Jurnal Kedokteran Methodist, Vol.18 No 2 Desember 2025
https://ejurnal.methodist.ac.id/index.php/jkm/issue/view/269

RESEARCH ARTICLE

The Correlation Between Erythrocyte Sedimentation Rate (ESR) and Platelet Count with Fever Levels in Pediatric Patients with Typhoid Fever at Methodist General Hospital Medan in 2023

Donitha Rorescki Simanjuntak[1], Alexander P. Marpaung[2], Salomo G. U, Simanjuntak [3], Dwi Lunarta D.S. Siahaan [4], Lesmana Syahrir [5]

1. Medical Education Study Program, Faculty of Medicine, Methodist University of Indonesia
2. Department of Microbiology, Faculty of Medicine, Universitas Methodist Indonesia
3. Department of Internal Medicine, Faculty of Medicine, Universitas Methodist Indonesia
4. Department of Anesthesiology, Faculty of Medicine, Universitas Methodist Indonesia
5. Department of Pediatrics, Faculty of Medicine, Universitas Methodist Indonesia

Correspondence:
damayantisaragih2@gmail.com

ABSTRACT

Background : *typhoid fever is an acute febrile disease caused by Salmonella typhi bacterial infection and can be caused also by Salmonella Paratyphoid a, Salmonella Typhi B, and Salmonella Paratyphoid C. Found endotoxin in bacterial polysaccharide S.typhi stimulate the production of cytokines and cause systemic symptoms such as fever, vomiting, headache, diarrhea, constipation. Endotoxins induce changes in bone marrow cells and affect ESR values and platelet counts. At the level of fever, there are 3 levels of temperature increase, namely febris, subfebris and hyperpyrexia.* ***Objective:*** *this study was conducted to determine the relationship of the value of ESR and platelet count to fever levels in pediatric patients with typhoid fever.*

Method: *research method with observational analytical measurement through retrospective approach with cross sectional design, using secondary data in medical records, researchers make observations or measurements of variables at a particular time.*

Results : *In the analysis there is a significant relationship between the value of the LED with fever level with a value of p=0.039 and there is no relationship between platelet count with fever level with a value of p=0.089.*

Conclusion: *there is a relationship between the value of LED with fever level and there is no relationship between platelet count with fever level with a value of p= 0.089.*

Keywords: typhoid fever, erythrocyte sedimentation rate, platelet count, fever rate

INTRODUCTION

Typhoid fever is an infectious disease caused by the bacterium *Salmonella enterica* serovar Typhi, commonly known as *Salmonella typhi* (*S. Typhi*). This bacterium primarily attacks the human digestive system and presents with characteristic symptoms such as prolonged high fever (hyperthermia), defined as a body temperature increase >37.5∘C. This elevation can be influenced by hormonal disturbances, metabolic shifts, or increased ambient temperature. Other clinical manifestations include fatigue, headache, nausea, abdominal pain, and either constipation or diarrhea. The spread of typhoid fever is closely linked to population density, personal hygiene, poor environmental sanitation, and the lack of diagnostic facilities accessible to the general public.1

Typhoid fever affects populations globally and, like other infectious diseases, is highly prevalent in developing countries where personal hygiene and environmental sanitation are suboptimal. The prevalence of cases varies significantly depending on geographical location, local environmental conditions, and community behavior.2

According to World Health Organization (WHO) data, the global burden of typhoid fever is estimated at 11–20 million cases per year, resulting in approximately 128,000–161,000 deaths annually. Most cases occur in Southeast Asia, South Asia, and Sub-Saharan Africa. In Indonesia, the incidence of typhoid fever ranges from 350 to 810 cases per 100,000 individuals, with a prevalence of 1.6%. It ranks fifth among infectious diseases affecting all age groups in Indonesia and is the 15th leading cause of death, with a mortality rate of 1.6%. According to the 2021 Performance Report of the North Sumatra Provincial Health Office, 9,035 cases of typhoid fever were recorded.2,3

The high frequency of this disease is attributed to a lack of public attention to hygiene. *Salmonella typhi* transmission occurs through several routes, often referred to as the 5Fs: food, fingers, fomites, flies, and feces. Transmission follows the fecal-oral route, primarily through contaminated food. The bacteria can be shed in the vomitus, urine, and feces of infected individuals, which are then transported by flies that contaminate food, beverages, fresh vegetables, and fruits. *S. typhi* enters the human body through the mouth via contaminated intake. These bacteria can survive for months or even a year in feces, butter, milk, cheese, and frozen water. Once it enters the digestive tract, the incubation period for typhoid fever typically lasts between 10 to 14 days.4,5

