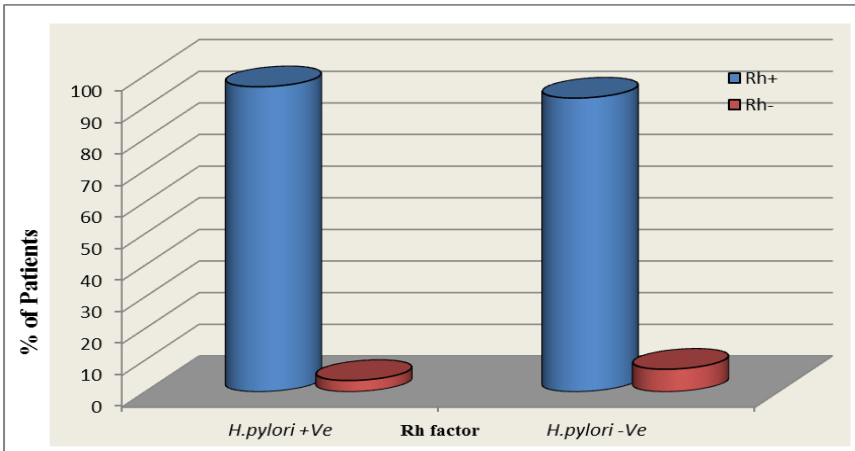


Figure 3: Distribution of *H. pylori* positive and negative in PUD patients according to Rh factor

3.5 Distribution of gastric and duodenal ulcers according to ABO phenotypes.

The higher incidence of gastric ulcer (GU) was (58.33%) in blood group A when compared with other blood groups ($p < 0.01$), while a higher incidence of duodenal ulcer (DU) was (81.25%) in blood group O when compared with other blood groups in patients with *H. pylori* positive($p < 0.01$) as shown in table (7) & figure (4). These findings agree with previous

studies which showed that DUs were associated with blood group O, while GUs and gastric carcinoma were associated with blood group A.[39-41] This may be due to DU were associated with acid hypersecrtion, these cases were marked in patients with blood group O, while GU in the body of the stomach occurring in patients in which their duodenum was normal, were characterized by acid hyposecretion and this marked in patients with blood group A, the cause that blood type A is most likely to have gastric cancer.[42]

Table (7):- Distribution of gastric and duodenal ulcers according to ABO phenotypes.

ABO phenotypes	Patients number	Endoscopic findings	
		DU	GU
		N %	N %
A	24	10 (41.67)	14 (58.33)
O	32	26 (81.25)	6 (18.75)
B	16	11 (68.75)	5 (31.25)
AB	12	6 (50.00)	6 (50.00)
Chi-square value x^2	---	10.552 **	10.552 **

Data presented as n: number and percentage (%); ** ($p< 0.01$) high significant

DU: duodenal ulcer; GU: gastric ulcer

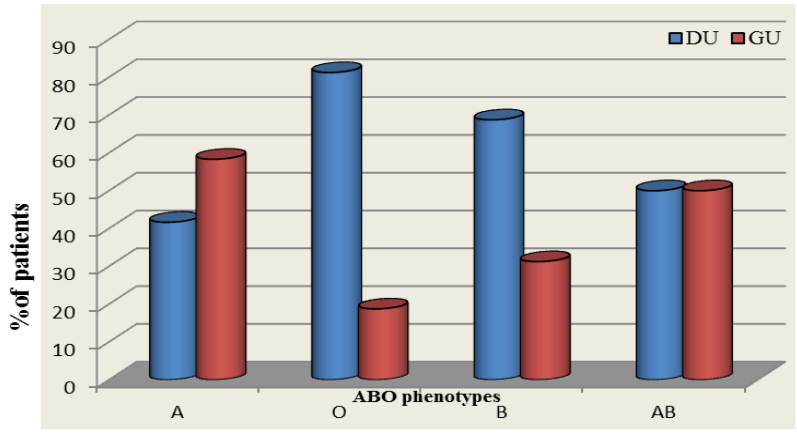


Figure 4: Distribution of gastric and duodenal ulcers according to ABO phenotypes

CONCLUSION

The results suggest that *H. pylori* infection is strongly associated with the blood group O, and it did not correlate to the Rh factor in patients with PUD in Iraq population, which is in agreement with other published data.

