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**Submission date:** 08-Feb-2022 08:28AM (UTC+0700)

**Submission ID:** 1757312512

**File name:** 2ndHESICON-TYPHOID\_FEVER-DR\_PARLIN-26012022.docx (51.21K)

**Word count:** 2307

**Character count:** 13675

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**Hematological profile of children under twelve years with thypoid fever at Idaman Banjarbaru Hospital, Indonesia**

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### Abstracts

**2**  
**Introduction :**

Typhoid fever is a disease caused by *Salmonella typhi*, *Salmonella paratyphi* A, B, C. Approximately 200,000 people die each year from about 21.6 million people infected with typhoid fever.

**The aim :**

This study aims to set the hematological profile in typhoid fever cases in children under twelve at Idaman Banjarbaru Hospital.

**Methods :**

The study was performed with a retrospective descriptive approach and a consecutive sampling technique. The study subjects were children under twelve diagnosed with typhoid fever registered in the Idaman Banjarbaru Hospital's medical records for November 2019 to February 2020.

**Results :**

The sample consisted of 56 patients, 32 boys, and 24 girls. Most patients were found in <5 years, i.e., 35 (62.5%). Thirty-five (62.5%) children have a normal weight. The hematological profile presents 8/35 (22.9%) of the patients <5 years had iron deficiency anemia, and 6/21 (28.6%) of the patients 5 - <12 years had iron deficiency anemia IDA. Hematocrit levels reduced in 21.43 % of patients, and hemoconcentration in 12.50% of patients. Erythrocyte levels in 100% of patients were normal. Leukopenia was present in 30.40% of children. All patients had average basophil values. Eosinopenia and lymphocytosis were found in 89.30%, 35.8% of patients, respectively. Thrombocytopenia and thrombocytosis were found in 14.30%, 5.40% of patients, respectively.

## Conclusion:

<sup>1</sup> The hematological profile of typhoid fever patients in children under twelve can have different results subject to each child's body's response to *S. typhi* and *S. paratyphi* that enter the body.

<sup>1</sup> **Keywords:** typhoid fever, under-twelve child, hematological profile.

## Introduction :

Typhoid fever or enteric fever is a disease caused by *Salmonella typhi*, *Salmonella paratyphi A, B*, and *C*. This disease is frequently found in children, mostly in tropical countries.<sup>1</sup> The term "enteric fever" is a collective term that refers to both typhoid and paratyphoid fever, and "typhoid" and "enteric fever" are often used interchangeably.

<sup>4</sup> Typhoid fever is most prevalent in impoverished areas that are overcrowded with poor access to sanitation. South-central Asia, Southeast Asia, and southern Africa have a high incidence of *S. Typhi* infection (more than 100 cases per 100,000 person-years).<sup>2</sup> The estimated prevalence of confirmed typhoid and paratyphoid among individuals were 9.7% and 0.9% respectively.<sup>3</sup> Typhoid fever prevails in children and young adults than in older patients.<sup>3</sup>

Typhoid fever has a clinical manifestation that varies from mild to severe, even with complications. The study at Dhaka, Bangladesh, from 323 confirmed pediatric typhoid fever showed leukopenia in 7.7% of patients, and thrombocytopenia in 7.7 of patients.<sup>4</sup> Rashed et al.'s study showed Leukopenia 3%, leukocytosis 10%, normal leukocytes 87%, and eosinopenia 21%.<sup>5</sup>

<sup>1</sup> This study aimed to set the hematological profile of children under five with typhoid fever. In addition, the results are hoped to help diagnose typhoid fever so that the management of typhoid fever will be better and more focused.