Laboratory testing serves as a critical parameter in the diagnostic workup for typhoid fever. The Erythrocyte Sedimentation Rate (ESR) is the rate at which erythrocytes settle from a blood sample and is a laboratory parameter used to evaluate infection, inflammation, and malignancy. The ESR test is performed by placing a blood sample in a Westergren tube for diagnostic purposes, with results reported in mm/hour. In typhoid fever, intestinal inflammation can trigger an increase in ESR. A significant rise in ESR in this condition indicates high blood viscosity, which may pose risks to the cardiac and nervous systems, potentially leading to complications such as meningitis.6

Platelet count is another parameter examined in typhoid fever. Platelets are anucleated cytoplasmic fragments, 2–4 μm in diameter, derived from megakaryocytes. The normal platelet count in peripheral blood ranges from 150,000 to 450,000 cells/μL, with a maturation process of 7–10 days in the bone marrow. Platelets are produced from stem cells in the bone marrow that differentiate into megakaryocytes. Toxemia resulting from bone marrow depression by endotoxins can lead to bone marrow suppression, subsequently causing thrombocytopenia.4

MATERIALS AND METHODS

This study is an observational analytic research using a retrospective approach with a cross-sectional design. The study utilizes secondary

data obtained from medical records. The research will be conducted at Methodist General Hospital, located at Jl. M. H. Thamrin No. 105, Medan.

The sample size for this study consists of 109 samples, comprising pediatric patients diagnosed with typhoid fever who underwent inpatient treatment at Methodist General Hospital. The sampling technique employed is non-probability sampling, where not every member of the population has an equal opportunity to be selected as a participant. The dependent variable in this study is the fever level in typhoid fever patients, while the independent variables are the Erythrocyte Sedimentation Rate (ESR) values and platelet counts.

Inclusion and Exclusion Criteria

Inclusion Criteria:

1. Pediatric patients diagnosed with typhoid fever as documented in the medical records.
2. Pediatric patients with a diagnosis of typhoid fever presenting with fever levels categorized as subfebrile, febrile, or hyperpyrexia.
3. Pediatric patients diagnosed with typhoid fever who showed positive results on the Tubex test.

Exclusion Criteria:

1. Patients with incomplete medical record data.
2. Patients who did not undergo the Tubex laboratory test.
3. Patients presenting with complications or co-existing comorbidities.

RESULTS AND DISCUSSION

Table 1. Frequency and Percentage of Age Distribution in Pediatric Patients with Typhoid Fever

Age (Years)	Frequency (n)	Percentage (%)
5	5	4.6%
6	6	5.5%
7	19	17.4%
8	23	21.1%
9	20	18.3%
10	15	13.8%
11	21	19.3%
Total	109	100%

Based on Table 1, all 109 patients (100%) were within the pediatric age group of 5–11 years. The distribution shows that 5 patients (4.6%) were 5 years old, 6 patients (5.5%) were 6 years old, 19 patients (17.4%) were 7 years old, 23 patients (21.1%) were 8 years old, 20 patients (18.3%) were 9 years old, 15 patients (13.8%) were 10 years old, and 21 patients (19.3%) were 11 years old. Consequently, the highest frequency of typhoid fever occurred in children aged 8 years (21.1%), while the lowest was observed in children aged 5 years (4.6%).

Table 2. Frequency and Percentage of Gender Distribution in Pediatric Patients with Typhoid Fever

Gender	Frequency (n)	Percentage (%)
Male	46	42.2%
Female	63	57.8%
Total	109	100%

Based on Table 2, the majority of pediatric patients with typhoid fever were female, with a frequency of 63 patients (57.8%), while males accounted for 46 patients (42.2%).

Table 3. Frequency and Percentage of Fever Levels in Pediatric Patients with Typhoid Fever

Fever Level	Frequency (n)	Percentage (%)
Subfebrile	26	23.9%
Febrile	66	60.6%
Hyperpyrexia	17	15.6%
Total	109	100%

Based on Table 3, the most frequent fever level observed in pediatric typhoid fever patients was febrile, accounting for 66 patients (60.6%), followed by subfebrile with 26 patients (23.9%), and hyperpyrexia with 17 patients (15.6%).

Table 4. Frequency and Percentage of Erythrocyte Sedimentation Rate (ESR) in Typhoid Fever Patients

ESR Category	Frequency (n)	Percentage (%)
Normal	49	45%
Elevated (High)	60	55%
Total	109	100%

Study Design This study is an observational analytical research utilizing a cross-sectional design. In this approach, observations and measurements of variables were conducted at a single point in time. The objective of this study is to analyze the correlation between platelet counts and hematocrit values among hospitalized DHF patients at RSUD Dr. Pirngadi Medan from 2022 to 2023.

Sampling Technique The samples were selected using a purposive sampling technique, which involves selecting subjects based on predefined characteristics. The use of purposive sampling was determined by specific considerations established by the researcher, aligned with the known traits or properties of the population. This technique is highly suitable for case studies where numerous aspects of representative cases are observed and analyzed.

