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The Relationship between Platelet-Lymphocyte Ratio (PLR) and Neutrophil-Lymphocyte Ratio (NLR) with Helicobacter Pylori Infection in Children

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Abstract

Objectives: Helicobacter pylori (HP) is a common cause of gastritis in children, inducing a low-grade systemic inflammatory response through pro-inflammatory cytokines. Previous studies have demonstrated a correlation between inflammatory mediators and H. pylori infection. This study aims to investigate the relationship between neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) with Helicobacter pylori gastritis in children.

Methods: This study enrolled sixty children aged two months until eighteen years diagnosed with gastritis who underwent a Campylobacter-like Organism (CLO) test following endoscopy. Patients were categorized into HP positive and HP negative groups. NLR and PLR were obtained from routine blood tests and analyzed for their association between the two groups.

Results: Of the sixty patients, 65% were girls, with a mean age of 11.43 ± 3.66 years. The study found a median NLR of 1.29 (IQR 0.68–2.97) and a mean PLR of 118.27 ± 36.64. The median NLR in the HP positive group (1.53 [0.84–2.64]) was higher than in the HP negative group (1.19 [0.68–2.97]), although the difference was not statistically significant ($p = 0.569$). A similar trend was observed for PLR, with a higher mean in the HP positive group (120.72 ± 44.6) compared to the negative group (115.82 ± 27.06), but without significant difference ($p = 0.610$). There were no significant differences between the two groups in hematological parameters such as hemoglobin, platelet count, leukocytes, neutrophils, or lymphocytes ($p > 0.05$).

Conclusion: Although NLR and PLR are accessible and cost-effective biomarkers, their inability to accurately predict H. pyloriinfection indicates that they are not yet suitable to replace or support conventional diagnostic approaches.

Keywords: Helicobacter Pylori, Gastritis, Neutrophil-to-Lymphocyte Ratio, Platelet-to-Lymphocyte Ratio

Introduction

Helicobacter pylori (H. pylori) represents one of the most prevalent bacterial pathogens affecting the pediatric population and is recognized as a primary etiological agent of gastritis in children [1, 2]. Globally, it is estimated that approximately 50% of individuals acquire this infection during early childhood, underscoring its widespread distribution and early onset [3]. In Indonesia, the prevalence of *H. pylori* infection exhibits regional variability, with reported rates ranging from 16.7% to 53.1% [4-6]. Although a declining trend in prevalence has been observed over recent years, *H. pylori* infection continues to pose a significant public health challenge, particularly among populations with lower socioeconomic status and those residing in rural or underdeveloped areas [5, 7, 8]. Longitudinal studies have demonstrated that persistent *H. pylori* infection in childhood is associated with an elevated risk of developing gastrointestinal malignancies later in life [9]. These findings underscore the critical importance of early detection and timely eradication of *H. pylori* to mitigate long-term adverse health outcomes in pediatric patients.

The pathogenesis of *Helicobacter pylori* (H. pylori) remains incompletely understood; however, it is strongly associated with gastric mucosal damage and inflammation [10]. Emerging evidence has demonstrated a correlation between inflammatory mediators and *H. pylori* infection, including biomarkers such as C-reactive protein (CRP) [3]. More recently, hematological indices such as the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have been recognized as non-invasive predictors of systemic inflammation in various clinical conditions, including gastritis [3, 9]. Although both NLR and PLR have been frequently associated with *H. pylori*-induced gastritis, the role of PLR in pediatric populations remains inadequately explored [1, 3]. In light of this, the present study aims to investigate the relationship between NLR and PLR—

both of which can be readily calculated from routine blood tests—and *H. pylori* infection in children.

Methods

This study was designed as an analytical, cross-sectional investigation conducted at the Pediatric Gastroenterohepatology Outpatient Clinic and Pediatric Inpatient Ward of the Teaching Hospital and affiliated network of the Faculty of Medicine, Universitas Sumatera Utara. The study was carried out over a six-month period from November 2024 to April 2025. Children aged between two months and eighteen years who were diagnosed with gastritis and underwent endoscopic examination followed by a Campylobacter-like Organism (CLO) test were included. Based on the CLO test results, participants were categorized into *H. pylori*-positive and *H. pylori*-negative groups.

