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# The Relationship of Hemoglobin Levels and Compliance with Drinking Zinc with Recurrent Diarrhea in Toddler

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***Abstract.*** *Diarrhea can be defined as a condition in which a person defecates with more liquid feces than usual and with a frequency of three or more times in 24 hours. Diarrhea is closely related to the occurrence of stunting cases. Diarrhea generally attacks toddlers because their immune systems are still weak and vulnerable. WHO and UNICEF policies in the treatment of diarrhea are the provision of oralit and zinc, based on research over 20 years. Iron plays a role in various physiological processes of the body, one of which is the immune system. The purpose of the study was to determine the relationship between hemoglobin levels and compliance with zinc intake with the incidence of recurrent diarrhea in toddlers at the Jaury Jusuf Putera Makassar Academic Hospital. The research design used was a non-experimental analytical cross-sectional study, namely a study conducted observationally to see the relationship between hemoglobin levels and compliance with zinc intake with the incidence of recurrent diarrhea, without providing treatment to the research subjects. The sample in the study was toddlers who experienced recurrent diarrhea at the Jaury Jusuf Putera Makassar Academic Hospital in March - May 2024 as many as 32 people. The results of the study showed that there was a relationship between hemoglobin levels and the incidence of recurrent diarrhea (p = 0.015). And there was a relationship between compliance with zinc consumption and the incidence of recurrent diarrhea (p = 0.004). It is recommended that health workers provide more education and control over the use of zinc drugs given in the management of diarrhea, as well as educate to maintain normal hemoglobin levels in toddlers. So that it can reduce the prevalence of recurrent diarrhea.*

***Keywords****: Adherence to Drinking Zinc, Hemoglobin, Recurrent Diarrhea, Toddler*

## 1. BACKGROUND

Diarrhea is one of the infectious diseases of the digestive tract that is a health problem in the world, including Indonesia. According to WHO and UNICEF, there are around 2 billion cases of diarrhea and 1.9 million children under five die from diarrhea worldwide each year. The latest data from the results of the 2020 Indonesian Nutritional Status Survey, the prevalence of diarrhea is at 9.8%. Diarrhea is closely related to the occurrence of stunting cases. Repeated diarrhea in infants and toddlers can cause stunting. Based on data from the 2020 Indonesian Health Profile, infectious diseases, especially diarrhea, contribute to death in the group of children aged 29 days - 11 months. Similar to the previous year, in 2020, diarrhea was still a major problem causing 14.5% of deaths. In the group of toddlers (12 - 59 months), deaths due to diarrhea were 4.55% (Ministry of Health of the Republic of Indonesia, 2022).

Diarrhea can be detrimental to the health of toddlers. Many impacts of diarrhea include dehydration, acid-base imbalance, hypoglycemia, hypokalemia, nutritional status problems, and circulation problems (Dewi et al., 2022). Diarrhea does not directly cause death, but it can

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have a bad impact if not treated properly. Diarrhea generally attacks toddlers under the age of 5 years because the toddler's immune system is still in the weak category, so toddlers are more susceptible to exposure to bacteria that cause diarrhea (Fitriani, et al., 2021). The greatest danger of diarrhea is dehydration. Clinical evaluation of diarrhea patients usually focuses on assessing the severity of dehydration and identifying its cause based on history and clinical findings. Cases of infant mortality due to dehydration are still common and usually occur due to the inability of parents to detect these danger signs (Mustain et al., 2022).

The success of diarrhea treatment in children can be achieved by involving and empowering the family (Yunas et al., 2022). Diarrhea management is a management therapy that focuses on care at home, both before the patient is taken to a health service (pre) and after the diarrhea patient returns home from the health service (post). Knowing the symptoms of dehydration, providing oral rehydration, preventing diarrhea by providing soft drinks and foods according to the child's age. Zinc can be given independently by the family or people closest to the child (Rosyida et al., 2022).

In addition to hygiene behavior, good environmental conditions and sanitation alone are not enough in dealing with diarrhea incidents, if not accompanied by compliance behavior in administering diarrhea medication (Kusumawardani & Rokhaidah, 2021). Therapy compliance is the starting point for successful management of diarrhea patients, such as steps to encourage mothers to start treatment as early as possible when diarrhea has just started. In addition, the success of diarrhea therapy in children can be achieved by involving and empowering the family (Wahyuningtyas et al., 2023).

Based on data from RS. Akademis Jaury Jusuf Putera Makassar. In 2023, there were 444 children with diarrhea. In the toddler group, there were 237 patients with diarrhea, while 47 patients experienced recurrent diarrhea. Based on the previous research above, the researcher is interested in conducting a study entitled "The relationship between hemoglobin levels and compliance with zinc consumption with the incidence of recurrent diarrhea in toddlers at RS. Akademis Jaury Jusuf Putera Makassar in 2024.

