

PROFILE OF NUTRITIONAL STATUS, HEMOGLOBIN, LEUKOCYTES, PLATELET, HEMATOCRIT, ALBUMIN AND SEROLOGY TEST IN CHILDREN INFECTED WITH DENGUE VIRUS AT DR SOETOMO HOSPITAL YEAR 2015

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ABSTRACT

The Dengue Virus Infection (DVI) triggers changes in the host's hematological, biochemical, and immunological aspects, affecting variables like hemoglobin (Hb), leukocytes (WBC), platelets (Plt), hematocrit (Hct), albumin (Alb), IgM, IgG, and NS1Ag Dengue. This study aims to investigate the demographic and clinical characteristics of DVI patients, considering factors such as gender, age, nutritional status, Hb, WBC, Plt, Hct, Alb, dengue serologic tests, and DVI stage. Using a cross-sectional descriptive approach, medical records of 74 subjects were analyzed. Subjects were categorized as DF (33.78%), DHF I (27.03%), DHF II (4.05%), DHF III (25.68%), and DHF IV (9.46%). Predominantly, subjects were aged 6-12 years (48.65%) and predominantly male (58.11%). Most patients had a normal nutritional status (50%), seen in both females and males (32.26%, 62.79%), with DF being dominant (14.86%, 28.92%). Over-nutrition occurred in DF, DHF without shock, and DHF with shock at rates of 12.5%, 33.33%, and 54.17%. DF prevailed in patients aged <6 years (17.57%), while DHF I, DHF II, DHF III were more common in those aged 6-12 years (14.86%, 2.70%, 16.22%), and DHF IV in those aged <6 years (8.11%). Key findings revealed increased Hb levels from DF to DHF, with 38 of 74 DVI patients exhibiting leukopenia. The DVI stage showed an inverse correlation with Plt levels. Hct levels rose in DHF patients, and they had relatively low Alb levels. Primary infections were more frequent in DF, while secondary infections were predominant in DHF with shock. The study also noted variations in over-nutrition prevalence across DVI stages among patients at Dr. Soetomo General Hospital Surabaya in 2015.

Keywords: Dengue virus infection; nutritional status; hemoglobin; leukocytes; platelets

INTRODUCTION

Dengue Virus Infection (DVI) is a health issue that requires special attention as it can cause various clinical symptoms. Its manifestations include high fever for 2 to 7 days, a positive result in the Rumpel Leede (RL) test indicating

bleeding, thrombocytopenia, leukopenia, a 20% or more increase in Hct from the normal value, and hypoalbuminemia due to vascular permeability disorders or plasma leakage (Depkes, 2011). DVI can lead to death through its

resulting manifestations. This disease is prevalent, especially in regions with tropical and subtropical climates (WHO, 2009). Dengue epidemiology is a major health problem in Indonesia, Myanmar, Sri Lanka, Thailand, and Timor-Leste, which are in tropical and equatorial zones (WHO, 2009). According to data from the World Health Organization (WHO) in 2009, more than 35% of Indonesia's population lives in urban areas, with 150,000 cases reported in 2007, including 25,000 cases from Jakarta and West Java. DVI cases tend to cause deaths in children (WHO, 2009).

DVI affecting patients leads to changes in hematological, biochemical, and immunological parameters (Mercado, et al., 2016). Based on the severity of the disease, DVI is divided into undifferentiated fever, Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and expanded Dengue. DHF has four grades: grade I with fever symptoms and a positive RL test, grade II with additional spontaneous bleeding, grade III with signs of shock, and grade IV with severe shock (WHO, 2011).

The body's immunity, influenced by nutritional status such as Body Weight (BW), Height (Ht), and Body Mass Index (BMI), can also affect the development of DVI. Malnutrition makes the body more susceptible to infection (Hakim & Kusnandar, 2012), while better nutritional status can enhance antibody response to antigens (Megariani, et al., 2014). Considering

the severity of DVI, children receiving care in the pediatric department may show differences in profiles of BW, Ht, BMI, Plt count, leukocyte count, Hct, Alb, and serological test results. However, specific data on nutritional status profiles, Hb levels, leukocyte counts, Plt counts, Hct levels, Alb levels, and serological tests in children with DVI during the 2015 period are not available at the Dr. Soetomo Hospital Pediatric Polyclinic. Therefore, this study aims to evaluate the nutritional status profile, Hb levels, leukocyte counts, Plt counts, Hct levels, Alb levels, and serological tests in children infected with the Dengue virus.

