

<Original Article>

Association between *Helicobacter pylori* infection and ABO blood groups: a cross-sectional study in Hokkaido, Japan

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Summary *Helicobacter pylori* (*H. pylori*) is known to be closely associated with onset of diseases such as atrophic gastritis, gastric ulcer, and gastric cancer. In the present study, we conducted an epidemiological study on the relationship between *H. pylori* infection and the ABO blood group system in individuals undergoing routine medical checkups. Among the subjects whose Lewis blood type was determined to be the secretor phenotype in regard to blood type substances and who had minimal intake of dairy products, the rate of *H. pylori* infection was significantly higher ($p=0.029$) for type O blood compared to other blood types. In addition, the odds ratio for *H. pylori* infection adjusted for age, sex, and smoking and drinking habits was also significantly higher for type O blood compared to other blood types. The present findings suggest that differences in intake of dairy products affect the relationship between *H. pylori* infection and the ABO blood group system.

Key words: *Helicobacter pylori*, ABO blood groups, cross-sectional study

1. Introduction

In 1983, Warren and Marshall proposed a role for *Helicobacter pylori* (*H. pylori*) infections in the pathogenesis of gastroduodenal disease. In just over 20 years, many aspects of the pathogenesis of *H. pylori* infection have been discussed^{1,2}.

H. pylori enters the digestive tract through the mouth and attaches to the gastric mucosa, causing a

persistent infection that is known to be closely associated with the development of disorders such as atrophic gastritis, gastric ulcers, stomach cancer^{3,4}. These bacteria can recognize and bind to blood group antigens expressed on the surface of the gastric mucosa, which may play a critical role in the persistence of infection^{5,6,7}. In recent years, lactic acid probiotics have gained attention as a method of preventing *H. pylori* infection, and studies show that

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probiotics can inhibit attachment of *H. pylori* in the stomach^{8,9,10}. In the present study, the rate of *H. pylori* infection, and the relationship between *H. pylori* infection and human ABO and Lewis blood group systems were examined in the general population. Furthermore, we examined the effect of the frequency of consumption of products such as yogurt and lactic acid bacteria beverage on this relationship.

2. Subjects and methods

1) Study subjects

Since 1982, residents of the town of Yakumo in Hokkaido prefecture, Japan aged 39 years and older have undergone routine health examination. Cross-sectional and longitudinal studies of lifestyle related diseases have enrolled individuals who participated in these health examinations. The present cross-sectional study is part of the ongoing Yakumo Study.

The subjects were 955 individuals (356 men and 599 women), who were examined during a local health checkup in Yakumo town, Futami-gun,

Hokkaido Prefecture between 2009 and 2011. The protocol of this study was approved by the Ethics Committee of Fujita Health University (approval number 11-101)

2) *Helicobacter pylori* infection

In a cross-sectional study, we determined the presence of *Helicobacter pylori* (*H. pylori*) infection was determined and evaluated the level of anti-*H.pylori* immunoglobulin G by a urine *H. pylori* antibody detection kit (Otsuka Pharmaceutical Co., Ltd., Tokyo, Japan).

3) ABO and Lewis blood group phenotyping

In this study, we determined the ABO and Lewis blood groups of participants using the tube method¹¹. The ABO blood group phenotyping was performed using commercial monoclonal antibodies in a direct agglutination test. Anti-A, anti-B, anti-Le^a and Le^b mouse monoclonal antibodies were obtained from Ortho Clinical Diagnosis (Rochester, NY).

Lewis blood group tests were only performed

Table 1 Characteristics of the study subjects

		Male	Female	<i>p</i>
Number of subjects		356	599	
Age ^a		66.7±10.5	64.2±10.5	<0.001 ^c
<i>H. pylori</i> infection ^b		179 (50.3)	292 (48.8)	0.647 ^d
Smoking habit ^b	Never	86 (24.2)	492 (82.1)	<0.001 ^d
	Former	194 (54.5)	60 (10.0)	
	Curent	76 (21.4)	47 (7.9)	
Drinking habit ^b	Never	110 (30.9)	426 (71.1)	<0.001 ^d
	Former	21 (5.9)	10 (1.7)	
	Curent	225 (63.2)	163 (27.2)	
ABO blood type ^b	A type	133 (37.4)	225 (37.6)	0.966 ^d
	B type	86 (24.2)	138 (23.0)	
	AB type	30 (8.4)	55 (9.2)	
	O type	107 (30.1)	181 (30.2)	
Lewis blood type ^b	Le (a+ b-)	6 (3.5)	8 (2.9)	0.205 ^d
	Le (a- b-)	15 (8.6)	33 (12.1)	
	Le (a- b+)	135 (77.6)	189 (69.2)	
	Le (a+ b+)	18 (10.3)	43(15.8)	

^a Data are expressed as mean ± SD.

^b Data are expressed as number and percentages in perentheses.

^c t test.

^d χ^2 test.

during health checkups in 2011; thus, 447 subjects (174 men and 273 women) were included in the Lewis blood group analysis. Lewis blood group results were used to determine whether subjects were secretors or non-secretors. Le (a- b+) and Le (a+ b+) subjects were classified as secretors, whereas Le (a+ b-) subjects were classified as non-secretors.

4) Information regarding target

Information regarding consumption of products such as yogurt and lactic acid bacteria beverage was obtained from surveys conducted during health checkups. The chi-square test was used to compare the distributions of ABO and Lewis blood groups between different frequencies of consumption of these products. Subjects who consumed more than 1 probiotic product per day and up to 5 products per week were assigned to a daily consumption group, while those who consumed 3 or fewer probiotic products every month were assigned to a nonconsumption group.

