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Comparison of Hemoglobin Levels in Stunting and Non Stunting Children at State Elementary School 018092 Lobu Rappa

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ABSTRACT

Background : In North Sumatra, there is still a high potential for stunting with a stunting prevalence of 21.1 percent. It is assumed that anemia is one of the risk factors for stunting. Not much research has been done regarding the incidence of anemia as a risk factor for stunting. Objective: The purpose of this study was to determine the incidence of anemia in stunting and non-stunting children. Methods: This study uses an observational analytical approach with a cross-sectional design. The sample consists of 30 first-grade elementary school children who meet the inclusion and exclusion criteria. The data analysis used is the Fisher's Exact Test. Results: The results showed that out of 30 elementary school children measured, there were 11 children with stunting nutritional status, 7 of them have low hemoglobin levels or anemia, while 19 children with non-stunting nutritional status, 3 of them have low hemoglobin levels or anemia with the results of the chi-square statistical test (P=0,015).
Conclusion : There were differences in hemoglobin levels in stunted and non-stunted children at SD Negeri 010892 Lobu Rappa.

Keywords: Hemoglobin, stunting, children

1. INTRODUCTION

Stunting refers to a condition where a person's height is significantly lower than the average expected for their age and sex. It is a clear indicator of persistent undernutrition, often caused by chronic malnutrition over a long period of time. As a result, individuals who experience stunting early in life may also face challenges in cognitive, psychomotor, and intellectual development. Stunting is usually identified by comparing a person's height to established growth standards, which are widely used around the world to monitor and assess physical development (Candra MKes(Epid), 2020).

Globally, according to the annual average rate of reduction (AARR) of stunting based on the current trend from 2012-2022 is only 1.65% per year. However, a reduction of 6.08 is needed from now until 2030 to achieve the global target of reducing stunted children to 88.9 million (Kemenkes, 2013). In 2017, it was estimated that approximately 22.2% or 150.8 million children under the age of five worldwide were stunted. However, this figure shows a significant increase compared to the stunting rate of 32.6% in 2000 (Permanasari et al., 2021)

Based on data from the 2023 Indonesian Health Survey (SKI), there are three provinces with the highest prevalence of stunting in Indonesia, namely East Nusa Tenggara Province at 21.0%, Central Papua at 18.2% and Aceh at 17.2% (Ministry of Health of the Republic of Indonesia, 2023). North Sumatra Province has thirty-three districts with varying stunting incidence rates. The highest prevalence of stunting is 39.4% in South Tapanuli district, the lowest is in North Labuhan Batu district at 7.3 while in Asahan district it is 15.3% (Kemenkes, 2023).

Hemoglobin is a complex molecule that forms the main part of red blood cells. This molecule is produced by the bone marrow and has a vital role as a carrier of oxygen from the lungs to the entire body and carries carbon dioxide from body tissues back to the lungs. The process of hemoglobin formation is highly dependent on the production of red blood cells, which occurs in the spinal cord. If the bone marrow is functioning properly, then the production of red blood cells and erythrocytes can take place in about 5 to 9 days. Meanwhile, the age of red blood cells and hemoglobin is estimated to be around 120 days. Hemoglobin consists of several important components, including proteins, iron salts, and pigments that give blood its red color.

Based on the background explanation above, the researcher is interested in conducting a study entitled "Comparison of Hemoglobin Levels in Stunting and Non-Stunting Children to Determine Preventive Actions Through Increasing Nutritional Intake in Toddlers". In this study, the author wants to find out more about the phenomena of stunting and non-stunting at SD Negeri 018092 Lobu Rappa. The main reason for conducting this study was to identify the prevalence of stunting and analyze the comparison of hemoglobin levels between children who experience stunting and those who do not. This study is expected to provide a better understanding of the importance of nutritional interventions at the toddler stage to prevent stunting.

