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Risk Factors of *Helicobacter Pylori* Infection in Samosir Island

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ABSTRACT

Introduction. *Helicobacter pylori* infection mostly associated with gastrointestinal disease such as gastritis, peptic ulcer, duodenal ulcer, and gastric adenocarcinoma. Route of transmission of *H. pylori* are not fully understood, but human-to-human transmission via oral-oral or fecal-oral route is considered the most likely route. Prevalence of this bacterial infection also varies between countries, Indonesia itself has a fairly low prevalence of *H. pylori* infection at rate of 22.1%. This study aims to determine the prevalence and risk factors of *H. pylori* infection among Batak ethnicity in Samosir Island.

Method. A cross-sectional study was conducted from March – May 2021 to determine the prevalence and risk factors of *H. pylori* infections in Samosir Island through stool antigen test (SAT) examination.

Results. A total of 100 patients reside in Boho Village, Samosir Island enrolled in this study. All of the subjects were tested for *H. pylori* infection with SAT. The study also collected data using the questionnaire method, and obtained data on age, gender, occupation, education level, history of smoking and alcohol consumption, nutritional status, and also *H. pylori* diagnostic test results.

Conclusion. Prevalence of *H. pylori* infection in Samosir Island based on SAT is 18% with the risk factors that are significantly associated with environmental sanitation (p=0.001) and personal hygiene (p=0.004).

Keywords: *H. pylori, Batak Ethnicity, Stool Antigen Test*

INTRODUCTION

Helicobacter pylori infections mostly associated with gastrointestinal disease such as gastritis, peptic ulcer, duodenal ulcer, and gastric adenocarcinoma. Route of transmission of *H. pylori* are not fully understood, but human-to-human transmission via oral-oral or fecal-oral route is considered the most likely route.[1] *H. pylori* is a very common bacteria that is estimated to infect 50% of the world's population. The prevalence of this bacterial infection also varies between countries, such as Latin America, found to be quite high at 75 – 83 %.[2] Indonesia itself has a fairly low prevalence of *H. pylori* infection at rate of 22.1%. Previous studies of ethnicity that are infected with *H. pylori* found that Papuan (42.9%), Batak (40%), Bugis (36.7%), Sundanese (29.4%), Javanese (17.9%), Chinese (13%), and Dayak (7.5%).[3] Besides of ethnicity, other risk factors such as environmental conditions with poor sanitation and hygiene, clean water sources, food contamination, and socioeconomic status are also risk factors that play an important role in the emergence of *H. pylori* infection.[4] Several studies in Indonesia reported that poor sanitation, age, religion, ethnicity are risk factors for *H. pylori* infection.[3]

Based on the literature review, it can be concluded that the prevalence of *H. pylori* infection is relatively lower than the other developing countries. However, after further

study, there's tendency of higher infection in certain tribes in Indonesia. In addition, even within one tribe, there are differences in prevalence between ethnicities within the tribe. Historically, the Batak tribe consists of four regions, namely Samosir, Toba Holbung, Humbang, and Silindung. The Toba Batak people live in these four sub-regions in one district called the Toba district. Samosir island itself is inhabited by the samosir batak tribe.[5] Based on research conducted in Toba, the water of Toba is polluted with a mild level of pollution. Based on risk factors related to polluted water sources and the majority of the education level is quite low, both of these can increase the risk of *H. pylori* infection.[6]

MATERIALS & METHODS

A cross-sectional study was conducted from March - May 2021 to determine the prevalence and risk factors of *H. pylori* infection in Samosir Island through stool antigen test (SAT) examination. All research procedures were reviewed and approved by the Research Ethics Commission of the Faculty of Medicine, Universitas Sumatera Utara with the ethical review number 428/KEPK/USU/2022.

Subjects of this study were patients with complaints of abdominal pain. The sample of this study was taken from a population of patients who met the inclusion and exclusion criteria. The sampling method used was non-probability sampling, which is consecutive sampling. Residents who live on Samosir Island, patients with clinical symptoms of abdominal pain including feeling full after eating, feeling of fullness quickly, heartburn, burning in the heart, and willing to participate in this study and sign informed consent were included in this study. Meanwhile, patients who were taking proton-pump-inhibitor drugs, H-2-receptor antagonists, antacids, lactacids, or antibiotics in previous 2 weeks, and patients who were experiencing diarrhea on the day of sampling were excluded.