5) Statistical analysis

All statistical analyses were conducted using the statistical software (JMP ver. 10.0, SAS Institute, Cary, NC, USA). A probability value less than 0.05 was considered statistically significant. The *t* test was used to compare various continuous parameters. Categorical variables were compared by the chi-square test. Odds ratios and 95% confidence intervals (CI) for *H. pylori* infection were calculated using multivariate logistic regression with age, sex, smoking habits, and drinking habits as controlled factors.

3. Results

The characteristics of this study subjects in Table 1. The rate of *H. pylori* infection was 50.3% in men and 48.8% in women, and the rate of infection was found to increase with age. The rate of *H. pylori* infection was compared between the daily consumption and nonconsumption groups, considering the subjects' ABO and Lewis blood group status; however,

Table 2 Lewis^a and secretor genotypes are *H. pylori* infection for eating yogurt and lactic acid bacteria beverage with intake group and non-intake group

		Number of subjects	<i>H. pylori</i> infection ^d	<i>p</i> ^e	Multivariate adjusted Odds ratio (95% CI) ^f	Multivariate adjusted Odds ratio (95% CI) ^f
intake group ^b						
ABO blood type	A type	50	26 (52.0)	0.434	1.00	
	B type	34	12 (35.3)		0.44 (0.17-1.12)	
	AB type	15	8 (53.3)		1.05 (0.31-3.66)	
	O type	38	19 (50.0)		0.87 (0.35-2.14)	1.14 (0.52-2.50)
	except O type	99	46 (46.5)		0.711	1.00
non-intake group ^c						
ABO blood type	A type	37	16 (43.2)	0.142	1.00	
	B type	34	15 (44.1)		1.08 (0.41-2.86)	
	AB type	10	3 (30.0)		0.55 (0.10-2.44)	
	O type	36	23 (63.9)		2.50 (0.96-6.78)	2.59 (1.12-6.22)
	except O type	81	34 (42.0)		0.029	1.00

^a Lewis and secretor genotypes are Le(a- b+) and Le(a+ b+).

^b Intake group are more than it five times a week with eating yogurt and lactic acid bacteria beverage.

^c Non-intake group are less than it three times a month with eating yogurt and lactic acid bacteria beverage intake group.

^d Data are expressed as number and percentages in parentheses.

^e χ^2 test

^f Odds ratios are adjusted for sex, age, smoking habits and drinking habits. 95%CI, confidence interval.

no significant difference was found. Table 2 shows the comparison between intake and *H. pylori* infection rate according to the ABO blood group phenotypes by the non-intake of yogurt and lactic acid bacteria beverage and odds ratios with 95% confidence interval (CI). When the rate of *H. pylori* infection was analyzed among subjects who secreted blood group substances in their secretions (secretors), the rate of infection in O group subjects was significantly higher than that of subjects with other blood types ($p = 0.029$). Furthermore, the odds ratio (OR) of *H. pylori* infection for the controlled factors (i.e., age, sex, smoking habits, and drinking habits) was 2.59 in O group subjects, which was significantly higher than that of subjects with all other blood types (OR = 2.59, 95%CI: 1.12-6.22).

4. Discussion

Helicobacter pylori infection is a major risk factor for chronic gastritis and gastric cancer. Some findings show increased frequencies of these diseases in individuals with type O blood and in secretors (expressing Le (b) antigen), but other studies have not found any relationship between blood groups and this infection.

Some epidemiological studies have shown a relationship between *H. pylori* infection and ABO and Lewis blood groups¹²⁻¹⁵; however, these studies have not reached a consistent conclusion regarding the nature of this relationship^{16, 17, 18}. In this study, the relationship between *H. pylori* infection and the ABO and Lewis blood group systems was examined in the general population. Approximately fifty percent of subjects were infected with *H. pylori*. No significant association was found between *H. pylori* infection and expression of Lewis (a) or Lewis (b) and ABO blood group antigen. In addition, the effect of the frequency of consumption of products such as yogurt and lactic acid bacteria (LAB) beverage, and differences between secretors and non-secretors distinguished on the basis of Lewis and ABO blood groups were considered. When only secretors who very rarely consumed products such as yogurt and LAB beverage were analyzed, the rate of *H. pylori* infection in O

group subjects was significantly higher than that of all other types of blood groups. Furthermore, the odds ratio for *H. pylori* infection controlled for age, sex, smoking habits, and drinking habits was also significantly higher in O group subjects than in subjects with other blood types.

These results suggest that consumption of products such as yogurt and LAB beverage influences the relationship between *H. pylori* infection and ABO blood groups. *H. pylori* infection was determined by urine *H. pylori* antibody testing; thus, subjects who had successfully undergone eradication therapy may have been classified as negative. Approximately 18.3% of subjects were classified as negative because they underwent eradication therapy (unpublished data).

Lactic acid probiotics for prevention of *H. pylori* infection have recently garnered attention, and have been reported to be effective for inhibition of gastric colonization by *H. pylori*. Strategies to prevent *H. pylori* infection, among elderly as well as young people, remain an important issue in Japan today.

5. Conclusion

This study examined the relationship between *H. pylori* infection and blood group in subjects who underwent local health screening and found that different frequency of consumption of products such as yogurt and lactic acid bacteria beverage may influence the relationship between *H. pylori* infection and ABO blood group among secretors.

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