2. METHOD

This type of research uses analytical observation with cross-sectional. This research was conducted at State Elementary School 018092 Lobu Rappa, North Sumatra Province, Asahan Regency. The population of this research is elementary school students. The sample of this study was all students of grade 1 at SD Negeri 018092 Lobu Rappa. The number of samples used was 30 children. In this study, the technique used was the total sampling technique. Variables are characteristics of research subjects that can differ from one subject to another. Variables are categorized into two: dependent variables and independent variables (Sundari, 2024). Dependent variables or commonly called bound variables are variables that change due to changes in independent variables. In this study, the dependent variable is the incidence of stunting in children. Independent variables or commonly known as free variables are variables that are produced from changes that can cause changes in other variables. In this study, the independent variable is hemoglobin levels.

The research instrument used to measure stunted children is a microtoise and measures hemoglobin levels using the Point Of Care Testing (POCT) method using the easy touch GcHb tool which is collected using a measurement sheet. The measurement sheet is filled in by the researcher when the measurement is carried out on the respondents. The data in this study are primary data taken directly by the researcher. The data is in the form of a measurement questionnaire filled out directly by the researcher when the measurement was carried out. This study uses computer program analysis including univariate analysis and bivariate analysis. Univariate analysis aims to see the frequency of each variable used in this study, namely independent and dependent variables. The bivariate analysis used in this study was the Fisher's Exact test with the aim of analyzing differences in hemoglobin levels in stunted and non-stunted children.

3. RESULTS AND DISCUSSION

The place where the research was conducted was SDN 018092 Lobu Rappa. The research location is in Dusun IV, Lobu Rappa, Aek Songsongan District, Asahan Regency, North Sumatra. This location is far from the sub-district center so it is a bit difficult to get access such as information, or health services. This elementary school has 151 students consisting of 82 boys and 69 girls.

3.1. Univariate Analysis Results

Univariate analysis is used to analyze data that has been collected descriptively in the form of a frequency distribution table as follows.

Table 1. Respondent characteristics based on gender

No	Gender	Amount	Percentage (%)
1	Man	15	50
2	Woman	15	50
	Total	30	100

Table 1 shows the characteristics of the sample based on gender in 30 samples. In this table, it can be seen that the male sample (50%) is the same as the female sample, namely 15 samples each (50%).

Table 2. Respondent characteristics based on age

No	Age	Amount	Percentage
1	7 Years	30	100
	Total	30	100

Table 2 shows the characteristics of 30 samples based on age. It was found that all samples were 7 years old (100%).

Table 3. Respondent characteristics based on stunting category (H/A)

No	Stunting category	Amount	Percentage
1.	Stunting	11	36.7
2.	Non stunting	19	63.3
	Total	30	100

Table 3 shows that of the 30 samples examined, there were 11 children with stunting (36.7%) and 19 children with non-stunting (63.3%).

Table 4. Frequency distribution of respondents' age based on hemoglobin levels

No		Hemoglobin Level					
		Anemia		No Anemia		Total	
	Age	n	%	N	%	n	%
1.	7 Years	10	33.3	20	66.7	30	100
	Total	10	33.3	20	66.7	30	100

Table 4. shows that of the 30 samples that were examined, all samples were 7 years old with 10 samples (33.3%) having low hemoglobin levels (anemia) and the other 20 (66.7%) having normal hemoglobin levels (not anemic).

Table 5. Frequency distribution of standard deviation of respondents based on hemoglobin levels

No		Hemoglobin levels					
		Anemia		No Anemia		Total	
	Stunting category	N	%	N	%	n	%
1	Stunting	7	70	4	20	11	33.3
2	Non-Stunting	3	30	16	80	45	45.5
	Total	10	100	20	100	30	100

Table 5. shows that from 30 samples examined, 7 out of 10 anemic children (70%) were found to have stunted body condition, and 3 other anemic children (30%) had normal height according to their age (non-stunting). Of the 20 non-anemic children, 4 of them (20%) were stunted, and 16 other children were non-stunting (80%).