The exclusion criteria for this study were as follows:

1. Patients with organic diseases, systemic illnesses (including hematologic disorders or autoimmune conditions), or other infections;
2. Patients with gastrointestinal malignancies;
3. Patients who had received *H. pylori* eradication therapy within the previous four weeks or were currently taking other types of antibiotics prior to *H. pylori* diagnostic testing;
4. Patients who had consumed proton pump inhibitors (PPIs) or H2 receptor antagonists within two weeks prior to the diagnostic procedure for *H. pylori*.

The neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) were calculated from routine complete blood count results and analyzed to assess their association with *H. pylori* infection status. NLR was defined as the absolute neutrophil count divided by the absolute lymphocyte count, while PLR was calculated as the absolute platelet count divided by the absolute lymphocyte count. Additional hematologic parameters including hemoglobin (Hb), white blood cell (WBC) count, platelet (PLT) count, neutrophil count, and lymphocyte count were also evaluated. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) software, version 25. Both univariate and bivariate analyses were conducted. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test when the assumptions for Chi-square were not met. Comparisons between categorical and numerical variables were analyzed using the independent t-test for normally distributed data or the Mann–Whitney U test for non-normally distributed data. Additionally, receiver operating characteristic (ROC) curve analysis was employed to evaluate the diagnostic performance of NLR and PLR. A p-value of less than 0.05 was considered statistically significant.

Result

A total of 60 subjects were included in this study, comprising 30 individuals in the *H. pylori*-positive group and 30 individuals in the *H. pylori*-negative group. The characteristics of the study participants are presented in Table 1.

Table 1: Characteristics of Study Subjects

Characteristic	n = 60
Sex, n (%)	
Male	21 (35%)
Female	39 (65%)
Age (years)	11.43 ± 3.66[a]
Body weight (kg)	36.94 ± 10.77[a]
Height (cm)	140 (104–165)[b]
Socioeconomic Status, n (%)	
< 2× Regional Minimum Wage (RMW)	6 (10%)
≥ 2× Regional Minimum Wage (RMW)	54 (90%)
Clinical Symptoms, n (%)	
Vomiting	14 (23.3%)
Hematemesis (vomiting blood)	4 (6.7%)
Abdominal pain	42 (70%)
Neutrophil-to-Lymphocyte Ratio (NLR)	1.29 (0.68–2.97)[b]
Platelet-to-Lymphocyte Ratio (PLR)	118.27 ± 36.64[a]

[a] Mean ± standard deviation
[b] Median (minimum–maximum)

As presented in Table 1, 65% of the study subjects were female, with a mean age of 11.43 ± 3.66 years. The mean body weight and median height of the participants were 36.94 ± 10.77 kg and 140 cm (104–165 cm), respectively. The most frequently reported clinical symptom was abdominal pain, observed in 42 subjects (70%). The majority of participants (90%) belonged to a socioeconomic class earning more than twice the regional minimum wage (RMW). The median NLR and mean PLR values among all subjects were 1.29 (0.68–2.97) and 118.27 ± 36.64, respectively.

Bivariate analysis revealed no statistically significant differences between *H. pylori*-positive and *H. pylori*-negative groups with respect to sex, age, body weight, height, socioeconomic status, or clinical symptoms (Table 2).

Table 2: Characteristics of Study Subjects Based on H. pylori Infection Status

Characteristic	H. pylori (+) *(n = 30)*	H. pylori (−) *(n = 30)*	p-value
Sex, n (%)			
Male	10 (47.6%)	11 (52.4%)	0.787[a]
Female	20 (51.2%)	19 (48.8%)	
Age (years)	11.12 ± 3.91	11.75 ± 3.42	0.179[b]
Body weight (kg)	35.96 ± 11.58	37.93 ± 9.98	0.085[b]
Height (cm)	140 (104–165)	141.5 (104–162)	0.646[c]
Socioeconomic status, n (%)			
< 2× RMW	3 (50.0%)	3 (50.0%)	1.000[d]
≥ 2× RMW	27 (51.0%)	26 (49.0%)	

Data are presented as mean ± standard deviation (SD), median (minimum–maximum), and number (%) as appropriate.
[a] *Chi-square test,* [b] *Independent t-test,* [c] *Mann–Whitney U test,* [d] *Fisher's Exact test*