Data collection methods of this study uses questionnaires and SAT checks is then processed through 5 steps namely, editing, coding, data entry, tabulating, and analysis. Univariate and bivariate analyses were performed using the SPSS statistical program. Univariate analysis to determine the characteristics of patients with infection, then distribution test was carried out with Kolmogorov-Smirnov test and found that the data distribution wasn't normal. Bivariate analysis was conducted to determine the relationship of risk factors for *H. pylori* infection using the Fisher exact test. The desired amount of deviation (α) was 0.05, statistically significant if $p<0.05$. Then, multivariate analysis was performed using the regression test to assess how much the influence of risk factors have on the incidence of *H. pylori* infection.

RESULT

The study was conducted on 100 respondents in Boho Village, Sianjur Mula District, Samosir Regency, North Sumatra. All subjects were examined for *H. pylori* infection with the Stool Antigen Test (SAT). The study also collected data using the questionnaire method, and obtained data on age, gender, occupation, education level, smoking, alcohol consumption, nutritional status, and *H. pylori* diagnostic test results.

Table 1 shows the results of univariate analysis for each risk factor. Based on age analysis, the majority of respondents' age was in the <50 years age group as much as 61%. The gender of the respondents was mostly male, 62%. The education level of respondents was divided into 2 groups, namely lower middle (no school, elementary school, junior high school) and upper middle (junior high school, high school, diploma, bachelor's degree). The majority of respondents have a fairly good education, namely upper middle class as much as 63%. The economic status of respondents was assessed based on the UMR, and the majority of respondents had a poor economic status of 70%. Respondents' nutritional status was assessed based on body mass index (BMI). Based on univariate analysis, it can be seen that the

majority of respondents have excess nutritional status as much as 58%, History of smoking were assessed by Brinkman Index (IB) and 83% of the sample had mild IB and 17% had moderate-severe IB. Alcohol consumption was assessed using AUDIT-C scoring and 13% of the respondents were found to be medium-high risk and 87% were found to be low risk.

Table 1. Subject Characteristics

Variable	*Stool Antigen Test* (SAT)			*p value*
	Positive	Negative	Total (n=100)	
Age				0.181
≥ 50 years	10 (25.64%)	29 (74.36%)	39	
< 50 years	8 (13.11%)	53 (86.89%)	61	
Gender				0.596
Male	10 (16.13%)	52 (83.87%)	62	
Female	8 (21.05%)	30 (78.95%)	38	
Education				0.793
Lower-Middle	6 (16.22%)	31 (83.78%)	37	
Upper-Middle	12 (19.05%)	51 (80.95%)	63	
Marital Status				0.753
Married	14 (17.50%)	66 (82.50%)	80	
Unmarried	4 (20.00%)	16 (80.00%)	20	
Nutritional Status				0.444
Over-nutrition	12 (20.69%)	46 (79.31%)	58	
Sufficient	6 (14.29%)	36 (85.71%)	42	
Economic Status				0.257
Lower-Middle	15 (21.43%)	55 (78.57%)	70	
Upper-Middle	3 (10.00%)	27 (90.00%)	30	
Smoking Habit				0.183
Moderate-Severe IB	5 (29.41%)	12 (70.59%)	17	
Mild IB	13 (15.66%)	70 (84.34%)	83	
Alcohol Consumption				0.117
Medium-High Risk	0 (0%)	13 (100%)	13	
Low Risk	18 (20.69%)	69 (79.31%)	87	
Environmental Sanitation				0.001*
Poor	13 (35.14%)	24 (64.86%)	37	
Fine	5 (7.94%)	58 (92.06%)	63	
Personal Hygiene				0.004*
Poor	14 (30.43%)	32 (69.57%)	46	
Fine	4 (7.41%)	50 (92.59%)	54	

***p value* < 0.05**

Based on the analysis of age subvariables, in the group ≥ 50 years, there were 10 people with positive stool antigen test (SAT) results and 29 people with negative SAT results. In the <50 years old group, there were 8 people with positive SAT results and 53 people with negative SAT results. In the fisher-exact test, there was no significant association between the risk factor of age and H. pylori infection (p 0.181).

In male gender, 10 people with positive SAT results and 52 with negative SAT results. Conversely, in female gender, 8 people with positive SAT results and 30 people with negative SAT results. In the analysis test, there was also no significant relationship between the risk factors of gender and H. pylori infection (p 0.596).

Based on educational status, respondents were categorized into 2 groups. In the group with lower secondary education, there were 6 people with positive SAT results and 31 people with negative SAT results. In the group with upper secondary education, there were 12 people with positive SAT results and 51 people with negative SAT results. Statistically, there was no significant association between the risk factors of educational status and H. pylori infection (p 0.793).