Table 6. Frequency distribution of respondents' hemoglobin levels based on stunting category

No		Stunting category					
		Stunting		Non stunting		Total	
	Hemoglobin levels	n	%	n	%	n	%
1	Anemia	7	63.6	3	15.9	10	33.3
2	No anemia	4	36.4	16	84.1	20	66.7
	Total	11	100	19	100	30	100

Table 6 shows that out of 30 samples examined, 11 stunted children were found, 7 of whom (63.6%) had anemia, and 4 others (36.4%) had normal HB levels. Of the 19 non-stunting children, 16 children (84.1%) had normal HB levels, and 3 others (15.9%) had anemia

3.2. Bivariate Analysis Results

Bivariate analysis was carried out to determine the relationship between the independent variables and the dependent variables.

The statistical test used is chi-square (X2) with a degree of significance (α) of 5%. To be able to perform the chi square test, several requirements must be met, namely that there are no observed value cells that have a value of 0 and there are no cells that have an expected value <5. The results of the entire bivariate analysis can be seen in the table below:

Table 7. Differences in hemoglobin levels with deviation status of stunted and non-stunted children

No	HB levels	Deviation status				*p-value*	PR	CI 95%
		Stunting		Non stunting				
		F	%	F	%			
1	Anemia	7	63.6	3	15.8	0.015	9,333	1,637-53,208
2	No anemia	4	36.4	16	84.2			
Total		11	100	19	100			

Table 7 shows the test results using the Chi Square test because both variables are nominal so they are not normally distributed. This variable does not meet the Chi-Square requirements because even though a 2x2 table is used, it has 1 cell (25%) that has an expected count <5. So the alternative Fisher's Exact Test is used. The test results were obtained with a p-value = 0.015 (p-value <0.05) so it can be concluded that there is a significant difference between HB levels in stunted children and HB levels in non-stunted children.
These two variables were also tested using the Risk method to see the prevalence ratio value in order to determine how much influence HB levels have in influencing stunting. The prevalence ratio value obtained from the test results was 9.333 (CI 95% 1.637-53.208) which concluded that anemic children would be 9.333 times more at risk of stunting than non-anemic children.