REFERENCES

1. Tanikawa C, Matsuo K, Kubo M. Impact of PSCA Variation on Gastric Ulcer Susceptibility. PLOS ONE, 2013; 8(5): e63698.
2. Martins LC, de Oliveira Corvelo TC, Oti HT, et al. ABH and Lewis antigen distributions in blood, saliva and gastric mucosa and H pylori infection in gastric ulcer patients. World J Gastroenterol, 2006; 12(7): 1120-4.
3. Stenstrom B, Mendis A and Marshall B. H. pylori-the latest in diagnosis and treatment. Aust. Fam. Physician, 2008; 37(8): 608-12.
4. Kanbay M, Gür G, Arslan H, et al. The relationship of ABO blood group, age, gender, smoking, and H. pylori infection. Dig Dis Sci, 2005; 50(7): 1214-7.
5. Wu TC, Chen LK and Hwang SJ. Seroprevalence of H. pylori in school-aged Chinese in Taipei City and relationship between ABO blood groups. World J Gastroenterol, 2003; 9: 1752-5.
6. Moayyedi P, Axon AT, Feltbolwer R, et al. Relation of adult lifestyle and socioeconomic factors to the prevalence of H. pylori infection. Int J Epidemiol, 2002; 31: 624-31.
7. Al-Windi A, Hussain AH and Salih N. Seroprevalence of anti-H. pylori antibodies in population of Sulaimani governorate/Kurdistan Region/Iraq. Journal of Zankoy Sulaimani- Part A, 2013; 15(3): 175-185.
8. Hussein NR, Robinson K and Atherton JC. A study of age-specific H. pylori seropositivity rates in Iraq. Helicobacter, 2008; 13(4): 306-7.
9. Javed M, Amin K, Muhammad D, et al. Prevalence of H. Pylori. Professional Med, 2010; 17(3): 431-439.
10. Tadege T, Mengistu Y, Desta k, et al. Seroprevalence of H. pylori Infection in and its Relationship with ABO Blood Groups. Ethiop J Health Dev, 2005; 19(1): 56-60.
11. Bayan K, Tózón Y, Yilmaz S, et al. Clarifying the relationship between ABO/Rhesus blood group antigens and upper gastrointestinal bleeding. Dig Dis Sci, 2009; 54: 1029-34.
12. Borén T, Falk P, Roth KA, et al. Attachment of H. pylori to human gastric epithelium mediated by blood group antigens. Science, 1993; 262: 1892-1895.
13. Keramati MR, Sadeghian MH, Ayatollahi H, et al. Role of the Lewis and ABO Blood Group Antigens in H. pylori Infection, Malays J Med Sci, 2012; 19(3): 17-21.
14. Petrović M, Artiko V, Novosel S, et al. Relationship between H. pylori infection estimated by 14C-urea breath test and gender, blood groups and Rhesus factor. Hell J Nucl Med, 2011; 14(1): 21-4.

15. Hajime I, Kenichiro I, Saburo S, et al. Five minute endoscopic urea breath test with 25mg of C13-urea in the management of H. pylori infection. Eur. J. Gastroenterol. Histopathol, 2002; 14(10): 1093-1100.
16. Patel SK, Pratap CB, Verma AK, et al. Pseudomonas fluorescens-like bacteria from the stomach: a microbiological and molecular study. World J. Gastroenterol, 2013; 19(7): 1056–1067.
17. Marshall BJ, McGechie DB, Rogers PA, et al. Pyloric Campylobacter infection and gastroduodenal disease. Med. J. Aust, 1985; 149: 43944.
18. Cutler AF. Testing for H. pylori in clinical practice. Am. J. med, 1996; 100: 35S.
19. Abo-Shadi MA, El-Shazly TA and Al-Johani MS. Clinical, Endoscopic, Pathological and Serological Findings of H. pylori Infection in Saudi Patients with Upper Gastrointestinal Diseases. British Journal of Medicine & Medical Research, 2013; 3(4):1109-1124.
20. Abdulqawi K, El-Mahalaway A, Abdelhameed A, et al. Correlation of serum antibody titres with invasive methods for rapid detection of H. pylori infections in symptomatic children. Int Exp Pathol, 2012; 93(4): 295-304
21. Lai Y, Yang J and Huang S. Pretreatment urea breath test results predicts the efficacy of H. pylori eradicate in patients with active duodenal ulcer. World. J. Gastroenterol, 2004; 10: 991-994.
22. Patnayak R, Reddy V, Jena A, et al. Utility of immunohistochemistry in demonstrating H. pylori. Oncology Gastroenterology and Hepatology, 2015; 4(1): 4-7.
23. Jones, Scott ML and Voak D. Monoclonal anti-D specificity and Rh D structure: criteria for selection of monoclonal anti-D reagents for routine typing of patients transfusion. Medicine, 1995; 5: 171-184.
24. British Committee for standards in Haematology, Blood Transfusion Task force. Recommendations for evaluation, validation and implementation of new techniques for blood grouping, antibody screening and cross matching. Transfusion Medicine, 1995; 5: 145-150.
25. Soll AH. Pathogenesis of peptic ulcer and implications for therapy. New England J Med, 1990; 322: 90916.
26. Jafarzadeh A, Ahmedi-Kahanali J, Bahrami M, et al. Seroprevalence of anti-H. pylori and anti-CagA antibodies among healthy children according to age, sex, ABO blood groups and Rh status in south-east of Iran. Turk J Gastroenterol, 2007; 18(3): 165-71.