Table 2. Multivariate Test of Risk Factors of Research Subjects - Final Stage

Variable	B	.Sig	Exp(B)	95% CI	
				Lower	Upper
Environmental Sanitation	1.597	0.008*	4.940	1.527	15.974
Personal Hygiene	1.422	0.025*	4.144	1.194	14.392
Constants	-2.863	0.012	0.057		

Tables 3 show the results of multivariate tests conducted on risk factors that influence H. pylori infection. After 4 stages of regression test, it was found that the most influential risk factors for H. pylori infection were environmental sanitation (OR 4.94 p 0.008, CI 95%) and personal hygiene (OR 4.144, p 0.025, CI 95%).

Table 3. Independent Variable Relationship Strength Test

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	70.965	0.208	0.341
2	76.483	0.163	0.267
3	76.495	0.163	0.267
4	77.278	0.156	0.256

The regression test in this study is then continued with the calculation of the R Square coefficient. Based on table 7, the Nagelkerke R Square value in stage 4 test is 0.256. This shows that the strength of the relationship between the independent variables (risk factors) in influencing the dependent variable (*Helicobacter pylori* infection) is categorized as weak.

DISCUSSION

In this study, there are no significant association was found between the risk factor of age and the incidence of H pylori infection (p 0.181). This is in line with a socio-demographic study conducted by Goto Y et al (2016). The study found that there was a slight increase in the incidence of H. pylori infection with age but not statistically significant.[7] Similarly, a study by Rocha et al showed no significant difference in mean age between the two groups of positive and negative H. pylori infection.[8]

Furthermore, it was found that females had a greater prevalence of H. pylori infection than males. However, there was no statistically significant association between the risk factor of gender and the incidence of H. pylori infection. The results of this study were similar in Indonesia by Goto Y et al (2016) and in Yemen by Almashhadany DA et al (2023) with the conclusion that there was no statistically significant relationship between the incidence of H. pylori infection and gender, although the frequency of infection was more experienced by women ($p>0.05$)[7,9]. Gender also does not provide a significant difference with the incidence of *H. pylori* infection in the population in Lanyu, Taiwan in 2014.[10]

Bivariate analysis showed no significant association between the risk factor of educational status and H. pylori infection. However, Taiwanese residents on Lanyu island had an increased incidence of H. pylori infection in those with low education levels. There was a statistically significant increased risk of H. pylori with a p value of 0.027.[10]

The discrepancy in the results of these two studies can be caused by various factors. Influential factors include the study conducted by Chen HL et al (2014), the diagnostic tool used was the urea breath test (UBT) which has good diagnostic accuracy compared to SAT. Another factor is the difference in demographic characteristics where in this study the majority of respondents were female. Differences in the categorization of educational status data can also affect the significance of the results. In that study, educational status was divided into 3 groups (primary, secondary, university education) while in this study the data was divided into 2 groups.[10]

In this study, there was no significant relationship between marital status and the incidence of H. pylori infection. This is in line with research conducted by Ozaydin et al.[11] In a study conducted on 4622 respondents in Turkey, it was found that there was no significant relationship between marital status and *H. pylori* infection assessed through UBT. However, Taiwanese residents of Lanyu island had an increased incidence of *H. pylori* infection in those with marital status ($p < 0.001$).[10]

In this study, there was no significant relationship between economic status and the incidence of *H. pylori* infection. A similar study conducted on 196 healthy populations in North Jakarta by Goto Y et al (2016) also concluded that there was no relationship between economic status and the incidence of H. pylori infection. However, the Taiwanese population on Lanyu island had an increased incidence of H. pylori infection in those with low economic status. There was a statistically significant increased risk of H. pylori (p 0.007).[10] Higher socioeconomic levels also have a lower risk of infection compared to lower socioeconomic levels.[10]

Participants with farming occupations with lower socioeconomic levels had a higher risk of *H. pylori* infection compared to participants with non-farming occupations and high family income. This may be due to poor hygiene and lifestyle practices among farmers and low family income groups.[12]

The different statistical analysis results between this study and the study conducted by Chen et al, may be due to differences in the characteristics of the population used as research respondents.[10] In general, the global prevalence of H. pylori in Indonesia is 22.1% with the highest presentation in the Batak tribe at 28%.[13,14] Meanwhile, the global prevalence of *H. pylori* in Taiwan is higher at 53.9%.[15] This is a contributing factor to the difference in risk factor analysis values.

