

Learning Achievement Level in Children with Helicobacter Pylori Gastritis

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Abstract

Most children with H.pylori gastritis suffered from recurrent abdominal pain (RAP) that disrupted their activities. RAP has become 10 – 20% cause of non-attendance at school and disrupted leaning process in children resulted in lower learning achievement level. This research aims to assess learning achievement level in children with H. pylori gastritis. It was an observational analytical study with a cross-sectional approach in Gastroenterology Polyclinic Haji Adam Malik general hospital, Universitas Sumatera Utara hospital, and the network hospitals from October 2019 to July 2020. Research subjects who met the inclusion and exclusion criteria underwent physical examination, and gastroscopy and CLO tests. Interviews were carried out to obtain basic characteristic data that was relevant to children's learning achievement level. Fisher's exact statistical test and multivariate analysis were carried out to assess learning achievement level in children with H. pylori gastritis. There was a significant relationship ($p=0.015$) between H. pylori gastritis and learning achievement level with OR value 5.992 (95% CI: 1.307 – 26.837).

Keywords: Helicobacter pylori gastritis, recurrent abdominal pain, learning achievement level, pediatric

1. Introduction

Helicobacter pylori (H. pylori) are gram-negative bacteria with spiral-shaped flagella that inhabit the gastric mucosa and produce urease, catalase, and oxidase enzymes. The bacteria are one of the causes of gastrointestinal diseases as follow: gastric ulcer or gastritis (10 – 15%), gastric cancer (1 – 3%), and mucosa-associated lymphoid tissue (MALT) lymphoma (<0.1%). The severity of diseases was influenced by several factors, including host immunity, type of H.pylori, and the environment condition, such as diet, level of stress, level of hygiene, and presence of coinfection (Bagheri et al., 2015; Krzyzek and Gościński, 2018; Kliegman et al., 2016).

Half of the world's population are known to have H.pylori infection and most of the infections occurred in early childhood. Contact within the family appeared to be the main transmission route of H.pylori (through faecal-oral, oral – oral, or gastrointestinal – oral route). Meanwhile, the sources of infection transmission may also come from the environment, such as from contaminated water and vegetables. Several researches have reported that children often get H.pylori infection from their infected mothers or siblings (Santoni et al., 2014). The prevalence of H.pylori infection was higher in industrial independent countries, but varied worldwide and dependent on many factors, such as age, ethnicity, geographical and socioeconomic status, bacterial virulence, patients characteristics, and environmental factors, especially hygienic conditions (Santoni et al., 2014).

There has not been many studies on *H.pylori* in children in Indonesia. The research done in DR Moewardi Regional Hospital Solo reported 7.2% prevalence of *H.pylori* infection in 963 children aged 0 – 14 years old. From gender, the prevalence of *H.pylori* positive in male and female children were 7.5% and 6.9% respectively. From age, 3.7% prevalence was reported in 187 children in 5 – 9 years old age group, 12% in 190 children in 10 – 14 years old age group (Suparyatmo, Soewignjo, and Mutaqin, 1995). Another study in Bali by Kandra (1995) reported the prevalence of *H.pylori* infection in children as follow: 17.4% in 6-year-old children, 29.1% in 7-year-old children, 25.6% in 8 year-old-children, 8.1% in 9-year-old children, and 3.5% in 10-year-old children. Based on gender, there were 76 (44.2%) female children and 96 (55.8%) male children with *H.pylori* infections (Kandra, 1995).

Clinical manifestations of *H.pylori* infections in children could not be clearly identified. The infections should be acquired in early childhood. However, the complex bonds between the bacteria and host have determined the clinical manifestations of the disease. Around 85% individuals with *H.pylori* infections were asymptomatic throughout their lifetime. Meanwhile, *H.pylori* bacteria were the cause of gastritis and gastric cancer in 10% and 1% individuals respectively (Kao, Sheu, and Wu, 2016; Hegar, 2017). Most pediatric patients with *H.pylori* gastritis showed clinical symptoms, such as recurrent abdominal pain.

