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Seroprevalence study of IgG anti CagA& IgA anti *H.Pylori* and their relationship to blood groups in Erbil city

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Abstract

Background and objective: *Helicobacter pylori* is a worldwide bacterial pathogen that associated with increasing risk of gastritis peptic ulcer and gastric adenocarcinoma. Especially strains harbor cytotoxin associated gene A (CagA) which classified by WHO in the category of class 1 carcinogen. The study designed to assess seroprevalence of anti-Cag A IgG & anti-*H.pylori* IgA antibodies among asymptomatic GIT free manifestations among adult & children in Erbil /Kurdistan region. Linkage between seropositive *H.pylori* infection & ABO blood group, age, gender & smoking, were also verified.

Methods: A total to 369 blood samples were collected from adult & child participant free of Gastrointestinal diseases. The sera were screened for anti- CagA IgG & anti -H pylori IgA antibody using ELISA assay. Further, the samples were subjected to ABO blood grouping using hemagglutination test. The result was statistically analyzed using chi-square test.

Results: Seroprevalence of IgG anti-cagA positivity was 41.5% among adult which was significantly (P <0.001) higher than the frequency among children (22.1%). For IgG anti-*H pylori*, the prevalence was significantly (P <0.001) higher among adults than children (44.9% vs 14.4% respectively). The seroprevalence of mixedpositive IgG & IgA anti- *H pylori* antibodies was 28.7% among adults and 13.5% among children (P = 0.002). The rate of IgG & IgA seropositivity was higher among adult & children with Blood-group (O) although no significant association was detected.

Conclusion: The findings of the present study suggest that anti-CagA IgG & Ig A seropositivity may correlate with infection by CagA-positive *H. pylori* strains, based on serological data alone. Therefore, this marker can be considered a useful non-invasive screening tool when molecular characterization of the CagA gene is unavailable, though direct genotyping the gold standard. Blood group type O was predominant among participant seropositive for anti- CagA IgG antibodies. The alarming finding in this study was the very high titers of anti-CagA IgG (>150) among the screened participant, which might be a risk factor for increased risk of gastric cancer.

Keywords: *Helicobacter Pylori,* IgG anti-CagA, IgA anti - *H.pylori.*

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Introduction

Helicobacter pylori is a gram- negative spiral- shape bacterium and worldwide 50% of peoples get infected (1). Infection with *H.pylori* is mainly established in childhood period and persisted for the life of the host (2). The prevalence rate of infection of *H.pylori* positively associated with age, low socioeconomic status and geographical location (3). Clinically, the spectrum of diseases correlated with *H.pylori* includes peptic & duodenal ulcer, autoimmune gastritis, gastric cancer, vit B12 deficiency, idiopathic thrombocytopenia and iron deficiency (4). In most peoples, infection with *H.pylori remains* asymptomatic with stomach act as a major reservoir site for colonization (5).With 50% of individual worldwide, *H .pylori* inhabit stomach asymptomatically (1).

Among virulence factor most commonly possessed in *H.pylori* and most frequently identified namely Cytotoxin associated gene A (CagA) and vacuolating Cytotoxin gene A (Vac A) (6). CagA is a powerful bacterial toxin linked with increasing risk of gastritis, peptic ulcer and gastric adeno carcinoma (7-9), a link that has also been demonstrated locally, with H. pylori infection significantly associated with chronic active gastritis and gastric adenocarcinoma among gastritis patients in Erbil (33). CagA & other pathogenic factors are introduced and transport into host cells via H.pylori related type IV secretion system (T4SS) which behave as a needle like structure that protrude from surface of the bacteria (3). *H. pylori* CagA is an oncoprotein impacted on gastric epithelial cells, where it experience phosphorylation (PI)3 kinase and acts to disrupt cell-signaling, causing inflammation, loss of cell polarity, promoted motility, and Epithelial-to-Mesenchymal Transition (EMT), at length fostering cancer (10).