Nutritional status was not associated with the incidence of *H. pylori* infection in bivariate or regression tests. This is in line with research conducted by Rocha et al, on 140 populations in Brazil. In this study, it was found that there was a significant increase in the incidence of H. pylori infection in excess nutritional status but no statistically significant relationship was found.[8] However, there is another study that shows a positive linear correlation between nutritional status (BMI) and the incidence of *H. pylori* infection (p 0.0001), where the risk of *H. pylori* infection is greater in overweight patients.[16]

In this study, there was no association between smoking and the incidence of *H. pylori* infection (p 0.181). Although included in the regression test ($p < 0.25$), the final analysis results showed no significant OR value. This is in line with research conducted by Goto Y et al, which states that there is no significant relationship between smoking habits and the incidence of H. pylori infection. Smoking habits have different results between several studies with an increased risk of H. pylori infection. A descriptive study in Jazan city, Saudi Arabia of 422 patients with *H. pylori* infection did not show relationship between the incidence of H. pylori infection and smoking habit.[17] This is also supported by a meta-analysis conducted on 14 case-control studies incorporated into the Stomach Cancer Pooling Project, found that there is no relationship between smoking habit and *H. pylori* infection.[18]

In this study, there was no association between alcohol consumption and the incidence of *H. pylori* infection (p 0.117). Although included in the regression test ($p < 0.25$), the final analysis showed no significant OR value. Alcohol habits also had different results between studies. This is in line with a study in China by Zhang et al, where there was no association between alcohol consumption and *H. pylori* infection in that population (p 0.055).[12]

Therefore, this study is not in line with a study conducted by Chen HL et al, which states that there is a significant relationship between alcohol consumption and *H. pylori* infection (OR 1.64, p 0.006, CI 95%).[10] This was also reinforced by Brenner et al (1997) who suggested there was a protective effect against *H. pylori* infection in moderate and high alcohol consumption. Alcohol can directly or indirectly affect the gastric mucosa, gastric acid secretion and gastric emptying which causes changes in the living conditions of H. pylori in the stomach.[19]

In this study, there was an association between environmental sanitation and the incidence of *H. pylori* infection. Populations with poor environmental sanitation are 4.9

times more likely to experience *H. pylori* infection (OR 4.940, p 0.008, CI 95%). This is in line with research conducted by Syam et al, In this multi-center study on five major islands in Indonesia, it was found that there was a significant lower incidence of H. pylori infection in the population who used tap water as a source of drinking water compared to the population who used well/river water (OR 9.67, p 0.03, CI 95%).[14]

In a study conducted by Jemere et al, it was concluded that water source is a vital risk factor in the incidence of H. pylori infection. The study found that the use of river water as a water source increased the risk of *H. pylori* infection by 12 times (OR 12.5, p 0.021, CI 95%).[20]

In this study, there was an association between personal hygiene and the incidence of H. pylori infection by statistical fisher-exact test and multivariate test. A person with poor personal hygiene has 4.1 times the risk of H. pylori infection (OR 4.144, p 0.025, CI 95%). The results of this study are consistent with the study by Jemere et al. No toilet in the house was also a predictor of H. pylori infection due to poor personal hygiene in this study. This is due to the fact that, the absence of a latrine (OR 4.3, p value 0.043, CI 95%) creates poor hygienic conditions in the family. The family is a risk factor for easy transmission of H. pylori infection.[20]

In a socio-demographic study conducted in Malaysia, a high incidence of H. pylori was found in individuals who practiced poor hygiene. The parameters used in the study included the habit of washing hands after going to the toilet (OR 3.49, p 0.037, CI 95%), the habit of washing hands before eating (OR 10.41, p 0.028, CI 95%), and the availability of latrines in the house (OR 2.76, p 0.002, CI 95%).[21]

CONCLUSION

The prevalence of Helicobacter pylori infection in this study based on stool antigen test was 18%. The largest age group was <50 years old by 61%, the largest gender was male by 62%, the largest marital status was married by 80%, the largest education level was upper middle class by 63%, more nutritional status by 58%, the largest smoking habit in mild IB by 83%, the largest alcohol consumption habit at low risk by 87%, good environmental sanitation by 63%, and good personal hygiene by 54%.

Risk factors that significantly affect *Helicobacter pylori* infection in this studies were environmental sanitation (p 0.001) and personal hygiene (p 0.004). Based on the results of the multivariate test, the risk factors that were proven to influence *Helicobacter pylori* infection were environmental sanitation (OR 4.94, p 0.008, CI 95%) and personal hygiene (OR 4.14, p 0.025, CI 95%). The strength of risk factors in influencing H. pylori infection was categorized as weak (Nagelkerke R Square 0.256).

Declaration by Authors

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