Researchers agreed that the cause of most recurrent abdominal pain (RAP) was related to *H.pylori* infections. RAP in children was often made analogous to functional dyspepsia symptom in adults. Some studies reported 22 – 37% children with RAP had positive *H.pylori* infection by serological confirmation. Another research showed 30% children with RAP had *H.pylori* bacteria in the antrum of the stomach, whereas 10% children had the bacteria in the corpus of the stomach. RAP usually occurs at least 3 times within a 3-month time span and disrupts activities. RAP in children has become 10 – 20% cause of non-attendance at school, while gastric ulcer accounted for 10 – 15% of gastrointestinal symptoms. Therefore, gastritis had a high likelihood to disrupt learning process in children and decrease learning achievement level (Bagheri et al., 2015; Rohr et al., 2018).

This research aims to assess the relationship between learning achievement level and *H.pylori* gastritis in children, in which children suspected of gastritis who came in with recurrent abdominal pain had 10 – 20% probability to experience disruption in the learning process. Consequently, learning achievement level in children would be lower based on report card results (Rohr et al., 2018; Hamdu and Agustina, 2011). *H.pylori* gastritis diagnosis in this research used an invasive biopsy urease test or often referred to as *Campylobacter-Like-Organism* (CLO) with high sensitivity (88 – 95%) and specificity (100%) (Rohr et al., 2018; Iranikhah et al., 2013; Quak, 2015).

2. Methods

This research was an observational analytical study with cross-sectional approach to assess learning achievement level in children with *H. pylori* gastritis. The research was conducted in Gastroenterology Polyclinic Haji Adam Malik (HAM) General Hospital Medan, Universitas Sumatera Utara Hospital, and the network hospitals from October 2019 – July 2020. Research subjects were pediatric patients in the following hospitals aged 7 – 18 years old with recurrent abdominal pain who agreed to join the research and provided consent. Exclusion criteria were pediatric patients with cognitive impairment, intellectual disability, and malignant diseases. Sample size in this research was calculated by using cross-sectional design formula, with a minimum sample size of 46 subjects. Basic characteristic data of research subjects was obtained from interviews and

questionnaires. Next, all research subjects underwent physical examination and gastroscopy and CLO tests for *H. pylori* diagnosis. Research subjects were grouped based on *H. pylori* diagnosis (positive or negative), and followed by learning achievement level assessment from children's report cards.

2.1. Research ethics

All parents and guardians of the research subjects had given their consent to be involved in the research after the explanation of patients' condition and planned observation. This research has received approval from the Research Ethics Committee of Medical Faculty, Universitas Sumatera Utara.

2.2. Data analysis

Data in this research was primary data, directly collected from the research subjects from anamnesis and physical examination. There were additional tests carried out, such as gastroscopy and CLO. Data analysis was carried out by using Statistical Package for the Social Sciences (SPSS) for Windows software version 20. Fisher's exact test and multivariate analysis were carried out to assess the relationship between *H. pylori* gastritis diagnosis and learning achievement level in children.

3. Results

3.1. Research subject data characteristic

There were 49 children with symptoms of gastritis who met the inclusion and exclusion criteria. Endoscopic examination showed 29 (59.2%) children with *H. pylori* (+) and 20 (40.8%) children with *H. pylori* (-). Clinical symptoms reported were stomachache (65.3%), vomiting blood (16.3%), vomiting (16.3%), and nausea (2%). There were 35 (71.4%) female patients and 14 (28.6%) male patients with an average age of 12.84 years old (7.10 years old – 17.80 years old). The average body weight and height were 37.79 kg and 138.89 cm.

Most patients in this research were Bataknese (32.7%). There were some Malay (18.4%), Aceh (14.3%), Minang (12.2%), and Java (10.2%) people. Moreover, there were small populations of Chinese (6.1%), Papuanese (4.1%), and Indian (2%) in the research subject populations. The majority of parents of the research subjects were university graduates and had high socioeconomic status. There were 37 (75.5%) children with history of gastritis in the family. The demographic characteristic of the research subjects is presented in Table 1.