METHODS

This study is a type of descriptive research utilizing a cross-sectional method, where the researcher does not apply any treatment to the observed variables. The study population comprises all medical records of pediatric patients who experienced DVI and received treatment at Dr. Soetomo Regional General Hospital in 2015. All patients meeting the inclusion criteria were included in the research sample from January 2015 to December 2015. The sample was selected based on previously recorded medical record numbers, ensuring that all patients meeting the inclusion criteria were included in the research sample. Data analysis was performed descriptively and presented in tabular form.

RESULTS

Distribution of Nutritional Status in Pediatric DVI based on the Severity of DVI

The highest prevalence of DF occurs in individuals with normal nutritional status, accounting for 15 cases (60%) out of 25 DF patients. In contrast, the lowest prevalence is observed in DF patients categorized as severely undernourished or obese, with 0 cases (0%) out

of 25 DF patients. Among DHF cases, 11 patients are identified with obesity. The majority of DHF grade I cases are found in individuals with normal nutritional status, constituting 12 cases (60%) out of 20 DHF grade I patients, while the lowest incidence is observed in the severely undernourished category, with 0 cases (0%) out of 20 DHF grade I patients. For DHF grade II patients, the highest incidence is seen in those

with obesity, accounting for 2 cases (66.67%) out of 3 DHF grade II patients, while the lowest incidence is observed in individuals categorized as severely undernourished, undernourished, or normal, with 0 cases (0%) out of 3 DHF grade II patients. Among DHF grade III patients, the majority have normal nutritional status, comprising 7 cases (36.84%) out of 19 DHF grade III patients, while the lowest incidence is observed in the severely undernourished

category, with 1 case (5.26%) out of 19 DHF grade III patients. Lastly, DHF grade IV patients show the highest prevalence in those with overweight (3 cases, 42.86%) and normal nutritional status (3 cases, 42.86%) out of 7 DHF grade IV patients, while the lowest prevalence is observed in the severely undernourished (0 cases, 0%) and undernourished (0 cases, 0%) categories out of 7 DHF grade IV patients.

Table 1. Distribution of Nutritional Status in Pediatric DVI based on the Severity of DVI

Nutrition Status	DF	DHF I	DHF II	DHF III	DHF IV
Severely Underweight	0 (0%)	0 (0%)	0 (0%)	1 (5,26%)	0 (0%)
Underweight	7 (28%)	3 (15%)	0 (0%)	2(10,53%)	0 (0%)
Normal	15 (60%)	12 (60%)	0 (0%)	7(36,84%)	3(42,86%)
Overweight	2 (15.38%)	1 (7.69%)	0 (0%)	2 (15.38%)	1 (7.69%)
Obesity	0 (0%)	2 (18.18%)	1 (9.09%)	3 (27.27%)	1 (9.09%)

Patients with DHF grade I are most commonly found in the underweight nutritional status category, accounting for 3 individuals (42.86%). For patients with DHF grade II, the majority have a nutritional status in the obesity category, namely 1 individual (100%). As for patients with DHF grade III, the highest number is in the obesity nutritional status category, with 3 individuals (37.5%). Meanwhile, patients with DHF grade IV are most frequently found in the normal nutritional status category, totaling 2 individuals (50%). On the other hand, in men, the most common nutritional status for patients with

DF is in the normal category, with 10 individuals (71.43%). Patients with DHF grade I are most commonly found in the normal nutritional status category, including 11 individuals (84.62%). For patients with DHF grade II, the majority have a nutritional status in the overweight and obesity categories, each with 1 individual (50%). The highest number of patients with DHF grade III is in the normal nutritional status category, totaling 5 individuals (45.45%). Patients with DHF grade IV are most frequently found in the overweight nutritional status category, with 2 individuals (66.67%).

Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct of Pediatric DVI Patients based on the Degree of DVI and Severely Underweight

There is 1 patient with DVI having a severely underweight nutritional status with a

severity level of DVI in DHF grade III. This patient has Hb >12 g/dL (17.6 g/dL), Alb was not checked, Plt <50×10³/mm³ (33×10³/mm³), leukocytes count 5001-10000/mm³ (5120/mm³), Hct >45% (52.5%), and Dengue IgM test is positive.

Table 2. The Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct Levels in Pediatric DVI based on the Severity of DVI and Severely Underweight Nutritional Status

Laboratory Profile	Severely Underweight				
	DF	DHF I	DHF II	DHF III	DHF IV
Hb (g/dL)					
≤12	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>12	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Total	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Albumin (g%)					
<3.5	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
3.5-5.0	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Not checked	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Thrombocytes ($\times 10^3/\text{mm}^3$)					
<50	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
50-100	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>100	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Leukocytes (/mm ³)					
<5001	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
5001-10000	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
>10000	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Hematocrit (%)					
<35	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
35-45	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>45	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Total	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
Dengue serologic test					
IgM+	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)
IgG+	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
NS1+	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct of Pediatric DVI Patients by Degree of DVI and Underweight

There are 12 cases of DVI with underweight nutritional status, comprising 7 cases of DF, 3 cases of DHF grade I, and 2 cases of DHF grade III. No cases with underweight nutritional status were observed in DHF grade II and DHF grade IV. Among children with DVI and underweight nutritional status, 6 patients each had Hb levels ≤ 12 g/dL and > 12 g/dL. The highest Hb level among children with DVI and underweight nutritional status was 15.7 g/dL, while the lowest was 9.3 g/dL. Among children with DVI and underweight nutritional status whose albumin levels were checked, 2 patients

each had albumin levels < 3.5 g% and 3.5-5.0 g%. The highest albumin level among these children was 4.49 g%, while the lowest was 2.78 g%. Eight patients did not have their albumin levels checked. The majority of children with DVI and underweight nutritional status had Plt levels $> 100 \times 10^3/\text{mm}^3$, totaling 6 patients. The highest Plt level among these children was $173 \times 10^3/\text{mm}^3$, while the lowest was $32 \times 10^3/\text{mm}^3$. Most children with DVI and underweight nutritional status had Leukocyte levels $< 5001/\text{mm}^3$, comprising 7 patients. The highest Leukocyte level among these children was $19,500/\text{mm}^3$, while the lowest was $1980/\text{mm}^3$. Among children with DVI and underweight nutritional status, 48 patients had Hct levels ranging from 35-45%, with 6 patients

having the most prevalent range. The highest Hct level among these children was 46.2%, while the lowest was 27.3%. Twelve children with DVI and

underweight nutritional status tested positive for Dengue IgM, and 4 of them also tested positive for Dengue IgG.

Table 3. The Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct Levels in Pediatric DVI based on the Severity of DVI and Undernourished Nutritional Status

Laboratory Profile	Underweight				
	DF	DHF I	DHF II	DHF III	DHF IV
Hb (g/dl)					
≤12	6 (85,71%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>12	1 (14,29%)	3 (100%)	0 (0%)	2 (100%)	0 (0%)
Total	7 (100%)	3 (100%)	0 (0%)	2 (100%)	0 (0%)
Albumin (g%)					
<3.5	1 (14,29%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
3.5-5.0	0 (0%)	2 (66,67%)	0 (0%)	0 (0%)	0 (0%)
Not checked	6 (85,71%)	1 (33,33%)	0 (0%)	1 (50%)	0 (0%)
Thrombocytes ($\times 10^3/\text{mm}^3$)					
<50	1 (14,29%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
50-100	2 (28,57%)	1 (33,33%)	0 (0%)	1 (50%)	0 (0%)
>100	4 (57,14%)	2 (66,67%)	0 (0%)	0 (0%)	0 (0%)
Total	7 (100%)	3 (100%)	0 (0%)	2 (100%)	0 (0%)
Leukocytes (/mm ³)					
<5001	4 (57,14%)	2 (66,67%)	0 (0%)	1 (50%)	0 (0%)
5001-10000	2 (28,57%)	1 (33,33%)	0 (0%)	1 (50%)	0 (0%)
>10000	1 (14,29%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	7 (100%)	3 (100%)	0 (0%)	2 (100%)	0 (0%)
Hematocrit (%)					
<35	5 (71,43%)	0(0%)	0(0%)	0(0%)	0(0%)
35-45	2(28,57%)	3(100%)	0(0%)	1(50%)	0(0%)
>45	0(0%)	0(0%)	0(0%)	1(50%)	0(0%)
Total	7(100%)	3(100%)	0(0%)	2(100%)	0(0%)
Dengue serologic test					
IgM+	7(100%)	3(100%)	0(0%)	2(100%)	0(0%)
IgG+	1(14,29%)	2(66,67%)	0(0%)	1(50%)	0(0%)
NSI+	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)

Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct of Pediatric DVI Patients by Degree of DVI and Normal Nutritional Status

There are 37 cases of DVI among individuals with normal nutritional status, comprising 15 cases of DF, 12 cases of DHF grade I, 7 cases of DHF grade III, and 3 cases of DHF grade IV. Among pediatric DVI patients with normal nutritional status, the majority have Hb levels above 12 g/dL, specifically 26 patients. The highest recorded Hb level in these patients is

16.9 g/dL, while the lowest is 5.8 g/dL. For those with normal nutritional status, 9 patients had their Alb levels examined, most falling within the range of 3.5-5.0 g%. The highest Alb level in this group is 4.4 g%, and the lowest is 2.53 g%. A total of 26 patients did not undergo Alb level testing. Among pediatric DVI patients with normal nutritional status, the highest frequency for Plt levels is between $50 \times 10^3/\text{mm}^3$ and $100 \times 10^3/\text{mm}^3$, with 14 patients falling into this category. The highest recorded Plt level is $221 \times 10^3/\text{mm}^3$, and the lowest is $15 \times 10^3/\text{mm}^3$.

Regarding leukocyte levels, 23 patients with normal nutritional status have levels below 5001/mm³. The highest recorded leukocyte level is 12,290/mm³, while the lowest is 1540/mm³. For Hct levels, 23 patients with normal nutritional status have levels between 35% and 45%. The

highest recorded Hct level in this group is 48.6%, and the lowest is 17.1%. Among pediatric DVI patients with normal nutritional status, 35 patients have positive IgM Dengue, and among them, 15 also have positive IgG Dengue. Additionally, 3 patients are NS1 positive.

Table 4. The Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct Levels in Pediatric DVI based on the Severity of DVI and Normal Nutritional Status

Laboratory Profile	Normal				
	DF	DHF I	DHF II	DHF III	DHF IV
Hb (g/dl)					
≤12	11 (73,33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
>12	4 (26,67%)	12 (100%)	0 (0%)	7 (100%)	3 (100%)
Total	15 (100%)	12 (100%)	0 (0%)	7 (100%)	3 (100%)
Albumin (g%)					
<3.5	0 (0%)	1 (8,33%)	0 (0%)	1 (14,29%)	0 (0%)
3.5-5.0	4 (26,67%)	2 (16,67%)	0 (0%)	2 (28,57%)	1 (33,33%)
Not checked	11 (73,33%)	9 (75%)	0 (0%)	4 (57,14%)	2 (66,67%)
Thrombocytes (×10³/mm³)					
<50	1 (6,67%)	5 (41,67%)	0 (0%)	3 (42,86%)	1 (33,33%)
50-100	6 (40%)	2 (16,67%)	0 (0%)	4 (57,14%)	2 (66,67%)
>100	8 (53,33%)	5 (41,67%)	0 (0%)	0 (0%)	0 (0%)
Total	15 (100%)	12 (100%)	0 (0%)	7 (100%)	3 (100%)
Leukocytes (/mm³)					
<5001	8 (53,33%)	9 (75%)	0 (0%)	5 (71,43%)	1 (33,33%)
5001-10000	6 (40%)	3 (25%)	0 (0%)	2 (28,57%)	1 (33,33%)
>10000	1 (14,29%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	1 (6,67%)	0 (0%)	0 (0%)	0 (0%)	1 (33,33%)
Hematocrit (%)					
<35	8 (53,33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
35-45	7 (46,67%)	12 (100%)	0 (0%)	2 (28,57%)	2 (66,67%)
>45	0 (0%)	0 (0%)	0 (0%)	5 (71,43%)	1 (33,33%)
Total	15 (100%)	12 (100%)	0 (0%)	7 (100%)	3 (100%)
Dengue serologic test					
IgM+	14 (93,33%)	11 (91,67%)	0 (0%)	7 (100%)	3 (100%)
IgG+	4 (28,57%)	4 (36,36%)	0 (0%)	5 (71,43%)	2 (66,67%)
NS1+	2 (13,33%)	1 (8,33%)	0 (0%)	0 (0%)	0 (0%)

Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct of Pediatric DVI Patients by Degree of DVI and Overweight

There are 13 children suffering from DVI with the nutritional status categorized as overweight. The breakdown is as follows: 3 children with the severity level of DF, 2 children with DHF grade I, 1 child with DHF grade II, 4 children with DHF grade III, and 3 children with

DHF grade IV. Among the children with DVI and overweight nutritional status, 11 have Hb levels >12 g/dL. The highest Hb level in this group is 17.6 g/dL, while the lowest is 11.5 g/dL. In the same group, children with DVI and overweight nutritional status who underwent albumin level examinations showed that 5 of them have Alb <3.5 g%. The highest Alb level in this group is 4.61 g%, while the lowest is 2.45 g%. Six

children did not undergo albumin level examinations. Furthermore, children with DVI and overweight nutritional status, having a Plt count $<50 \times 10^3/\text{mm}^3$, are 6 in number. The highest Plt level in this group is $211 \times 10^3/\text{mm}^3$, and the lowest is $12 \times 10^3/\text{mm}^3$. In the same group, children with IVD and overweight nutritional status, most of them have leukocyte counts between 5001-10,000/ mm^3 , which is 8 children. The highest leukocyte count in this group is 23,400/ mm^3 , while the lowest is 3130/ mm^3 .

Children with DVI and overweight nutritional status, with Hct levels between 35-45%, are most numerous, comprising 7 children. The highest Hct level in this group is 48.2%, while the lowest is 32.3%. Out of the total 13 children with DVI and overweight nutritional status, all are declared positive for IgM Dengue, and among them, 5 children are also found to be positive for IgG Dengue. There is no information regarding patients who underwent NS1 tests.

Table 5. The Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct Levels in Pediatric DVI based on the Severity of DVI and Overweight Nutritional Status

Laboratory Profile	Overweight				
	DF	DHF I	DHF II	DHF III	DHF IV
Hb (g/Dl)					
≤ 12	2(66,67%)	0(0%)	0(0%)	0(0%)	0(0%)
>12	1(33,33%)	2(100%)	1(100%)	4(100%)	3(100%)
Total	3(100%)	2(100%)	1(100%)	4(100%)	3(100%)
Albumin (g%)					
<3.5	0(0%)	0(0%)	1(100%)	2(50%)	2(66,67%)
3.5-5.0	0(0%)	1(50%)	0(0%)	0(0%)	1(33,33%)
Not checked	3(100%)	1(50%)	0(0%)	2(50%)	0(0%)
Thrombocytes ($\times 10^3/\text{mm}^3$)					
<50	1(33,33%)	0(0%)	1(100%)	2(50%)	2(66,67%)
50-100	0(0%)	1(50%)	0(0%)	2(50%)	1(33,3%)
>100	2(66,67%)	1(50%)	0(0%)	0(0%)	0(0%)
Total	3(100%)	2(100%)	1(100%)	4(100%)	3(100%)
Leukocytes (/ mm^3)					
<5001	2(66,67%)	0(0%)	0(0%)	0(0%)	1(33,33%)
5001-10000	1(33,33%)	2(100%)	1(100%)	2(50%)	2(66,67%)
>10000	0(0%)	0(0%)	0(0%)	2(50%)	0(0%)
Total	3(100%)	2(100%)	1(100%)	4(100%)	3(100%)
Hematocrit (%)					
<35	2(66,67%)	0(0%)	0(0%)	0(0%)	0(0%)
35-45	1(33,33%)	2(100%)	1(100%)	1(25%)	2(66,67%)
>45	0(0%)	0(0%)	0(0%)	3(75%)	1(33,33%)
Total	3(100%)	2(100%)	1(100%)	4(100%)	3(100%)
Dengue serologic test					
IgM+	3(100%)	2(100%)	1(100%)	4(100%)	3(100%)
IgG+	1(33,33%)	1(50%)	0(0%)	2(50%)	1(33,33%)
NS1+	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)

Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct of Pediatric DVI Patients by Degree of DVI and Obesity

There are 11 children suffering from DVI

with nutritional status classified as obesity, consisting of 3 children with DHF grade I, 2 children with DHF grade II, 5 children with DHF grade III, and 1 child with DHF grade IV. All children with DVI and obesity nutritional status

have Hb levels >12 g/dL. The highest Hb level in children with DVI and obesity nutritional status is 16.1 g/dL, while the lowest is 12.4 g/dL. Children with DVI and obesity nutritional status, whose Alb levels were examined, are divided into two categories, Alb <3.5 g% and 3.5-5.0 g%, each with 5 children. The highest Alb level in children with DVI and obesity nutritional status is 4.66 g%, while the lowest is 2.76 g%. One child did not undergo albumin level examination. Children with DVI and obesity nutritional status have Plt counts <50×10³/mm³ and >100×10³/mm³, each with 5 children. The highest Plt level in children with DVI and obesity nutritional status is 196×10³/mm³, while the lowest is 13×10³/mm³. Children with DVI and

obesity nutritional status, having leukocyte counts <5001/mm³, are the most numerous, with 5 children. The highest leukocyte count in children with DVI and obesity nutritional status is 19,120/mm³, while the lowest is 1980/mm³. Children with DVI and obesity nutritional status are most numerous at Hct levels of 35-45%, comprising 8 children. The highest Hct level in children with DVI and obesity nutritional status is 49.6%, while the lowest is 35.4%. In children with DVI and overweight nutritional status, there are 10 children who are IgM Dengue positive, and among them, 6 children are also IgG Dengue positive. One child was found to have undergone NS1 testing with a positive result.

Table 6. The Frequency Distribution of Hb, Alb, Plt, Leukocytes, and Hct Levels in Pediatric DVI based on the Severity of DVI and Obesity Nutritional Status

Laboratory Profile	Overweight				
	DF	DHF I	DHF II	DHF III	DHF IV
Hb (g/Dl)					
≤12	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
>12	0(0%)	3(100%)	2(100%)	5(100%)	1(100%)
Total	0(0%)	3(100%)	2(100%)	5(100%)	1(100%)
Albumin (g%)					
<3.5	0(0%)	1(33,33%)	1(50%)	2(40%)	1(100%)
3.5-5.0	0(0%)	2(66,67%)	0(0%)	3(60%)	0(0%)
Not checked	0(0%)	0(0%)	1(50%)	0(0%)	0(0%)
Thrombocytes (×10³/mm³)					
<50	0(0%)	1(33,33%)	1(50%)	2(40%)	1(100%)
50-100	0(0%)	0(0%)	0(0%)	1(20%)	0(0%)
>100	0(0%)	2(66,67%)	1(50%)	2(40%)	0(0%)
Total	0(0%)	3(100%)	2(100%)	5(100%)	1(100%)
Leukocytes (/mm³)					
<5001	0(0%)	2(66,67%)	0(0%)	2(40%)	1(100%)
5001-10000	0(0%)	1(33,33%)	2(100%)	1(20%)	0(0%)
>10000	0(0%)	0(0%)	0(0%)	2(40%)	0(0%)
Total	0(0%)	3(100%)	2(100%)	5(100%)	1(100%)
Hematocrit (%)					
<35	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
35-45	0(0%)	2(66,67%)	2(100%)	4(80%)	0(0%)
>45	0(0%)	1(33,33%)	0(0%)	1(20%)	1(100%)
Total	0(0%)	3(100%)	2(100%)	5(100%)	1(100%)
Dengue serologic test					
IgM+	0(0%)	3(100%)	1(50%)	5(100%)	1(100%)
IgG+	0(0%)	2(66,67%)	0(0%)	4(80%)	0(0%)
NS1+	0(0%)	0(0%)	1(50%)	0(0%)	0(0%)