3.3. Discussion

From the results of the univariate test, it can be seen that there are differences in the hemoglobin levels of stunted and non-stunted children. Of the 11 stunted children, 7 of them are anemic because they have hemoglobin levels below normal (<11g/dl). In the 19 non-stunted children, 16 of them have normal HB (≥11g/dl) and only 3 children are anemic. From these results it can be clearly seen that stunted children have a tendency to anemia.
The bivariate test results also show the standard deviation of stunting and non-stunting which affects hemoglobin levels, causing a difference between HB levels in stunted children and HB levels in non-stunted children which shows significant results with a p-value = 0.015 and a prevalence ratio value of 9.333 (CI 95% 1.637-53.208). From the prevalence ratio value, it can be concluded that stunting or non-stunting conditions will make a significant difference in children's hemoglobin levels. The more children who are stunted, the more children will have low hemoglobin levels (anemia).
These results are in line with research(Oktarina et al., 2024)which uses a meta-analysis method with the results of 15 articles tested, 9 of which state that anemia and stunting events will be significantly related. Children who experience stunting have a 1.31-6.785 times higher risk of experiencing anemia than non-stunting children, likewise children with anemia will be at risk of 2.27 (95% CI = 1.30–3.95) of stunting than children who are not anemic.
Another study that strengthens the findings of this study is research conducted by (Utami et al., 2023) in 1,986 children aged 6-9 years which explained that there was a relationship between stunting and anemia with a p-value = 0.020 where stunted children would be 1,307 times more at risk of suffering from anemia (1,043-1,639) likewise anemic children would be 1,355 times more at risk of suffering from stunting.
(Nisa et al., 2024) also conducted research on 74 children aged 6-10 years with the results that the amount of hemoglobin levels would be seen to be significantly lower in stunted and severely stunted children compared to non-stunted children or normal children with a p-value = 0.031 in boys and 0.003 in girls.
Research result (Riaty & Nursyam, 2022) shows the average hemoglobin level in stunted children is 10.74 ± 0.35 while the average Hb level in severe stunted children is 10.65 ± 3.8. The results of the statistical test obtained a Sig. (2-tailed) value of 0.00 < 0.05. Which means there is a significant difference between the hemoglobin levels of stunted and non-stunted children.
In the research (Butarbutar et al., 2024) which was conducted using a cross-sectional technique, and with a sample of 28 grade 1 elementary school students, the results of the examination concluded that there was a difference in Hb between stunted and non-stunted children with a p-value of 0.061 (<0.05).
Based on the theory summarized in the research(Nugraheni et al., 2023), stunting will affect a child's hemoglobin levels because of various interrelated factors between the two including nutrition in the food provided, infection from infectious diseases, sanitation, and parenting patterns. The occurrence of stunting due to nutritional deficiencies that support child development will affect the immune system and cause anemia. Stunting children are at greater risk of contracting infectious diseases, while anemia can be influenced by acute and chronic inflammation due to infection.
The result of anemia is a reduced supply of oxygen to body tissues, which if it continues can inhibit the growth of children, and cause disorders in cognitive and motor development. That is why stunting and anemia are interrelated and affect each other (Nugraheni et al., 2023).
Classification of stunted children was carried out using the CDC 2000 graph because all samples were >5 years old, and from the results it was found that there were 11 cases of stunting (36.7%) of the 30 children examined at SDN 018092 Lobu Rappa. In the 11 children, there were more children with anemia, namely 7 (63.6%) of 11 children,

while from 19 (63.3%) non-stunting children there were 16 children (84.2%) with normal HB, and only 3 children (15.8%) were anemic.
These results are in line with research (Gowele et al., 2021) which obtained results from 666 school children aged 5-10 years, 28.1% experienced stunting.
Other research that is also in line with this is found in research (El-Shafie et al., 2020) using the cross-sectional method, namely from 33,150 children aged 6-11 years, 380 people (17%) of them experienced stunting.
From the theory that has been summarized, stunting is a form of chronic malnutrition that represents the inability to obtain adequate nutritional intake over a long period of time due to poor diet, repeated infections, and chronic diseases. The long-term impacts of stunting on individuals include decreased cognitive and physical development, reduced productivity, and increased risk of degenerative diseases such as diabetes. In addition, children who experience stunting tend to experience rapid weight gain, which can increase the risk of obesity in the future (Gowele et al., 2021).
(El-Shafie et al., 2020) in his research assessed the causes of stunting and revealed that non-pathological causes are the highest in prevalence consisting of family, and idiopathic. The characteristics of the cause of family history are; bones that are in accordance with the age that should be with normal growth rate, but adult height is predicted according to the family.
According to(Candra MKes(Episode), 2020b)In his book, there are risk factors that are the main causes of stunting which are divided into genetic factors, economic status, birth spacing <2 years, low birth weight, maternal anemia, environmental hygiene, and nutritional deficiencies (protein, calcium, zinc, and iron).

4. CONCLUSION

The following conclusions were obtained based on the researcher's findings and discussion. There is a difference in the hemoglobin levels in stunted and non-stunted children, where it was found that out of 11 stunted children, 7 of them were anemic because they had hemoglobin levels below normal (<11g/dl), while of the 19 non-stunted children, 16 of them had normal HB (≥11g/dl) andonly 3 children are anemic. From these results it can be clearly seen that stunted children have a tendency towards anemia. The number of stunted children at State Elementary School 018092 Lobu Rappa, Aek Songsongan District is 11 people.

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