Table 1. Research subject demographic characteristic

Subject characteristic data	n = 49
Gender, n (%)	
Male	14 (28.6)
Female	35 (71.4)
Age, years old	
Average	12.84
Median	13.11
SD	2.79
Min – max	7.10 – 17.80
Body weight, kg	
Average	39.55
Median	40
SD	14.12
Min – max	9.10 – 85
Body height, cm	
Average	141.84
Median	146
SD	16.29
Min – max	104 – 168
Ethnicity, n (%)	
Acehnese	7 (14.3)
Batakese	16 (32.7)
Indian	1 (2)
Javanese	5 (10.2)
Malay	9 (18.4)
Minangnese	6 (12.2)
Papuanese	2 (4.1)
Chinese	3 (6.1)
Child education level, n (%)	
Pre-school	1 (2)
Primary school	15 (30.6)
Secondary school	17 (34.7)
High School	16 (32.7)
Father education level, n (%)	
High school	8 (16.3)
University graduate	41 (83.7)
Mother education level, n (%)	
High school	5 (10.2)
University graduate	44 (89.8)
Socioeconomic status, n (%)	
High (household income $\geq$ Rp 5 mio/month)	44 (89.8)
Low (household income $<$ Rp 5 mio/month)	5 (10.2)
Family history of gastritis, n (%)	
Yes	37 (75.5)
No	12 (24.5)
Clinical symptoms, n (%)	
Nausea	1 (2)
Vomiting	8 (16.3)
Vomiting blood	8 (16.3)
Stomachache	32 (65.3)
H. pylori, n (%)	
Positive	29 (59.2)
Negative	20 (40.8)
Learning achievement level, n (%)	
Good (average score $\geq$ 70)	31 (63.3)
Poor (average score $<$ 70)	18 (36.7)

Table 2 shows the relationship between subject characteristic data and learning achievement. Among 14 male subjects, there were 8 (57.1%) children with poor learning achievement. Whereas in 35 female subjects, 10 (28.6%) of them had poor learning achievement. There was no significant

relationship between gender and learning achievement ($p=0.061$). Moreover, age, body weight, and body height did not have significant relationship with learning achievement either ($p= 0.698$, $p= 0.356$, and $p= 0.440$ respectively).

Subjects in this research came from different ethnicity, but there was no significant relationship ($p= 0.841$) between ethnicity and learning achievement. Meanwhile, on socioeconomic status, among 44 children with high socioeconomic status, 14 (31.8%) children had poor learning achievement. While among 5 children with low socioeconomic status, 4 (80%) of them did poor academically. However, there was no significance between socioeconomic status and learning achievement, with $p= 0.054$. Moreover, there were no relationships in education level of children and mother with learning achievement. Nonetheless, father education level was significantly related to learning achievement, with $p= 0.039$.

Family history of gastritis did not have significant relationship with learning achievement ($p=0.168$). Similarly, clinical symptoms of gastritis, such as nausea, vomiting, vomiting blood, and stomachache, did not have significant relationship with learning achievement ($p=0.420$). *H.pylori* infection, however, had a positive relationship with learning achievement ($p= 0.015$), where among 29 subjects with *H.pylori* (+), 15 (51.7%) patients had poor learning achievement. In contrast, among 20 subjects with *H.pylori* (-), only 3 (15%) of them had poor learning achievement.

Table 2. Relationship between basic characteristic data and learning achievement level

