



## THE CORRELATION BETWEEN IRON DEFICIENCY ANEMIA AND NUTRITIONAL STATUS IN TODDLERS AT UNS HOSPITAL

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### ABSTRACT

**Background:** Anemia occurs in 1 in 3 toddlers in Indonesia. Iron deficiency anemia (IDA) is one of the most common causes of anemia in toddlers. Iron deficiency affects the synthesis of DNA, neurotransmitters, and mitochondrial cytochrome. Lacking nutrition can cause health problems in toddlers. This is characterized by the nutritional status of toddlers classified as short or underweight. This study aims to determine the correlation between IDA and nutritional status in toddlers.

**Method:** This research is an analytical observational study with a cross sectional approach. The population for this study were toddlers who had been treated at UNS Hospital from 2021 to 2023. The samples in this study were taken using purposive sampling, totaling 115 toddlers. The independent variable is IDA and the dependent variable is the toddler's nutritional status. Data analysis used the Spearman test with SPSS version 25.

**Result:** This study showed 75 IDA toddlers and 40 others had normal hemoglobin. The toddlers were tested with 2 z-score indicators. The highest number of test results with the Weight/Length indicator was -2SD to 2SD (good nutrition) with a total of 87 toddlers and the Length/Age indicator was -2SD to 2SD (normal) with a total of 67 toddlers. It was analyzed using the Spearman test and a significant value of 0.235 for the Weight/Length indicator and 0.140 for the Length/Age indicator. Both indicators show results of more than 0.05 ( $p > 0.05$ ).

**Conclusion:** There is no significant correlation between iron deficiency anemia and nutritional status in toddlers at UNS Hospital. This shows the need for a more comprehensive approach to nutrition in toddlers with IDA, rather than just focusing on increasing hemoglobin levels.

**Keywords:** *iron deficiency anemia, nutritional status, pediatrics*

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## INTRODUCTION

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Anemia is a condition when hemoglobin levels are below normal values. Anemia conditions often occur in pregnant women, school-age children and even toddlers. Anemia is also a health problem that often occurs throughout the world, especially in developing countries such as Indonesia<sup>[1]</sup>. Anemia occurs in one in three Indonesian children under the age of five<sup>[2]</sup>. Of course, this has a big impact on the physical health, and social well-being, as well as the economy of the community. Anemia is not a condition that suddenly occurs, many factors can trigger this condition such as vitamin B12 deficiency, folic acid deficiency, and iron deficiency<sup>[3]</sup>. Toddlers aged 6 to 59 months can be called anemic if the hemoglobin level is lower than 11.0 g / dL<sup>[4]</sup>. Among all types of anemia, iron deficiency anemia is one of the most common causes of anemia in toddlers. The cause is that the food consumed by toddlers has low iron levels<sup>[5]</sup>. In addition to producing hemoglobin, iron is also very important in the process of child growth. Iron deficiency also affects the synthesis of DNA, neurotransmitters, and mitochondrial cytochromes<sup>[3]</sup>. Thus, children suffering from iron deficiency anemia can experience a decline in their motor, sensory, cognitive, and social functions<sup>[2]</sup>.

Malnutrition is still a major problem in some developing countries such as Indonesia. Anemia is an indicator of malnutrition and ill health<sup>[6]</sup>. Nutrients are important for the growth and development of the nutritional status of toddlers. Foods that lack nutrients can cause health problems in toddlers. For example, children get tired quickly due to lack of energy, brain disorders, and other reasons. If this happens continuously for a long time, it will cause problems with the nutritional status of toddlers. This is characterized by short or underweight nutritional status in toddlers.

Stature, which encompasses an individual's posture and overall body shape, is typically associated with the nutritional status of toddlers. Nutritional status itself can be interpreted as a health parameter that is influenced by the balance between incoming nutrients and the body's nutritional needs to develop. Failure to provide adequate nutrition for toddlers can cause growth disorders and end up being short or underweight in stature<sup>[7]</sup>.