H.pylori has gained global recognition with higher rate of infection worldwide (11). In developed and developing countries, seroprevalence rate of *H.pylori* was estimated to be 50% & 90% respectively (12). Association between ABO/Rh blood group antigens and *H.pylori* infection was a matter of discussion and controversial results was reported especially in strain of *H.pylori* positive for CagA gene (6). With high prevalence of blood group O was reported among patients with gastroduodenal ulcer (13). CagA positive *H.Pylori* strain thus classified by WHO in the category of class I thus carcinogen. In Erbil community no study designed to assess prevalence of *H .pylori* anti-CagA IgG & IgA among asymptomatic peoples. Nevertheless, H. pylori IgG seropositivity has been documented among symptomatic Erbil populations, such as pregnant women with hyperemesis gravidarum (32), further supporting the need for data on CagA-specific

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seroprevalence in asymptomatic subjects.

Aim of study: The present study aimed to verify the seroprevalence of IgG anti CagA & IgA anti *H.pylori* antibodies among asymptomatic GIT free subjects in association with ABO blood group and as a non- invasive marker for strain positive for CagA gene

Methods

Study design: This study was a cross-sectional included apparently healthy subject free of GIT sign & symptom & preformed in Erbil/Kurdistan region.

Data collection: The screened participates were adults & children healthy general population-free of gastrointestinal diseases with age range between 5->60 years. A total of 369 adult & children were enrolled with 104 children & 265 adults. According to gender, the participant included 213 female & 156 males. The enrolled subjects were interviewed and the questionnaire included age, gender, BMI, history for smoking & chronic diseases. Exclusion criteria a included people with history of GIT diseases & chronic long standing metabolic & non-metabolic diseases beside autoimmune diseases. Blood specimens were collected and sera separated & immediately stored at -20 c until analysis. Part of the blood sample were screened for ABO blood grouping using agglutination test.

The sera were tested for IgG anti CagA & IgA anti-*H.pylori* antibodies using Enzyme-linked immunosorbent assay (ELISA assay) by using kits from (DRG Germany Company).

According to the manufacturers guidelines, the cut off value of the anti-Cag A & anti- *H.pylori* IgA antibodies were 18>du/ml& 16>du/ml respectively.

Ethical approval: The study was approved by the Research Ethical Committee of Hawler Medical University/ College of Nursing/ Erbil. The information consent was obtained from participant by verbal. About ethics in children we talk with their parents about this study & agree.

Statistical analysis: Data were analysis using the statistical package of social sciences (SPSSs, version 26). The Chi-square test of association was used to compare proportions of two or more groups. Fisher s exact test was used when the expected frequency (value) was less than 5 more than 20% of the cells of the table. McNemar test was used to compare proportion of the same sample but with two different tests. A P-value of <0.005 was considered statistically significant.

Results

The total number of participants were 369. Their mean age (±SD) was 32 (±18) years, the median was 31, and the age range was 6-75. More than half (56.6%)

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of the sample were females. The male: female ratio was 0.77: 1.

The seroprevalence of anti-CagA IgG positivity was 36.0% (in the whole sample); 41.5% among adults, which was significantly (P <0.001) higher than the rate among children (22.1%). The prevalence of IgA positivity was 36.3%. Again, it was significantly (P <0.001) higher among adults than among children (44.9% vs 14.4%, respectively). The prevalence of a mixed antibodies positivity was 28.7% among adults and 13.5% among children (P = 0.002). More details are presented in (Table 1 and Figure 1).

Table 1. Prevalence of IgG anti CagA and IgA positivity of H. pylori among children and adults

	Children No. (%)	Adults No. (%)	Total No. (%)	P-value*
IgG Prevalence				
Positive	23 (22.1)	110 (41.5)	133 (36.0)	
Negative	81 (77.9)	155 (58.5)	236 (64.0)	<0.001
IgA Prevalence				
Positive	15 (14.4)	119 (44.9)	134 (36.3)	
Negative	89 (85.6)	146 (55.1)	235 (63.7)	<0.001
Total	104 (100.0)	265 (100.0)	369 (100.0)	

*Calculated by chi-square test.