## Methods ;

<sup>2</sup> The study was performed with a retrospective descriptive approach and a consecutive sampling technique. The study subjects were children under twelve diagnosed with typhoid fever registered in the Idaman Banjarbaru Hospital's medical records for November 2019 to February 2020. The inclusion criteria were children under twelve with typhoid fever and had a complete blood count, Widal or IgM *Salmonella typhi* (Tubex test). The exclusion criteria were lacking data from laboratory tests on medical records. All data were analyzed descriptively. Nutritional status is assessed based on body weight-for-age, divided into normal-weight and under-weight.<sup>6</sup> In this study, normal-weight if the z-score of -2 SD to +1 SD. The Under-weight if the z-score -3 SD < z <-2 SD.<sup>3</sup> This study has obtained ethical clearance

from the Research Ethics Commission of Medical Faculty of University of Lambung Mangkurat No. 916/KEPK-FK ULM/EC/XI/2021.

**Results :**

There were 56 children under twelve diagnosed with typhoid fever in this study, 32 boys and 24 girls.. Patient characteristics can be seen in Table-1.

Table-1. Characteristics of children under twelve with typhoid fever at the Idaman Banjarbaru Hospital for the period November 2019 to February 2020

Characteristics (n=58)	Sum (n)	(%)
Age (Months)		
0 - <60	35	62.50
60 - <144	21	37.50
Gender		
Boys	32	57.10
Girls	24	42.90
Nutritional status (Weight-for-age)		
Under-Weight	21	37.50
Normal-Weight	35	62.50

Table-1 shows that most patients were found in 0 - <60 months, namely 35 (62.5) children. Thirty-five (65.52%) children have a normal weight.

The hematological profile showed that 8/35 (22.9%) of the patients <5 years had iron deficiency anemia (IDA), and 6/21 (28.6%) of the patients 5 - <12 years had iron deficiency anemia IDA.

Table-2 Hematological profile of children under twelve with typhoid fever based on erythrocyte index

Hematological profile	<Normal	Normal	>Normal
Hemoglobin	14 (25.00%)	42 (75.00%)	0 (0.00%)
Hematocrit	12 (21.43%)	37 (62.07%)	7 (12.50%)
Thrombocyte	8 (14.30%)	45 (80.3%)	3 (5.40%)
RBC	0 (0.00%)	56 (100.00%)	0 (0.00%)

Table-3 show the hematological profiles of typhoid fever patients in children under twelve based on leukocytes, and leukocyte count.

**1**  
 Table-3 Hematological profile of children under five with typhoid fever based on leukocytes and leukocyte count

Hematological profile	<Normal	Normal	>Normal
Leukocyte	17 (30.40%)	26 (46.40%)	13 (23.20%)
Basophils	56 (100.00%)	0 (0.00%)	0 (0.00%)
Eosinophils	50 (89.30%)	6 (10.70%)	0(0.00%)
Band Neutrophils	40 (71.40%)	16 (28.60%)	0 (0.00%)
Segmented Neutrophils	24 (42.90%)	14 (25.00%)	18 (32.10%)
Lymphocyte	18 (32.10%)	18 (32.10%)	20 (35.80%)
Monocyte	1 (1.80%)	28 (50.00%)	27 (48.20%)

**Discussion :**

Based on Table-1, the highest age group was in the age group 0- <60 months with a percentage of 62.5%. The result of this study is suited to the study of John et al. (2016) and Saha et al. (2020), who found that the highest incidence of typhoid fever is in children between 2 and 4 years.<sup>3,4</sup> The children's hygienic patterns are still inadequate at this age, and children desire to buy snacks.<sup>7</sup> Inadequate hygienic patterns were allied with carriers of bacterial enteric pathogens in families with children who had typhoid fever.<sup>8</sup> Salmonellae on the hands of convalescent carriers are efficiently eliminated by washing hands with soap and water.<sup>9</sup> Based on gender, it appears that typhoid fever was more prevalent in male children under twelve, i.e., 32 (57.10%) children; this can happen because the boys are more active outside the house, more independent, and has more chance of exposure to street food.<sup>10</sup>

According to nutritional status, most children have average body weight, 62.50%. This study's results are contrasting from Ramaningrum study that presents children with poor nutritional status will be more at risk of suffering from typhoid fever due to reduced immune systems.<sup>11</sup>