Nutritional, health, and nurturing factors are interrelated with each other in the main components that affect a toddler's growth. Children who are malnourished and accompanied by a lack of stimulus from parents usually have a low IQ<sup>[3]</sup>. Breast milk has its own specialty, which has iron content that can be more easily absorbed by toddlers 2-3 times more effectively than other nutritional intake such as formula milk. Therefore, babies who lack breast milk intake need to get other foods rich in iron that can be started as early as toddlers aged six months<sup>[8]</sup>. Failure to provide adequate nutrition for toddlers can lead to growth disorders, resulting in short stature or being underweight. In particular, foods such as pureed meats, beans, tofu, and fortified cereals can provide the necessary iron to support healthy growth during this critical period of development.

The use of anthropometric indicators for toddlers under the age of two years is guided by the WHO growth chart, which serves as a benchmark due to its superior methodology and diverse, global research base<sup>[9]</sup>. This growth chart is particularly valuable because it reflects the ideal growth patterns of children from five different continents, accounting for a variety of supportive environments. Accurate tracking of these indicators is crucial, as they are directly influenced by nutritional, health, and nurturing factors. For instance, children who are malnourished not only display deviations in growth but may also suffer from

cognitive deficits, such as lower IQ levels, if they lack adequate parental stimulation. Therefore, ensuring toddlers receive proper nutrition, including iron-rich foods like iron-fortified cereals, pureed meats, and leafy greens, becomes essential in promoting optimal growth as outlined by these charts

Indicators weight-for-height commonly used to identify thin and fat toddlers. This problem is usually caused by an acute event that results in the weight loss of toddlers. Examples are the occurrence of outbreaks in the toddler environment or lack of food intake that causes toddler weight to drop drastically or not in accordance with the growth that should be and lead to underweight<sup>[10]</sup>. Meanwhile, height-for-age is a sign of chronic nutritional problems. Some risk factors include unhealthy living behavior, poverty, and for a long-time consuming food that have low nutrition. Thus, in the end it causes the child to become stunted<sup>[10]</sup>.

However, in recent studies it was found that normal hemoglobin values are not only based on gender but also based on ethnicity and physiological status. There have been studies proposing to assess the lower limit of the new normal hemoglobin values based on ethnicity, gender, and age<sup>[11]</sup>. Basically, there have been many studies on anemia, but discussion about one of the derivatives of anemia, namely iron deficiency anemia, is still rarely found. Some examples of iron deficiency anemia research are iron deficiency anemia that affects physical growth in children in elementary school<sup>[5]</sup> and regarding risk factors for iron deficiency anemia in pregnant women and menstruating women<sup>[12]</sup>. Until now there has been no research on the correlation between iron deficiency anemia and nutritional status in toddlers under the age of two years. Therefore, researchers are interested in examining the correlation of iron deficiency anemia with nutritional status in toddlers at UNS Hospital.

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## METHODS

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This analytical observational study used an approach cross sectional. Purpose of the study Cross sectional itself is a study that studies how risk factors relate to the effects caused. In research Cross sectional, the subject variable was measured and observed only once at that time<sup>[13]</sup>. The population of this study is toddlers under two years old who have been treated at UNS Hospital from 2021 to 2023. This study has been approved by health research ethics committee of Dr. Moewardi General Hospital, Indonesia No.1934/X/HREC/2023.

The sampling technique used in this research was purposive sampling. In determining the sample size, the formula for the estimation of the proportion with an unknown population size was used.

A minimum number of 96 samples is required based on the results of calculations using the above formula. In the end, data were taken that fit the criteria of exclusion and inclusion amounting to 115 samples.

In this study, researchers used iron deficiency anemia (IDA) in toddlers under two years of age as independent variables and toddlers under two years of age who did not have anemia as study controls. The data used is secondary data obtained from patient medical records at UNS Hospital. The categorical measurement scale is stated as positive IDA when hemoglobin levels <11 g/dl and serum iron levels <50 µg/dl or can use MCHC levels <31% and hypochromic microcytic peripheral blood images and negative IDA when hemoglobin levels >11 g/dl (as control).

The dependent variable in this study was nutritional status in toddlers under two years of age. The data used is secondary data obtained from patient medical records at UNS Hospital. Measuring nutritional status in toddlers using 2 anthropometric indicators, weight-for-height, and height-for-age. Anthropometric indicators of toddlers

under the age of two years use a benchmark growth chart made by WHO.