Participants and Criteria The study population included all patients diagnosed with DHF who possessed complete medical record data. The inclusion criteria were focused on patients with a confirmed DHF diagnosis and accessible laboratory results. Conversely, the exclusion criteria for this research involved DHF patients with comorbidities, such as diabetes, hypertension, or heart disease.

Data Analysis A total of 280 samples were successfully collected and processed. Data analysis was performed using SPSS (Statistical Product and Service Solution) software. The data were evaluated through univariate analysis to describe respondent characteristics and bivariate analysis to determine the correlation between the primary variables.

RESULTS

Table 1. Frequency Distribution Based on Gender

Gender	Frequency (n)	Percentage (%)
Female	98	35%
Male	182	65%
Total	280	100%

Table 4 presents the results of the Erythrocyte Sedimentation Rate (ESR) examinations. The data reveals a predominant tendency toward elevated ESR levels, observed in 60 patients (55%), followed by normal ESR values in 49 patients (45%). Consequently, the majority of pediatric typhoid fever patients exhibited increased ESR levels, while a smaller proportion maintained normal levels.

Table 5. Frequency and Percentage of Platelet Counts in Pediatric Patients with Typhoid Fever

Platelet Count Category	Frequency (n)	Percentage (%)
Trombositopenia < 150.000 /µL	12	11%
Normal 150.000- 400.000 /µL	97	89%
Total	109	100%

Based on Table 5, the results of the platelet count examinations show a predominant trend within the normal range (150,000−400,000/µL), observed in 97 patients (89%). Thrombocytopenia (<150,000/µL) was found in 12 patients (11%), while no patients presented with elevated platelet levels (thrombocytosis). Consequently, the majority of pediatric typhoid fever patients had normal platelet counts, whereas none exhibited increased levels.

Table 6. Correlation Between Erythrocyte Sedimentation Rate (ESR) and Fever Levels

ESR Category	Subfebrile n (%)	Febrile n (%)	Hyperpyrexia n (%)	Total N (%)	p-value
Normal	17 (15.6%)	27 (24.8%)	5 (4.6%)	49 (45.0%)	0.039
Elevated (High)	9 (8.3%)	39 (35.8%)	12 (11.0%)	60 (55.0%)	
Total	26 (23.9%)	66 (60.6%)	17 (15.6%)	109 (100%)	

Statistical Analysis Narrative (Chi-Square Test)
Based on Table 6, among the 60 typhoid fever patients with elevated ESR levels, 9 patients (8.3%) presented with subfebrile temperatures,

39 patients (35.8%) were febrile, and 12 patients (11%) experienced hyperpyrexia. Of the 49 patients with normal ESR values, 17 patients (15.6%) were categorized as subfebrile, 27 patients (24.8%) were febrile, and 5 patients (4.6%) presented with hyperpyrexia.

Statistical analysis using the Chi-Square test yielded a p-value of 0.039 ($p<0.05$), indicating a statistically significant association between ESR values and the fever levels in typhoid fever patients. These results suggest that higher ESR values are associated with an increased severity of fever in pediatric patients with typhoid fever.

Table 7. Association Between Platelet Count and Fever Levels

Platelet Count	Subfebrile n (%)	Febrile n (%)	Hyperpyrexia n (%)	Total N (%)	p-value
Low (Thrombocytopenia)	4 (3.7%)	4 (3.7%)	4 (3.7%)	12 (11.0%)	0.087
Normal	22 (20.2%)	62 (56.9%)	13 (11.9%)	97 (89.0%)	
Total	26 (23.9%)	66 (60.6%)	17 (15.6%)	109 (100%)	

Based on Table 6, of the 97 typhoid fever patients with normal platelet counts, 62 patients (56.9%) presented with febrile temperatures, followed by 22 patients (20.2%) who were subfebrile, and 13 patients (11.9%) with hyperpyrexia. Among the 12 patients with low platelet counts (thrombocytopenia), 4 patients (3.7%) were subfebrile, 4 patients (3.7%) were febrile, and 4 patients (3.7%) presented with hyperpyrexia.

Statistical analysis using the Chi-Square test yielded a p-value of 0.087 ($p>0.05$). This indicates that there is no statistically significant association between the platelet count and the fever level in typhoid fever patients. These findings suggest that the severity of the fever is not directly related to the patient's platelet count in this study population.

DISCUSSION

The Association Between Erythrocyte Sedimentation Rate (ESR) and Fever Levels Based on the bivariate analysis in Table 6, using the Chi-Square test with cell merging, a p-value of 0.039 ($p<0.05$) was obtained. This confirms a statistically significant association between ESR values and the severity of fever in typhoid patients.