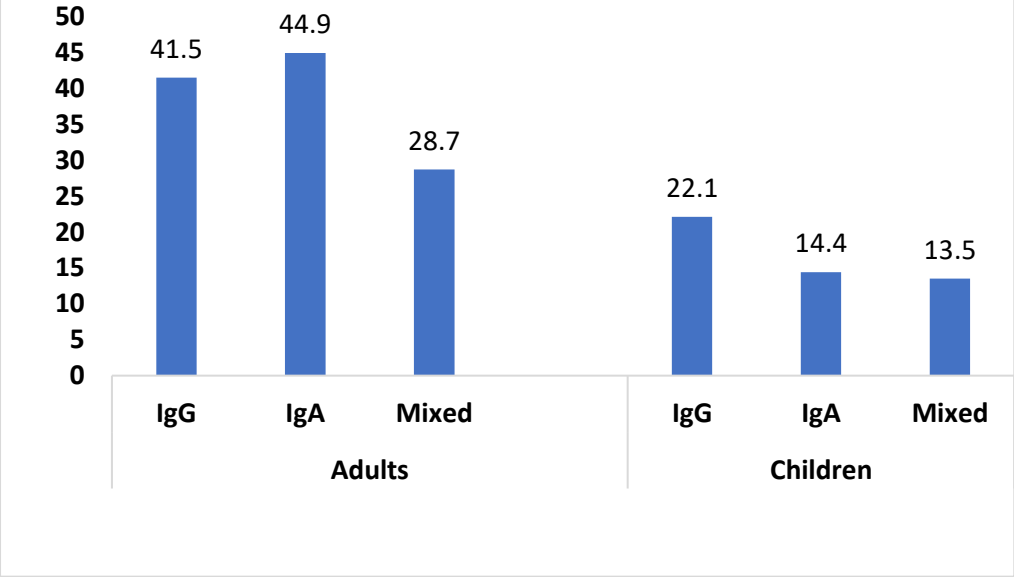

Figure 1. Prevalence of IgG anti-CagA and IgA *H. pylori* seropositivity among children and adults

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The seroprevalence of IgG anti-CagA& IgA anti- H.pylori seropositivity in the whole samples were 36.0% and 36.3% respectively.

Titers > 150 were detected among seropositive IgG anti-Cag A (55%) & anti-H.pylori IgA (38%), of the whole sample screened.

Considering males only, the prevalence rates of IgG, IgA, and mixed antibody positivity among adults were 42.9%, 42.9%, and 30.5%, respectively, compared with 21.8%, 14.5%, and 14.5% among children. All the differences were significant (P = 0.008, P < 0.001, and P = 0.027, respectively). The same pattern can be applied to females. All the rates (IgG, IgA, and both) were higher among adults than children (P = 0.021, P <0.001, and P = 0.029, respectively). More details are presented in Table 2.

Table 2. Prevalence of IgG anti-CagA and IgA positivity of H. pylori among children and adults in each of the male and female groups

	Children No. (%)	Adults No. (%)	Total No. (%)	P-value*
Males				
IgG Prevalence				
Positive	12 (21.8)	45 (42.9)	57 (35.6)	
Negative	43 (78.2)	60 (57.1)	103 (64.4)	0.008
IgA Prevalence				
Positive	8 (14.5)	45 (42.9)	53 (33.1)	
Negative	47 (85.5)	60 (57.1)	107 (66.9)	<0.001
Prevalence (both positive)				
Both Positive	8 (14.5)	32 (30.5)	40 (25.0)	
Negative (1 or both negative)	47 (85.5)	73 (69.5)	120 (75.0)	0.027
Total males	55 (100.0)	105 (100.0)	160 (100.0)	
Females				
IgG Prevalence				
Positive	11 (22.4)	65 (40.6)	76 (36.4)	
Negative	38 (77.6)	95 (59.4)	133 (63.6)	0.021
IgA Prevalence				
Positive	7 (14.3)	74 (46.3)	81 (38.8)	
Negative	42 (85.7)	86 (53.8)	128 (61.2)	<0.001
Prevalence (Both Positive)				
Both Positive	6 (12.2)	44 (27.5)	50 (23.9)	
Negative (1 or both negative)	43 (87.8)	116 (72.5)	159 (76.1)	0.029
Total females	49 (100.0)	160 (100.0)	209 (100.0)	

*Calculated by chi-square test.