To find out whether there is a correlation between the dependent variable and the independent variable, the results of this study will be analyzed using the spearman test data analysis method. Data processing will be carried out with the Statistical Package for the Social Sciences (SPSS) version 25 computer program.

**RESULT**

Research on the correlation between iron deficiency anemia and nutritional status in toddlers at UNS Hospital has been carried out on December 2023 – Januari 2024 at the UNS Hospital Medical Record Installation.

The samples in this study were all toddlers who had been examined for hemoglobin. The research data was strengthened by examination of serum iron or MCHC levels and the results of peripheral blood images that had been treated at UNS Hospital during the 2021-2023 period that met the inclusion and exclusion criteria. Based on data obtained during that period, there were 174 toddlers. The data was reprocessed using the Mentzer Index to filter out some anemia data that did not have further examination. So that out of the 174 toddlers, 75 toddlers were diagnosed with IDA, 40 toddlers who had normal hemoglobin, and 3 toddlers who were diagnosed with anemia leading to thalassemia and 56 patients who did not meet the criteria. In the end, data were taken that fit the criteria of exclusion and inclusion amounting to 115 samples.

**Table 1.** Variable Characteristics

Characteristics	Frequency (n)	Percentage (%)
<b>Gender</b>		
Male	72	63
Female	43	37
<b>Group</b>		

IDA	75	65
Normal	40	35
<b>Weight/Height</b>		
<-2 SD	21	18
-2 SD to 2 SD	87	76
> 2 SD	7	6
<b>Height/Age</b>		
< -3 SD	16	14
-3 SD to -2 SD	29	25
-2 SD to 2 SD	67	58
> 2 SD	3	3

In this study, which can be seen in table 1, that both indicators, Weight/Height and Height/Age have good nutrition or normal (-2 SD to 2 SD) categories as the dominant amount. Although in the data, the number of IDA studied is 30% more when compared to the number of normal toddlers data. This indicates that toddlers categorized as IDA studied on average have good or normal nutrition in their growing age.

**Table 2.** Data Analysis

Indicators	IDA (%)	Normal (%)	Sig.2 tailed
<b>Weight/Height</b>			
<-2 SD	11	7	
-2 SD to 2 SD	48	28	0,235
> 2 SD	6	0	
<b>Height/Age</b>			
<-3 SD	14	0	
-3 SD to -2 SD	12	13	0,136
-2 SD to 2 SD	39	19	
> 2 SD	0	3	

Based on table 2, which contains the normal and IDA groups based on the Weight/Height and Height/Age Z-score indicators studied on toddlers. The results showed that as many as 18% of toddlers were malnourished, 76% of toddlers were well nourished, and 6% of toddlers were overnourished. From this data, it was found that as many as 11 IDA-positive samples were undernourished. However, the IDA-positive toddlers group with normal toddlers have the same similarity that is equally dominant in the good nutrition category. These two variables were tested by Spearman correlation and

obtained significance (sig.2 tailed) of 0,235 and 0,136. So it can be concluded, between the two variables studied has no correlation..

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### DISCUSSION

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The results of toddlers who experienced IDA as many as 75 patients (65%), these results showed that there were still quite a lot of toddlers who experienced IDA. Among all types of anemia, IDA is one of the most common causes of anemia in toddlers<sup>[1]</sup>. IDA can occur at any age, especially toddlers. In addition to producing hemoglobin, iron is also especially important in the process of toddler's growth. In addition, hormone synthesis, oxidation systems, energy metabolism, and the development of nerve function and tissue system connections also require iron. Thus, toddlers suffering from IDA can experience a decline in their motor, sensory, cognitive, and social functions. The discussion includes the results of research and discussion in a comprehensive manner<sup>[2]</sup>. The results of the analysis can be seen in table 2, the results of nutritional status analysis with Weight/Height indicators using spearman significance value (Sig. 2 tailed) obtained is 0.235. Similar analysis results can be found in the results of analysis on the Height/Age indicator get a significance value of 0.136. The results of this processed analysis showed a result of more than 5% (0.05). The results of data analysis showed no significant relationship between the two variables studied<sup>[14]</sup>.