27. Sasidharana S and Uyuba A. Prevalence of H. pylori infection among asymptomatic healthy blood donors in Northern Peninsular Malaysia. Trans R Soc Trop Med Hyg, 2009; 103(4): 395.
28. Mattos LC, Cintra JR, Sanches FE, et al. ABO, Lewis, secretor and non-secretor phenotypes in patients infected or uninfected by the H. pylori bacillus. Sao Paulo Med J/Rev Paul Med, 2002; 120(2): 55-8.
29. Ryberg A, Petersson F, Redeen S, et al. Host Gene Polymorphisms in Relation to H. pylori Infection and Associated Diseases in a Population Based Cohort. Gastroenterology Research, 2013; 6(6): 207-218.
30. Hassoon WA, Melconian AK and AL-Safar JM. Study the Relationship between Hemodialysis (HD) Patients and Their ABO Blood Grouping as Well as Screening of Hemodialysis Access-related Bacterial Infections. Journal of Biological Sciences, 2013; 5(6): 291.
31. Jaff MS. Relation between ABO blood groups and H. pylori infection in symptomatic patients. Clin Exp Gastroenterol, 2011; 4: 221-6.
32. Valliani A, Khan F, Ahmed B, et al. Factors Associated with H. pylori Infection, Results from a Developing Country-Pakistan. Asian Pac J Cancer Prev, 2013; 14(1): 53-56.
33. Lin CW, Chang YS, Wu SC, Cheng KS. H. pylori in gastric biopsies of Taiwanese patients with gastroduodenal diseases. Jpn J Med Sci Biol, 1998; 51(1): 13.
34. Alkout AM, Blackwell CC, Weir DM, et al. Isolation of a cell surface comonent of H. pylori that binds H type 2, Lewis a and Lewis b antigens. Gastroenterology, 1997; 112: 1179–1187.
35. Jaff MS. Higher frequency of secretor phenotype in O blood group – its benefits in prevention and/or treatment of some diseases. Int J Nanomedicine, 2010; 5: 901–905.
36. Franchini M, Capra F, Targher G, et al. Relationship between ABO blood group and von Willebrand factor levels: from biology to clinical implications. Thromb J, 2007; 5: 14.
37. Atherton JC, Tham KT, Peek RM, et al. Density of H. pylori infection in vivo as assed by quantitative culture and histology. J Infect Dis, 1996; 174: 552-556.
38. Bhuiyan TR, Qadri F, Saha A, et al. Infection by H. pylori in Bangladeshi children from birth to two years: relation to blood group, nutritional status, and seasonality. Pediatr Infect Dis J, 2009; 28: 79-85.
39. Garratty G. Blood groups and disease: a historical perspective. Transfus Med Rev, 2000; 14(4): 291–301.

40. Smith AW, Aathithan S, Power EG, et al. Blood group antigens and H. pylori infections. Lancet, 1994; 343: 543.
41. Edgren G, Hjalgrim H, Rostgaard K, et al. Risk of Gastric Cancer and Peptic Ulcers in Relation to ABO Blood Type: A Cohort Study. American Journal of Epidemiology, 2010; 172: 1280–1285.
42. Dkeet A. C: Gastric ulceration and Pyloric Sphincteric cylinder; The pyloric Sphincteric cylinder in Health and disease , 4th edition;1998 ch29, p138.