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No significant associations were detected between the blood groups and the following: IgG (P = 0.810), IgA (P = 0.482), and both IgG and IgA (P = 0.204). It is worth mentioning that the rate of positivity was higher among participant with blood group 'O' (Table 3).

Table 3. Prevalence of IgG anti-CagA and IgA positivity of H. pylori by blood groups

Blood group	Positive No. (%)	Negative No. (%)	Total No. (%)	P-value*
		IgG		
A+	29 (32.6)	60 (67.4)	89 (100.0)	
A-	1 (14.3)	6 (85.7)	7 (100.0)	
B+	23 (32.9)	47 (67.1)	70 (100.0)	
B-	3 (42.9)	4 (57.1)	7 (100.0)	
AB+	9 (39.1)	14 (60.9)	23 (100.0)	
AB-	0 (0.0)	1 (100.0)	1 (100.0)	
O+	64 (40.0)	96 (60.0)	160 (100.0)	
O-	4 (33.3)	8 (66.7)	12 (100.0)	0.810
Total	133 (36.0)	236 (64.0)	369 (100.0)	
		IgA		
A+	30 (33.7)	59 (66.3)	89 (100.0)	
A-	2 (28.6)	5 (71.4)	7 (100.0)	
B+	19 (27.1)	51 (72.9)	70 (100.0)	
B-	3 (42.9)	4 (57.1)	7 (100.0)	
AB+	8 (34.8)	15 (65.2)	23 (100.0)	
AB-	0 (0.0)	1 (100.0)	1 (100.0)	
O+	66 (41.3)	94 (58.8)	160 (100.0)	
O-	6 (50.0)	6 (50.0)	12 (100.0)	0.482
Total	134 (36.3)	235 (63.7)	369 (100.0)	

*Calculated by Fisher's exact test.

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A significant association was detected between age and IgG positivity (P <0.001). The rate was 18.4% among participant aged 5 to 12 years. It increased steadily with age, reaching 62.8% among those aged 50-59, but then decreased to 28.1% among those aged 60 years or older. Nearly the sample pattern can be applied to IgA, where there was a significant increase to 53.5% among those aged 50-59, and then a decrease to 25% among those aged 60 or older (P <0.001). Regarding the IgG and IgA positivity, the difference across the age groups was also significant (P = 0.001), but there was no consistent and steady increase. More details are presented in Table 4.

Table 4. Prevalence of IgG anti-CagA and IgA positivity of *H. pylori* by age

Age (years)	Positive No. (%)	Negative No. (%)	Total No. (%)	P-value*
		IgG		
5-12	14 (18.4)	62 (81.6)	76 (100.0)	
13-18	9 (32.1)	19 (67.9)	28 (100.0)	
19-29	23 (31.1)	51 (68.9)	74 (100.0)	
30-39	24 (47.1)	27 (52.9)	51 (100.0)	
40-49	27 (41.5)	38 (58.5)	65 (100.0)	
50-59	27 (62.8)	16 (37.2)	43 (100.0)	
≥ 60	9 (28.1)	23 (71.9)	32 (100.0)	<0.001
Total	133 (36.0)	236 (64.0)	369 (100.0)	
		IgA		
5-12	7 (9.2)	69 (90.8)	76 (100.0)	
13-18	8 (28.6)	20 (71.4)	28 (100.0)	
19-29	29 (39.2)	45 (60.8)	74 (100.0)	
30-39	30 (58.8)	21 (41.2)	51 (100.0)	
40-49	29 (44.6)	36 (55.4)	65 (100.0)	
50-59	23 (53.5)	20 (46.5)	43 (100.0)	
≥ 60	8 (25.0)	24 (75.0)	32 (100.0)	<0.001
Total	134 (36.3)	235 (63.7)	369 (100.0)	

*Calculated by chi-square test.