This is comparable to the research conducted by Astuti, 2016 that there was no correlation between the incidence of anemia and the development of toddlers. In her research, it was explained in more detail that most toddlers affected by anemia still have normal development. As for the screening used to monitor the development of toddlers, she uses Denver Development Screening Test (DDST)<sup>[3]</sup>. Based on table 2, it was found that 48% of

toddlers who experienced IDA had a good nutritional status with Weight/Height indicator. However, if the variable was changed slightly, namely anemia in the mother, then in the study conducted by Prabandari, 2017 it was found that mothers who have anemia are at risk of having babies with poor nutritional status<sup>[15]</sup>. For the record, the babies studied in his study were infants aged 6-12 months, the majority of whom did not use exclusive breastfeeding. This is also in line with research conducted by Hastuty, 2020 that there is a significant relationship between anemia of pregnant women and the incidence of stunting in toddlers<sup>[16]</sup>. The reason is that there are still many pregnant women who are reluctant to consume Fe tablets regularly, the reason is because the side effects of Fe tablets make pregnant women feel uncomfortable.

However, in this study it was found that most toddlers who experienced IDA still had normal nutritional status. This is certainly contrary to the theory where when the baby is in development it needs a variety of nutrients, including iron, which plays an important role in growth. Thus, researchers argue that the normal levels of hemoglobin set by WHO are not relevant to the actual normal levels in Indonesian's toddlers. If WHO determines that toddlers aged 6-59 months have normal hemoglobin levels above 11 g / dl, it could be that normal hemoglobin levels of toddlers in Indonesia are below that number. In line with research conducted by Domenica Cappellini and Motta, (2015) Normal hemoglobin levels can vary depending on the ethnicity of the individual<sup>[11]</sup>. This discrepancy underscores the need for further studies to explore the true nutritional needs of children in specific populations, particularly in regions with different dietary patterns and health conditions, ensuring that guidelines reflect the realities faced by these communities<sup>[17]</sup>. However, this is only the opinion of researchers, there is still a lot of research

needed to prove this theory. Moreover, the research conducted by researchers has many limitations.

The limitations of this study only focus on the condition of IDA in toddlers while nutritional status in toddlers is influenced by several things such as history of anemia in pregnant women, history of exclusive breastfeeding, quality and quantity of complementary foods, family, and environmental factors. However, this was not studied by researchers so that the analysis of risk factors for the cause of malnutrition or conditions severely stunted in each group is less than optimal. Research conducted by Suryani, (2017) said that there is a significant influence between maternal education, number of children, family economic status, and maternal knowledge on the nutritional status of toddlers<sup>[17]</sup>. According to researchers, a mother's knowledge will affect the nutritional status of her toddler, where mothers who know how the nutritional needs of their toddlers will try to meet the nutritional needs of their toddlers in accordance with the knowledge they have. With existing knowledge, a mother will try a variety of foods that suit the needs of her toddler and try to use various tricks so that her toddler wants to eat. Similar research was also conducted by Sari, (2016) Where the results of the study are toddlers who have parents with sufficient income have a higher number of toddlers with poor nutritional status<sup>[18]</sup>. This happens because parents of toddlers, especially mothers, do not understand about the fulfillment of toddler nutrition.

In this study, data collection through medical records which is secondary data, so the validity of the data is not entirely accurate. This is because there are no direct interviews with the parents of the toddlers. So, researchers cannot dig further information about the factors that affect the nutritional status of toddlers. Even though the growth of toddlers is multifactorial, there are many

variables that can affect existing data. In the end, it can be said that the research conducted by researchers has quite a few variables, while there are many other variables that can affect the growth and development of nutritional status in toddlers. In addition, IDA gold standard examinations, namely serum iron, transferrin saturation, and ferritin are rarely carried out at UNS Hospital for reasons of cost efficiency. Even from 115 samples obtained, only 14 of them had a gold standard examination. Thus, researchers use alternative ways to ensure that the toddlers studied have IDA, namely by looking at MCHC levels, peripheral blood images, and using Mentzer Index in distinguishing between the incidence of ADB and thalassemia disease.