Subject characteristic data	Learning achievement		p
	Poor (n = 18)	Good (n = 31)	
Gender, n (%)			
Male	8 (57.1)	6 (42.9)	0.061 ^a
Female	10 (28.6)	25 (71.4)	
Age, average (SD), years old	13.05 (3.04)	12.72 (2.68)	0.698 ^b
Body weight, average (SD), kg	42.02 (17.70)	38.11 (11.65)	0.356 ^b
Body height, average (SD), cm	144.22 (18.95)	140.45 (14.68)	0.440 ^b
Ethnicity, n (%)			
Acehnese	3 (42.9)	4 (57.1)	0.841 ^c
Batakese	8 (50)	8 (50)	
Indian	0	1 (100)	
Javanese	1 (20)	4 (80)	
Malay	2 (22.2)	7 (77.8)	
Minangnese	2 (33.3)	4 (66.7)	
Papuanese	1 (50)	1 (50)	
Chinese	1 (33.3)	2 (66.7)	
Socioeconomic status, n (%)			
High (household income $\geq$ Rp 5 mio/month)	14 (31.8)	30 (68.2)	0.054 ^d
Low (household income < Rp 5 mio/month)	4 (80)	1 (20)	
Child education level, n (%)			
Pre-school	0	1 (100)	0.127 ^c
Primary school	7 (46.7)	8 (53.3)	
Secondary school	3 (17.6)	14 (82.4)	
High school	8 (50)	8 (50)	
Father education level, n (%)			
High school	6 (75)	2 (25)	0.039 ^d
University graduate	12 (29.3)	29 (70.7)	
Mother education level, n (%)			
High school	4 (80)	1 (20)	0.054 ^d
University graduate	14 (31.8)	30 (68.2)	
Family history of gastritis, n (%)			
Yes	16 (43.2)	21 (56.8)	0.168 ^d
No	2 (16.7)	10 (83.3)	
Clinical symptoms, n (%)			
Nausea	1 (100)	0	0.420 ^c
Vomiting	2 (25)	6 (75)	
Vomiting blood	4 (50)	4 (50)	
Stomachache	11 (34.4)	21 (65.6)	
H. pylori, n (%)			
Positive	15 (51.7)	14 (48.3)	0.015 ^d
Negative	3 (15)	17 (85)	

^aChi-square, ^bT-independent, ^cKruskal Wallis, ^dFisher's Exact

3.2. Multivariate analysis

Multivariate analysis was conducted to observe whether learning achievement level was also affected by other independent variables in this study. The variables included in multivariate analysis had p value <0.25, which are gender, socioeconomic status, education level of child and parents, family history of gastritis, and H.pylori. Table 3 shows the result of multivariate analysis done, where father education level and H.pylori significantly affected learning achievement in children.

Table 3. Multivariate analysis of independent variables

Independent variables	p
Gender	0,061
Socioeconomic status	0,054
Child education level	0,218
Father education level	0,039
Mother education level	0,054
Family history of gastritis	0,168
H. pylori	0,015

The infection of H.pylori that became the main concern affecting learning achievement in children had OR value of 5.992 (95% CI: 1.307 – 26.837). This means that children with H.pylori infections had 5.992 likelihood of lower learning achievement than children without H.pylori infections.

Table 4. Multivariate analysis of H.pylori affecting learning achievement level

Independent variable	B	Sig.	Exp(B)	95% C.I. for EXP(B)	
				Lower	Upper
H. pylori	1,779	0,021	5,922	1,307	26,837

4. Discussion

Helicobacter pylori infections are diseases acquired at early childhood and usually persist without antibiotics. The incidence rate of H.pylori infection in developed countries was reported at 20%, whereas in developing countries was at 90% through oral-oral and faecal-oral as main transmission routes (Calik et al., 2016). Recurrent abdominal pain (RAP) is one of the most found gastrointestinal symptoms in children at their pre-school to high school age with a prevalence of around 10% (Alimohammadi et al., 2016). Malaty et al (2006) found that H.pylori infections occurred in 80% children with RAP symptoms (Malaty et al., 2006).

In this research, there were 49 research subjects with a complaint of recurrent abdominal pain (RAP). There were 29 (59.2%) patients with H.pylori (+). The average age of research subjects was 12.84 years old, with the youngest patient was 7.10 years old and the oldest patients was 17.80 years old. Hasosah (2019) reported 49.83% H.pylori (+) cases with over half research subjects in >10 years old age group (Hasosah, 2019). In the study done in Iraq by Mohsen et al reported that in 33.3% positive H.pylori infection cases, 40% subjects were in 10 – 13 years old age group (Mohsen et al., 2018). The relationship between H.pylori infections and age was not determined in this study.