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No significant associations were detected between smoking and the following tests: IgG (P = 0.780), IgA (P = 0.321), and mixed IgG and IgA (P = 0.474). More details are presented in Table 5.

No significant difference was found between the IgG and IgA test results (P = 1.000). The rate of agreement between the two tests was 76.4% (90+192/369). Around a third (32.3%) of those who tested positive for IgG, found to have negative IgA. On the other hand, 18.6% of those who tested negative by IgG, found to have positive IgA. More details are presented in Table 6.

Table 5. Prevalence of IgG anti-CagAand IgA positivity of H. pylori by smoking in adult

	Smoking			
	Yes	No	Total	P-value*
	No. (%)	No. (%)	No. (%)	
IgG Prevalence				
Positive	13 (38.2)	120 (35.8)	133 (36.0)	
Negative	21 (61.8)	215 (64.2)	236 (64.0)	0.780
IgA Prevalence				
Positive	15 (44.1)	119 (35.5)	134 (36.3)	
Negative	19 (55.9)	216 (64.5)	235 (63.7)	0.321
Prevalence (Both Positive)				
Both Positive	10 (29.4)	80 (23.9)	90 (24.4)	
Negative (1 or both negative)	24 (70.6)	255 (76.1)	279 (75.6)	0.474
Total	34 (100.0)	335 (100.0)	369 (100.0)	

*Calculated by chi-square test.

Table 6. Association between IgG anti-CagA and IgA test results

		IgA prevalence			
IgG prevalence		**Positive**	**Negative**	**Total**	**P-value***
Positive	Frequency	90	43	133	
	Row %	67.7	32.3	100.0	
	Column %	67.2	18.3	36.0	
Negative	Frequency	44	192	236	1.000
	Row %	18.6	81.4	100.0	
	Column %	32.8	81.7	64.0	
Total	Frequency	134	235	369	
	Row %	36.3	63.7	100.0	
	Column %	100.0	100.	100.0	

*Calculated by McNemar test.

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Discussion

The pathogenesis and complexity of *H.pylori* infection and related GIT ailments such as gastritis, peptic ulcer and gastric peptic ulcer and adenocarcinoma lies in different virulence factor such as CagA and VacA.

Worldwide, the prevalence of *H.pylori* infection varies between countries and within countries (14). Assessment of seroprevalence and seropositivity for IgG, IgA and IgM in symptomatic patients and asymptomatic people differ from assessment of specific antibodies targeted critical and oncogenic virulence factor such as CagA protein which exist in some strains of *H.pylori* (14, 15).

The current study showed that in the whole sample screened, the seroprevalence of the IgG anti CagA antibody and IgA anti-*H.pylori* antibody was 36.0% and 36.3% respectively (Table-1). Among adults & children, the prevalence was significantly higher among adult than children (P <0.001) for both IgG anti- CagA & IgA anti-*H.pylori* antibodies (Table-1).

Mixed antibody positivity was again significantly higher among adult than children (Figure-1). Few studies worldwide assess the seroprevalence of IgG anti Cag A antibody asymptomatic peoples (6, 14, 16, 17). In Iran, Egypt and Libya, seroprevalence were reported in 10.6%, 29.5% and 42.5% respectively. (6, 14, 15, 17). The question whether IgG anti-CagA seropositivity really reflect the strains of *H. pylori* to be CagA gene positive was confirmed by Yaseri et al (2015)(19), in which 95.6% compatibility existed. In clinical field routine serological test for diagnosis of *H.pylori* infection relies only on testing IgG anti *H.pylori* but not IgG anti-CagA antibody. But IgG anti- CagA seropositivity increases the sensitivity & us predictive marker for strains of *H.pylori* that harbor CagA gene by 97.61% (20).