Based on Table-2, it appears that 14 (25.00%) children suffer from anemia. All children suffering from anemia had iron deficiency anemia (IDA) based on the RDW value, the Mentzer index, and the RDW index; all children had iron deficiency anemia (IDA). The result of this study is suited to Akbayram et al.' study, which found that 16% of children had anemia.<sup>12</sup> Inflammation (including typhoid fever) will increase the degradation of ferroportin by hepcidin. As a result, the absorbed iron will be reduced, which causes anemia accompanied by the accumulation of intracellular iron.<sup>13</sup>

Based on Table-3, leukopenia was found in 17 (30.40%) patients. Leukopenia is associated with fever and disease toxicity. The result of this study is similar to Qamar's study, which found that 52% of patients had leukopenia.<sup>14</sup>

In this study, thrombocytopenia was found in 14.30% of children. In Ahmad et al.'s study, they found thrombocytopenia in 127 (63.5%%) patients.<sup>15</sup> Thrombocytopenia is an essential marker in children presenting with typhoid fever, notably in those having severe symptoms. So platelet count should be monitored in patients with enteric fever because severe thrombocytopenia can lead to multi-organ failure and can markedly induce increased morbidity and mortality.<sup>16</sup>

Leucopenia, eosinopaenia, thrombocytopenia, and anemia in typhoid fever can be attributed to myeloid maturation arrest, decreased erythroblasts and megakaryocytes, and increased number of erythroblasts and megakaryocytes phagocytic activity of histiocytes in the bone marrow.<sup>17</sup>

On the leukocyte count, all patients had average basophil values. Eosinopenia was found in 50 (89.30%) patients. Ishaq et al. study (2020) identified that 59% of typhoid fever patients undergo eosinopenia.<sup>18</sup> Eosinophils are active primarily in the late stages of inflammation when antigen-antibody complexes are formed and can phagocytose. Eosinopenia is usually associated with an acute bacterial infection that usually induces fever. The reduction of eosinophils is caused by the release of cytokines during margination that occurs in eosinophils.<sup>18</sup>

Band neutropenia was traced in 40 (71.40%) children and segmented neutropenia in 24 (42.90%) children. Neutropenia is due to decreased neutrophil production, increased cell damage, bacterial and viral infections, administration of chemotherapy, and severe infections. This study's result suits the study of Qamar et al. (2013) and Uplaonkar, which identified neutropenia in 48 (32%) typhoid fever patients.<sup>19</sup>

Lymphocytosis was found in 35.80% of children. Relative lymphocytosis followed by neutropenia during the recovery phase is considered a feature of complications of typhoid fever.<sup>20</sup> Monocytosis was found in 48.20% of pediatric patients. This study's results are the same as that of Qamar et al. (2013), who found monocytosis in 30.67% of typhoid fever patients.<sup>14</sup> Monocytes are the largest blood cells and have a function as the body's second layer of defense and can perform phagocytosis properly and include macrophages. In the blood, monocytes will go to the source of inflammation to assist the host immune response and act as mediators of antimicrobial defense. Monocytosis is usually caused by infection with viruses, bacteria, parasites, autoimmune diseases.<sup>21</sup>

#### **1 Conclusion :**

This study shows that 25.00% of children under twelve with typhoid fever suffer from IDA. Leukopenia was present in 30.40% of children. All patients had normal basophils values. Eosinopenia, band neutropenia, segmented neutropenia, lymphocytosis, monocytosis were found in 89.30%, 71.40%, 42.90%, 35.80%, 48.20% of children, respectively. The hematological profile of typhoid fever patients in children under twelve can have different results subject to each child's body's response to *S. typhi* and *S. paratyphi* that enter the body. The bacterial virulence, the patient's immune status, the previous vaccination against typhoid fever, and resistance to antibiotics can influence hematological profile changes.

#### **Conflict of interest :**

The authors have no conflicts of interest to declare that are relevant to this article's content.

**Funding:**

No funds, no grants, or other support was received.

**Acknowledgment:**

I want to thank nurse Novie Norhayati for collecting patient medical record data at RSD Idaman Banjarbaru, and Estiani who input the data collected to the SPSS program.

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