Among the 21 male pediatric subjects, 10 children (47.6%) were *H. pylori*-positive, while among the 39 female subjects, 20 children (51.2%) tested positive for *H. pylori*. However, this difference was not statistically significant (*p*

= 0.787). The mean age of children with *H. pylori* infection was slightly lower (11.12 ± 3.91 years) compared to those without infection (11.75 ± 3.42 years), although the difference did not reach statistical significance (p = 0.179).The mean body weight and median height in the *H. pylori*-positive group were 35.96 ± 11.58 kg and 140 cm (range: 104–165), respectively, while in the *H. pylori*-negative group, these values were 37.93 ± 9.98 kg and 141.5 cm (range: 104–162), respectively. No significant association was observed between *H. pylori* infection and either body weight or height (p > 0.05). Similarly, socioeconomic status did not differ significantly between *H. pylori*-positive and *H. pylori*-negative groups (p = 1.000).
Furthermore, this study did not identify any statistically significant differences in NLR and PLR values between children with and without *H. pylori* infection. Hematological parameters analyzed in this study also showed no significant associations with *H. pylori* status (p > 0.05) (Table 3).

Table 3: Association Between Hematological Parameters and H. pylori Infection

Variable	H. pylori (+) *(n = 30)*	H. pylori (−) *(n = 30)*	p-value
Hemoglobin (g/dL)	11.83 ± 2.20	11.37 ± 1.95	0.389[a]
Platelet count (×10³/µL)	326.5 ± 101.24	356.07 ± 82.01	0.519[a]
White blood cell count (×10³/µL)	8.51 (5.3–14.6)	8.00 (5.2–16.8)	0.865[b]
Neutrophil (%)	53.5 (38.8–63.3)	50.1 (35.4–67.1)	0.929[b]
Lymphocyte (%)	32.25 (23.8–51.2)	41.7 (22.6–52.2)	0.501[b]
NLR	1.53 (0.84–2.64)	1.19 (0.68–2.97)	0.569[b]
PLR	120.72 ± 44.60	115.82 ± 27.06	0.610[a]

Data are presented as mean ± standard deviation (SD) or median (minimum–maximum), as appropriate.
[a] Independent *t*-test
[b] Mann–Whitney *U* test

This study demonstrated that children in the *H. pylori*-positive group had higher mean hemoglobin levels (11.83 ± 2.2 g/dL) and median leukocyte counts (8.51 ×10³/µL; range: 5.3–14.6) compared to those in the *H. pylori*-negative group (hemoglobin: 11.37 ± 1.95 g/dL; leukocytes: 8.00 ×10³/µL; range: 5.2–16.8). In contrast, the mean platelet count was lower in the *H. pylori*-positive group (326.5 ± 101.24 ×10³/µL) compared to the negative group (356.07 ± 82.01 ×10³/µL), although the difference was not statistically significant (p = 0.519).The median percentage of neutrophils was higher among *H. pylori*-positive subjects (53.5%; range: 38.8–63.3) than in *H. pylori*-negative subjects (50.1%; range: 35.4–67.1), whereas lymphocyte percentage was higher in the *H. pylori*-negative group (41.7%; range: 22.6–52.2) compared to the positive group (32.25%; range: 23.8–51.2). However, neither of these differences reached statistical significance (p = 0.929 and p = 0.501, respectively).
The median NLR was also higher in the *H. pylori*-positive group (1.53; range: 0.84–2.64) compared to the *H. pylori*-negative group (1.19; range: 0.68–2.97), but the difference was not statistically significant (p = 0.569). Similarly, the mean PLR was slightly higher in the *H. pylori*-positive group (120.72 ± 44.6) compared to the negative group (115.82 ± 27.06), without statistical significance (p = 0.610). Receiver Operating Characteristic (ROC) curve analysis (Fig 1) revealed that the area under the curve (AUC) for NLR in predicting *H. pylori* infection was 54.3%, with a p-value of 0.569 and a 95% confidence interval ranging from 39.4% to 69.2%. This finding suggests that NLR has limited diagnostic utility in predicting *H. pylori* infection in children.