As far as IgA anti- *H.pylori* Abs, the current study verified 36.3% seropositivity (Table-1) among the whole screened samples .In Duhok city, among symptomatic cases, anti- *H.pylori* IgA was detected in 40% of the cases (21). Some Studies reported prevalence of 2.6% and 17.2% of anti-*H.pylori* IgA Abs (22, 23). In clinical setting, level of anti-*H.pylori* IgA was found to be inversely correlated with severe active inflammation and IL-8 cytokine level (24). Mucosal IgA antibody against CagA strain of *H.pylori* are protective (15). Recent study refers to 27.4% seropositivity for IgA anti- Cag Abs among cases with gastritis (15). High titer of anti-Cag A IgA Abs was observed in people with normal gastric mucosa (15). Correlation exist between class II MHC and generation of anti-CagA IgA Abs. Thus, anti-CagA significantly increased in DRB1.03:01 positive people & is protective (15).

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In the current study, the frequencies of IgG anti-CagA seropositivity among both adult and children in male and female was 35.6% and 36.4% respectively (Table-2&3) our result disagree with a study that report seroprevalence of anti-CagA IgG among male (48%) and among female (31%) (14).

Recently in 2023, Adbelgawad, et al (16) reported a high prevalence rate of IgG anti-CagA in male (88.6%) in comparison with female (11.4%) among healthy blood donor. Recently in Duhok province among adult general population, the prevalence of IgG anti-*H.pylori* was significantly linked with male gender and smoking status (11). As far as impacts of IgG anti-CagA seropositivity in association with ages, the results of the current study showed a significant association between increasing age and increasing IgG anti-CagA and anti-*H.pylori* IgA Abs seroprevalence (P <0.001)(Table-4).

Our finding agrees with other studies (16, 18). Further no significant association were detected between history of smoking and no smoking and IgG anti-CagA and anti- *H.pylori* IgA seropositivity (P = 0.780 & P = 0.321 respectively)(Table-5). The result of the present study agrees with other study (25). Significant association was observed between anti-CagA IgG seropositivity and smoking (26, 27). In Duhok province lower prevalence rate of IgG anti- *H.pylori* Abs in smokers than non-smoking (36% vs 67%) (11). was reported smoking may increase risk of gastric cancer in people seropositive for *H.pylori* infection (6). Smoking facilitates colonization of mucus layer of stomach by *H.pylori* (28); beside nicotine reduces mucus secretion and gastric mucosal blood flow in addition decreases epidermal growth factor secretion (28).

The impacts of the blood groups, the current study revealed no significant association between blood groups and frequencies of IgG anti-CagA and IgA anti- *H.pylori* Abs (P = 0.810 & P = 0.482) respectively (Table-3). Although prevalence rates of both antibodies IgG and IgA were higher among blood group O (40% vs 41%). The results of the present study agree with study in Iran (6), but disagree with other study who reported blood group AB as more prevalence among people seropositive for IgG anti-CagA Abs (14).

In Kurds peoples in Erbil Kurdistan community, a study showed 37.16% prevalence of blood group O followed by group A(32%) & B(23%) (29). Majeed, et al (30) reported significantly higher prevalence of *H.pylori* among patients with gastroduodenal diseases with blood group O in Erbil city. The positive linking between O blood group and *H.pylori* infection might be due to the H antigen of the O blood group which represent receptorin gastric mucosa

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that enhance colonization of *H.pylori* (31).

Finally, the conclusion of the present study a fact that seropositive IgG anti-CagA accurately reflect infection with *H.pylori* strains positive for CagA gene & as a useful non-invasive marker if facilities not available for screening and molecular characterization of CagA gene in a given *H.pylori* strains (19, 20).

Limitation of this study: The sample size, in addition in future assessment of IgA anti-CagA antibody is of clinical relevance.

Conclusion

The present study verified that sero-positive IgG anti-CagA might be a predictive marker for the strains *H.pylori* positive for CagA gene: This need to be an confirmed via molecular characterization of CagA gene.

Competing interest

The authors declare that they have no competing interests.

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