DISCUSSION

Infants with excess body weight have a higher risk of contracting dengue hemorrhagic fever. Tedesco et al.'s (2016) study states that the prevalence of overweight and obesity is relatively high in cases of dengue fever, with 0.7% underweight and 18.1% overweight (Tedesco et al., 2016). However, these findings are not consistent with the research results of Maron and Trang, who assert that both overweight and underweight statuses do not affect the occurrence of DVI (Maron et al., 2010; Trang et al., 2016). Maron et al. in El Salvador also mentioned that the severity of DVI is influenced by various factors such as mosquito density and host response (Maron et al., 2010). The research findings of Maron and Trang are further supported by Rajapakse, who states that although malnutrition predisposes individuals to many infectious diseases, it does not seem to increase the likelihood of severe dengue fever (Rajapakse, 2011).

The reason why DVI is more prevalent in children with good nutritional status is that nutritional status influences the severity of DVI through the immune response, which involves an increased antibody response binding to antigens in well-nourished children (Megariani et al., 2014).

Obesity is associated with increased adipose tissue, macrophage infiltration in visceral adipose tissue, and a pro-inflammatory cytokine environment (Libraty et al., 2015). Proteins related to immunity produced by adipocytes include adiponin, tumor necrosis factor- α , leptin, and others (A et al., 2001). Preadipocytes can function as macrophage-like cells and enhance the direct participation of adipose tissue

in the inflammatory process (A et al., 2001). In adipose tissue, DENV can productively infect adipocytes and macrophages (Libraty, 2015). When there is a high viral load with a pro-inflammatory cytokine storm in vulnerable children, there is a potential for the development of more severe DHF (Libraty, 2015).

In patients with DVI, there is an increase in Hb levels from DF to DHF; the majority of DVI patients experience leukopenia ($<5001/\text{mm}^3$). Hemoglobin levels increase in accordance with the rising hemoconcentration in patients, and individuals who have recently been infected with the Dengue virus will have normal or decreased Hemoglobin levels (Mayetti, 2010). The relatively increased leukocyte count in Dengue Hemorrhagic Fever (DHF) cases may be caused by plasma leakage (Raditha, et al., 2013). The lower the Plt levels, the higher the degree of DVI. The decrease in platelet levels occurs due to bone marrow depression (Raditha, et al., 2013). The onset of shock can be accelerated by bleeding caused by the reduced platelet count (Buntubatu, et al., 2016). In DHF patients, there is an increase in Hct levels, and Alb levels are relatively low in DHF. The increase in Hct (hematocrit) and Hb (hemoglobin) occurs due to increased vascular permeability, triggering plasma leakage that fills the extravascular space with fluid (Patandianan, et al., 2013). In DHF, hypoalbuminemia not only occurs due to increased vascular permeability but can also result from decreased albumin synthesis in the liver because albumin is a negative acute-phase protein (Dharma, et al., 2006). In DF, primary infections are most common, while in DHF with shock, secondary infections are more prevalent.

CONCLUSION

In individuals experiencing DVI, there is an increase in Hb levels from DF to DHF. The majority of DVI patients experience

leukopenia (white blood cell count $<5001/\text{mm}^3$), namely 38 out of 74 patients. The lower the platelet count, the higher the

severity of DVI. In DHF patients, there is an increase in Hct levels, while albumin levels DHF patients with shock, secondary infections are more common.

tend to be lower. Primary infections most frequently occur in DF patients, whereas in

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