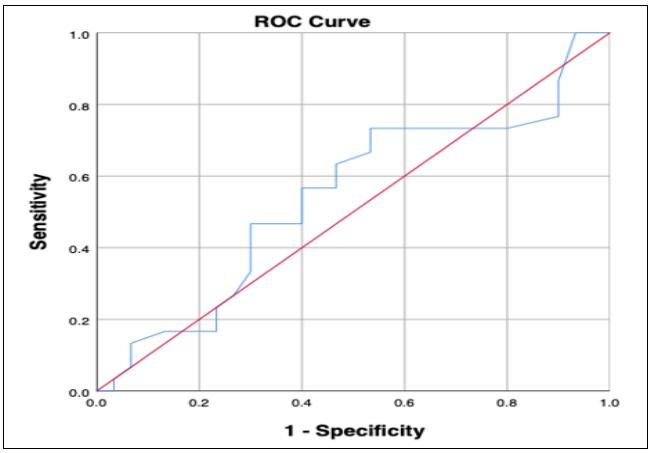

Fig 1: ROC Curve of NLR for Predicting H. pylori Infection

ROC curve analysis (Fig 2) demonstrated that the area under the curve (AUC) for the platelet-to-lymphocyte ratio (PLR) in predicting *Helicobacter pylori* infection was 0.501 (95% CI: 0.346–0.656; p = 0.988). These results indicate that PLR has no discriminative value and therefore cannot be utilized as a predictive biomarker for *H. pylori* infection in children.

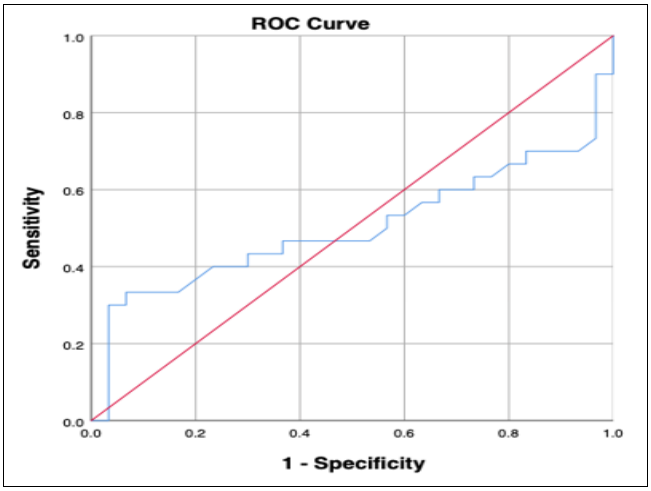

Fig 2: ROC Curve of PLR for Predicting H. pylori Infection

Discussion

Helicobacter pylori (*H. pylori*) is one of the most common bacterial infections in children and is a major etiological factor in pediatric gastritis [1, 2]. Studies have demonstrated that chronic *H. pylori* infection increases the risk of malignancy in children [9]. Therefore, accurate detection and prompt treatment of *H. pylori* infection hold substantial clinical significance.
In this study, *H. pylori* infection was found more frequently in female children (51.2%) compared to male children (47.6%), although this difference was not statistically significant (p=0.787). This finding is consistent with previous studies that reported no significant association between gender and *H. pylori* infection [11, 12]. A study conducted in 2023 in North Sumatra and Romania showed a higher prevalence of *H. pylori* infection in females (61.5% and 68.9%, respectively) than in males [7, 13]. This trend may

be explained by the possibility that girls are more likely to report their symptoms and seek medical attention [7]. Contrastingly, a meta-analysis by Ibrahim *et al*. indicated a higher prevalence of *H. pylori* infection among male children [14].

A study conducted in Vietnam in 2024 found that children aged 11 years and older had a fourfold increased risk of *H. pylori* infection compared to those under 5 years of age [15]. The present study supports this, reporting a mean age of 11.12 ± 3.91 years among children infected with *H. pylori*. The increased risk of infection with age may reflect cumulative exposure to infection sources, including close contact with family members or peers. Furthermore, evolving dietary habits and lifestyle factors in older children may influence gastrointestinal health and immune responses against *H. pylori* [16, 17]. These findings emphasize the need for age-appropriate preventive strategies and educational interventions to ensure hygienic living conditions and practices among children. Further research is warranted to better understand the age-related risk of *H. pylori* infection, which could inform more effective intervention strategies.