This finding is consistent with research by Gayatri (2018), which also reported a correlation between fever levels and ESR results in pediatric patients with typhoid fever. ESR is a diagnostic test that measures the rate at which erythrocytes settle in anticoagulated blood; a faster sedimentation rate results in a higher ESR value. Hemoglobin levels, and specifically fibrinogen concentration, significantly influence clinical ESR values. During inflammation, fibrinogen levels rise, causing red blood cells to clump (rouleaux formation) and settle more rapidly. Furthermore, a decrease in red blood cell count relative to plasma volume can increase the sedimentation rate. Macrocytic anemia can also elevate ESR, while the value typically decreases as the inflammatory process subsides.

When the body undergoes inflammation, the immune response triggers the production of inflammatory proteins, such as fibrinogen, which increases blood viscosity and accelerates erythrocyte sedimentation. The continuous high fever characteristic of typhoid fever is a systemic response to this inflammation, thus correlating with elevated ESR values. In typhoid fever, the fever often persists for several weeks, and the rise in ESR frequently reflects the clinical severity of the fever.

The Association Between Platelet Count and Fever Levels The data analysis in Table 7 regarding the relationship between platelet count and typhoid fever levels shows no significant association. The bivariate analysis using the Chi-Square test with cell merging yielded a p-value of 0.087 ($p>0.05$). These results indicate that there is no statistically significant correlation between the platelet count percentage and the degree of fever in pediatric typhoid patients.

This is in line with studies conducted by Ni Putu et al. (2017) and Arifin (2010), the latter of which reported a p-value of 0.677, stating no meaningful relationship between platelet counts

and fever levels. Bone marrow depression is considered a key mechanism in the development of hematological changes in typhoid. Bone marrow examination often reveals histiocytic hyperplasia with marked phagocytosis of platelets, white blood cells, and red blood cells—a process known as hemophagocytosis. This pathological finding refers to activated macrophages engulfing blood cells and progenitor cells, leading to anemia, leukopenia, and thrombocytopenia.

Variations in the level of endotoxins in a patient's body can result in differing hematological profiles and body temperatures. The uncertainty regarding the exact endotoxin load may have influenced the results of this study. Additionally, the patient's immune status plays a crucial role; a robust immune system may keep hematological and temperature readings within normal ranges. Although platelet percentages do not directly affect fever levels, the fever itself can impact platelets as part of the immune response.

Fluctuations in platelet counts in typhoid patients are related to toxicity caused by endotoxin-induced bone marrow depression and endogenous mediators, which ultimately affect hematological outcomes.

CONCLUSION

Based on the research findings regarding the association of Erythrocyte Sedimentation Rate (ESR) and platelet count with fever levels in pediatric typhoid fever patients at RSU Methodist Medan in 2023, it can be concluded that:

1. There is a statistically significant association between ESR values and the severity of fever.
2. There is no statistically significant association between the platelet count and the level of fever.

REFERENCES

[1]. WHO. *World health statistics* 2022 *(Monitoring health of the SDG*. 2022.
[2]. Kemenkes RI. (2021). Profil Kesehatan Indonesia. Jakarta: Kementrian Kesehatan Republik Indonesia
[3]. Oktafiani, R. (2019) Gambaran Jumlah Leukosit Dan Trombosit Pada Pasien Suspek Demam Tifoid Di Rsud Dr M. Zein Painan. Stikes Perintis Padang
[4]. Widodo, D., 2007, Demam Tifoid, Dalam Sudoyo, A.W., Setyohadi, B. Alwi, I., Simadibrata, M. & Setiati, S. Buku Ajar Ilmu Penyakit Dalam (Edt.), Edisi Keempat, Jilid 3, Hal 1752-1754, Fakultas Kedokteran Universitas Indonesia, Jakarta
[5]. Gandasoebrata,R(2010).Penuntun Laboratorium Klinik. Jakarta:Dian-Rakyat. Kiswari,Rukman (2014). Hematologi dan Tranfusi. Jakarta : Erlangga
[6]. Gayatri, PAID 2018, Hubungan Tingkat Demam dengan Hasil Pemeriksaan Hematologi pada Penderita Demam Tifoid Anak Usia 6-12 Tahun di RSUD Tabanan Kabupaten Tabanan Provinsi Bali Tahun 2017, Skripsi Program Studi Kedokteran, Universitas Wijaya Kusuma Surabaya.
[7]. Arifin, S., Hartoyo, E., Srihandayani, D., 2009. Hubungan tingkat demam dengan hasil pemeriksaan hematologi

pada penderita demam tifoid. Jurnal Universitas Lambung Mangkurat.

[8]. Kosasih,E.N & Kosasih, A.N. (2008) Tafsiran Hasil Pemeriksaan Labooratorium Klinik Edisi 2: Karisma Publishing Grup

[9]. Bula-Rudas, FJ, Rathore, MH, Maraqa, NF 2015, '*Salmonella Infections in Childhood', Advances in Pediatrics*,.