There has only been very few studies about the relationship between H.pylori gastritis and learning achievement in children. This research may be the first to be done to study that relationship. There were 29 patients with H.pylori (+) and 15 (51.7%) of them had poor learning achievement. In contrast, among 20 patients with H.pylori (-), only 3 (15%) patients had poor learning outcome. There was a significant relationship ($p = 0.015$) between H.pylori gastritis and learning achievement with Fisher's exact test. From multivariate analysis, OR value of H.pylori was obtained at 5.992 (95% CI: 1.307 – 26.837), which means that children with H.pylori infections were 5.922 times more likely to have poor academic performance compared to children without H.pylori infections.

Recurrent abdominal pain (RAP) in children was 10 – 20% cause of non-attendance at school, while gastric ulcer was accounted for 10 – 15% of gastrointestinal symptoms. Therefore, gastritis

had a high likelihood to disrupt learning process in children and decrease learning achievement level (Bagheri et al., 2015; Rohr et al., 2018). Based on Mann-Whitney statistical analysis test done by Arsyad et al (2018) with 95% confidence interval, $p=0.044$ was obtained, that showed the relationship between syndrome of dyspepsia and learning achievement in XI SMAN 4 Banda Aceh students (Arsyad et al., 2018). Patients with functional dyspepsia would experience symptoms that greatly interfere daily activities (El-Serag and Talley, 2003). In a survey done by Kumar (2012) has reported over half patients with dyspepsia had to depend on drugs and around 30% of them prefer to take sick leave from work or school due to the complaints they have with the clinical symptoms (Kumar, 2012).

The occurrence of dyspeptic symptoms was caused by several pathophysiological processes, such as gastric acid secretion, gastrointestinal dysmotility, *H.pylori* infection, visceral hypersensitivity, autonomic dysfunction, and psychological, diet, and environmental factors (Sudoyo et al., 2009). The statistical study done by Khotimah and Ariani (2012) stated that stress level had the greatest influence to dyspepsia syndrome (Khotimah and Ariani, 2012). The clinical manifestations of functional dyspepsia, such as heartburn, bloating, early satiety, nausea, and vomiting, were able to affect patients' quality of life and disrupt their daily activities, including learning progress of students with dyspepsia (Dobrek, 2009).

5. Conclusion

Children with *H. pylori* infection tended to have lower learning achievement level, with significance level of $p = 0.015$ and OR value 5.992 (95% CI: 1.307 – 26.837).

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References

- Alimohammadi.H, Fouladi.N, Salehzadeh.F, Alipour,Javadi,M,S. Childhood recurrent abdominal pain and *Helicobacter pylori* infection, Islamic Republic of Iran. EMHJ .2016;22:12.
- Arsyad RP, Irmaini, Hidayaturnami. Hubungan Sindroma Dispepsia dengan Prestasi Belajar pada Siswa Kelas XI SMAN 4 Banda Aceh. J Ilm Mhs Kedokt Biomedis. 2018;4(1):36-42.
- Bagheri N, Azadegan DF, Shirzad H, Rafieian K M, Rahimian G, Razavi A. The biological functions of IL-17 in different clinical expressions of *Helicobacter pylori*-infection. Microb Pathog. 2015;81(March):33-38.
- Calik Z, Karamese M, Acar O, Karamase SA, Dicle Y, Albayrak F, et al. Investigation of antigen in stool samples of patients with upper gastrointestinal complaints. Braz J Microbiol. 2016;47:167–71.
- Dobrek L, Thor P. Pathophysiological Concepts of Functional Dyspepsia and Irritable Bowel Syndrome Future Pharmacotherapy. Drug Reseach. 2009;66:447–60.
- El-Serag HB, Talley NJ. Systematic Review: Health-Related Quality of Life In Functional Dyspepsia. 2003;387–93.
- Hamdu G,Agustina L. Pengaruh Motivasi Belajar Siswa Terhadap Pestasi Belajar Ipa Di Sekolah Dasar. Jurnal Penelitian Pendidikan. 2011;12(1):81-86.
- Hasosah M. Accuracy of invasive and noninvasive methods of *helicobacter pylori* infection diagnosis in Saudi children. Saudi J Gastroenterol. 2019;25:126-31.
- Hegar B. Infeksi *Helicobacter Pylori* pada Anak. Sari Pediatr. 2017;2(2):82.
- Iranikhah A, Ghadir MR, Sarkeshikian S, Saneian H, Heidari A, Mahvari M. Stool antigen tests for the detection of *helicobacter pylori* in children. Iran J Pediatr. 2013;23(2):138-142.
- Kandera I.W. Proporsi infeksi *Helicobacter pylori* pada anak-anak SD Dauh Puri Kodya Denpasar. Dalam: Soewignjo S, Mulyadi K, Kandera.W, Winata S, Purwadi G.N, 1995. Seminar Nasional Helikobakter Pilori dan penyakit Gastroduodenal. Kelompok Studi Helikobakter pilori. Fakultas Kedokteran Unud, Bali: 25 Maret, 1995. h. 89-92.