This study did not find a significant association between *H. pylori* infection and socioeconomic status. Similar results were reported in a study by Thai Hoang Che *et al*. in Vietnam, where no significant correlation was observed between *H. pylori* infection and socioeconomic level ($p>0.05$) [16]. These findings contrast with previous studies [18, 19], possibly due to differences in the methodology used to assess socioeconomic status. Many earlier studies utilized a multidimensional index incorporating education level, occupation, and monthly income.

Persistent *H. pylori* infection in the gastric mucosa has been widely reported to contribute to iron deficiency anemia (IDA), particularly in pediatric and adolescent populations. A 2024 study by Nafianti S. *et al*. demonstrated a significant correlation between *H. pylori* infection and IDA [13]. However, in the present study, no significant difference was found between *H. pylori* infection and hemoglobin levels ($p=0.389$). This may be attributed to the use of mean hemoglobin levels in the analysis, without accounting for the influence of age on hemoglobin levels and the diagnostic criteria for anemia in children. This highlights the need for further research assessing anemia directly, using additional hematologic markers in relation to *H. pylori* infection.

A 2019 study involving 137 children found significantly elevated leukocyte and neutrophil counts in *H. pylori*-positive individuals, and a higher neutrophil-to-lymphocyte ratio (NLR) compared to *H. pylori*-negative children [9]. In the current study, median leukocyte and neutrophil counts were also higher in the *H. pylori*-positive group, although the differences were not statistically significant ($p=0.865$ and $p=0.929$, respectively).

The neutrophil-to-lymphocyte ratio (NLR) represents the ratio of neutrophils to lymphocytes in peripheral blood. This biomarker reflects two major components of the immune system: neutrophils, as indicators of acute inflammation, and lymphocytes, which play a central role in adaptive immunity. Hence, NLR is considered to reflect the balance between inflammatory and immune responses [20]. In this study, no significant difference in NLR was observed between children with and without *H. pylori* infection, although the NLR was higher in the infected group ($p=0.569$). This result aligns with a 2020 pediatric study that also reported no significant association between *H. pylori* infection and NLR, though neutrophil counts decreased following eradication therapy without reaching statistical significance [21]. A 2025 study from Iran likewise found low diagnostic sensitivity for NLR (11.76%) compared to endoscopic diagnosis in children [22]. Similarly, a study by Gulbagci *et al*., involving 906 patients with gastritis, found significant differences in NLR between groups with and without *H. pylori* infection, but the magnitude of difference was insufficient for clinical utility [23]. Farah *et al*. reported that although NLR exhibited strong diagnostic potential, its performance varied across different study populations, methodologies, and diagnostic criteria—underscoring the need for standardization in future research [24].

In 2020, Sasaran MO *et al*. examined the hematologic parameters in pediatric gastritis and found mildly elevated NLR and platelet-to-lymphocyte ratio (PLR) values in *H. pylori*-positive gastritis compared to *H. pylori*-negative gastritis, though these differences were not statistically significant. Their findings suggest that gastritis in children and adolescents does not significantly affect platelet counts, PLR, or NLR, nor were significant differences observed across various severity levels of gastritis [1]. These findings are consistent with the current study, which also found a slight increase in PLR among children with *H. pylori* infection, without statistical significance. Other studies also failed to demonstrate significant associations between *H. pylori* presence and inflammatory response, as measured by NLR and PLR, in patients undergoing gastroscopy for dyspepsia [25]. These findings indicate that the observed differences between groups are insufficient for NLR and PLR to be considered reliable diagnostic markers in clinical practice.

Although NLR and PLR are accessible and cost-effective biomarkers, their limited diagnostic accuracy in detecting *H. pylori* infection indicates that they are not suitable substitutes for conventional diagnostic approaches. As such, NLR and PLR should not replace standard diagnostic methods. Nonetheless, this study has several limitations. First, its cross-sectional design precludes causal inferences, and the relatively small sample size may have reduced statistical power. Further prospective, multicenter studies with larger sample sizes are needed to strengthen statistical power and improve generalizability of the findings.

Conclusion

In conclusion, although NLR and PLR are accessible and cost-effective biomarkers, their inability to accurately predict *H. pylori* infection indicates that they are not yet suitable to replace or support conventional diagnostic approaches.

Ethics

Ethical approval for the study was granted by the University of Sumatra Utara Research Ethics Board. The study was performed according to the ethical standards of the 1964 Declaration of Helsinki and its later amendments.

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