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## CONCLUSION

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There was no significant correlation between iron deficiency anemia and nutritional status in toddlers at UNS Hospital either with Weight/Length or Length/Age indicators.

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## REFERENCES

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1. Pradiyadnya IAMS, Rivandi IW. Respondensi Anemia Defisiensi Besi. *Fak Kedokt Univ Udayana*. 2017;(1202005126):1–30.
2. Kemenkes. *Direktorat Jenderal Pelayanan Kesehatan*. 2022.
3. Astuti EP, Prahesti R, Andriyani AD. *Gambaran Tingkat Kejadian Anemia dan Perkembangan Balita Usia 6-60 Bulan*. 2016;1–4.

4. Mukrima SS, Fahyuni EF, Taniredja T, Faridli EM, Harmianto S. Pencegahan dan Penanggulangan Anemia Pada Remaja Putri dan Wanita Usia Subur. *J Penelit Pendidik Guru Sekol Dasar*. 2016;6(August):128.
5. Sri Utami Arifin, Nelly Mayulu JR. Hubungan Asupan Zat Gizi dengan Kejadian Anemia pada Anak Sekolah Dasar di Kabupaten Bolaang Mongondow Utara. *ejournal keperawatan (e-Kp)*. 2013;1.
6. Holida R, Rahmasari P. Hubungan Status Gizi Dengan Kejadian Anemia Pada Remaja Putri Tunagrahita Dringan Di Slb N 1 Bantul. 2017;1–10.
7. Wulandari I, Rohmah N, Yulis ZE. Hubungan Berat Badan Lahir dengan Perawakan Pada Balita. *J Ilm Multi Disiplin Indones*. 2023;1(9):1278–85.
8. Fitriany J, Saputri AI. Anemia Defisiensi Besi. *Kesehat Masy*. 2018;4(1202005126):1–30.
9. IDAI. Rekomendasi Ikatan Dokter Anak Indonesia : Asuhan Nutrisi Pediatrik. *Paediatric*. 2011;3(2):5–6.
10. Kemenkes. Pemantauan Status Gizi. *Buku Saku Nas*. 2017;7–11.
11. Domenica Cappellini M, Motta I. Definition and Classification: Does Hemoglobin Change With Aging? *Semin Hematol*. 2015 Oct;52(4):261–9.
12. Suryadinata PYA, Suega K, Wayan I, Dharmayuda TG. Faktor Risiko Yang Mempengaruhi Kejadian Anemia Defisiensi Besi : A Systematic Review. *J Med Udayana*. 2022;11(2):6–12.
13. Soendari T. Metode Penelitian Deskriptif. Bandung, UPI Stuss, Magdal Herdan, Agnieszka. 2014;
14. Sastroasmoro S. Dasar-dasar metodologi penelitian klinis. 5th ed. Jakarta: Jakarta Sagung Seto; 2014.
15. Prabandari Y, Hanim D, AR RC, Indarto D. Hubungan Kurang Energi Kronik Dan Anemia Pada Ibu Hamil Dengan Status Gizi Bayi Usia 6-12 Bulan Di Kabupaten Boyolali. *Penelit Gizi dan Makanan (The J Nutr Food Res)*. 2017;39(1):1–8.
16. Hastuty M. Hubungan Anemia Ibu Hamil dengan Kejadian Stunting. *J Online Univ Pahlawan Tuanku Tambusai*. 2020;4(2):112–6.
17. Pramudyaningtyas R, Hekmah N, Yudistira S, Suryani N. Nugget Ayam Dan Haliling Untuk Mencegah Anemia Pada Balita: Uji Kadar Protein, Zat Besi, Dan Tingkat Kesukaan. *Gizi Indones*. 2022;45(2):151–60.
18. Suryani L. Faktor Yang Mempengaruhi Status Gizi Balita Di Wilayah Kerja Puskesmas Payung Sekaki. *JOMIS (Journal Midwifery Sci)*. 2017;1(2):47–53.
19. Sari E. Status Gizi Balita Di Posyandu Mawar Kelurahan Darmokali Surabaya. *J Keperawatan*. 2016;6(1):1–6.