- Kao CY, Sheu BS, Wu JJ. *Helicobacter pylori* infection: An overview of bacterial virulence factors and pathogenesis. *Biomed J.* 2016;39(1):14-23.
- Khotimah N, Ariani Y. Sindroma Dispepsia Mahasiswa Fakultas Keperawatan Universitas Sumatera Utara. Dosen Dep Keperawatan Dasar dan Med Bedah Fak Keperawatan Univ Sumatera Utara. 2012;21-3.
- Kliegman RM, Stanton BF, Geme JWS, Schor NF, Berhmen RE. *Peptic Ulcer Disease in Children.* Nelson Textbook of Pediatrics. 20th ed. Philadelphia: Elsevier;2016. h.1816-17.
- Kumar A. *Epidemiology of Functional Dyspepsia.* Mumbai Assoc Physicians India. 2012;60:9- 12.
- Krzyzek P, Gościński G. Morphology of *Helicobacter pylori* as a result of peptidoglycan and cytoskeleton rearrangements. *Prz Gastroenterol.* 2018;13(3):182-195.
- Malaty HM, Abudayyeh S, Graham DY, Gilger MA, Rabeneck L, O'Malley K. A prospective study for the association of *Helicobacter pylori* infection to a multidimensional measure for recurrent abdominal pain in children. *Helicobacter.* 2006 Aug;11(4):250-7.
- Mohsen AAH, Manji AJ, Hashim JM, Obeid RM. The significance of *helicobacter pylori* infection as a cause of recurrent abdominal pain in children. *Curr Pediatr Res.* 2018;22:82-7.
- Quak SH. Recurrent abdominal pain in children: A clinical approach. *Singapore Med J.* 2015;56(3):125-128.
- Rohr MRS, Ogata SK, Artigiani NR, Camorlinga PM, Kawakami E, Granato CFH. Development and validation of a whole-cell ELISA for serologically diagnosing *Helicobacter pylori* infection in Brazilian children and adults: a diagnostic accuracy study. *Sao Paulo Med J.* 2018;136(5):442-448. Santoni A, Dall'Oglio L, De Angelis P, et al. Utility of a stool antigen test to detect the incidence of *helicobacter pylori* infection and familial and community enviromental risk factors for this infection in pediatric age. *La Pediatr Medica e Chir.* 2014;34(2):89-95.
- Sudoyo AW, Setiyohadi B, Alwi I, K MS, Setiati S. *Buku Ajar Ilmu Penyakit Dalam Jilid 1.* Jakarta: Interna Publishing; 2009. 529-533.
- Suparyatmo JB, Soewignjo S, dan Mutaqin Z. Survei seroepidemiologik infeksi *Helicobacter pylori* di Surakarta. Makalah lengkap dari kumpulan Seminar Nasional Helikobakter Piloni dan Penyakit Gastroduodenal. Denpasar, Bali 25 Maret 1995. h. 96-7.