## 2. THEORETICAL STUDY

The toddler period is the period after birth until before the age of 59 months, consisting of newborns aged 0-28 days, infants aged 0-11 months and toddlers aged 12-59 months. The health of infants and toddlers is very important to pay attention to because during this period their physical and mental growth and development are very rapid. Health efforts for infants and toddlers include management and referrals, nutrition, monitoring growth and development, immunization, rehabilitation and long-term care for chronic/rare diseases, parenting and

developmental stimulation, and providing a healthy and safe environment (Ministry of Health of the Republic of Indonesia, 2020).

Diarrhea is defined as a condition in which there is an increase in the number of bowel movements that occurs due to an infection. A child can be said to have diarrhea if the volume of bowel movements is measured to be greater than 10 ml / kg per day. The consistency of the stool is runny, contains a lot of fluid (liquid) and is frequent (generally defecating more than 3 times in 24 hours) (Anggraini & Kumala, 2022).

Anemia is a condition when there is a decrease in hemoglobin (Hb) and/or the number of red blood cells from normal so that it is not enough to meet a person's physiological needs. Iron deficiency anemia accounts for 50% of all anemia (Mentari & Nugraha, 2023). Iron (Fe) is one of the micro minerals most needed by the human body. The body contains about 3-5 grams of iron. Iron deficiency anemia or Iron-deficiency Anemia (IDA) is anemia caused by low levels of (Fe) in the body. Fe plays a role in the body's physiological processes, including as an enzyme cofactor in the oxidative metabolism process, micro-RNA biogenesis, increasing the function of the thyroid gland, central nervous system, and immune system (Mentari & Nugraha, 2023). The immune system protects the body from pathogenic elements such as bacteria, viruses, fungi, protozoa and parasites that can cause infections (Darwin et al., 2021). Intestinal infections due to viruses (eg rotavirus), bacteria (eg E. coli), or parasites (eg Giardia) are common causes of diarrhea (Ministry of Health of the Republic of Indonesia, 2020)

Children under the age of 5 years are included in the population group that is susceptible to anemia. Anemia that occurs in children due to poor nutritional intake and infectious diseases, while children are a group susceptible to infectious diseases (Mentari & Nugraha, 2023). Children who are malnourished and have weak immunity are among the most at risk of suffering from life-threatening diarrhea (Wibisono et al., 2020). Failure to develop the immune response, especially the cellular immune response with manifestations of recurrent infections due to immune deficiency (Darwin et al., 2021). Recurrent diarrhea is diarrhea that occurs repeatedly in a short period of time, namely between one and three months (Wibisono et al., 2020).

The rationale for the use of zinc in the treatment of acute diarrhea is based on its effects on immune function or on the structure and function of the gastrointestinal tract and on the repair process of the gastrointestinal epithelium during diarrhea. Administration of zinc in diarrhea can increase the absorption of water and electrolytes by the small intestine, increase the rate of intestinal epithelial regeneration, increase the number of apical brush borders and increase the immune response that accelerates the clearance of pathogens from the intestine

(Anggraini & Kumala, 2022) Zinc supplementation added to standard diarrhea treatment with oral rehydration salts has been shown to be effective in treating diarrhea by reducing the frequency of defecation and shortening the duration of diarrhea. Zinc also improves the immune system so that it can prevent the risk of recurrence of diarrhea for 2-3 months after the child recovers from diarrhea (WHO, 2006). The use of drugs is said to be rational if the patient receives the right drug according to clinical needs, in the right dose and duration of treatment (Gilarsih et al., 2020). Compliance with taking zinc is the extent to which the behavior of parents of toddlers with diarrhea follows the rules or directions given by health workers regarding the treatment of diarrhea, in this case taking zinc for 10 consecutive days, to prevent recurrent diarrhea for the next 2-3 months (Aini et al., 2023).

## 3. RESEARCH METHODS

The research design used in this study was a non-experimental analytical cross-sectional study, namely a study conducted observationally to see the relationship between the independent variables, namely hemoglobin levels and compliance with zinc consumption, with the dependent variable, namely the incidence of recurrent diarrhea, without providing treatment to the research subjects. The research was conducted in the Dahlia Treatment Room of the Jaury Jusuf Putera Academic Hospital, Makassar. The research was conducted from March to May 2024. The tools used in this study were writing instruments in the form of pens. And the materials used were informed consent sheets and observation sheets. The population in this study were all toddler patients with recurrent diarrhea who were treated from January to December 2023 in the Dahlia Treatment Room of the Jaury Jusuf Putera Academic Hospital Makassar, totaling 47 patients. The sample used in this study was 32 people.

## 4. RESULTS AND DISCUSSION

**Table 1. Results of the Hemoglobin Level Relationship Test with Recurrent Diarrhea Incidents at the Jaury Jusuf Putera Academic Hospital Makassar 2024**

| Spearman's rho | N | Correlation Coefficient | Sig. (2-tailed) |
|---|---|---|---|
| Hemoglobin Level | 32 | 1.000 | . |
| Recurrent Diarrhea Occurrence | 32 | 0.425 | 0.015 |

Source: Secondary Data, 2024

From the calculation using the statistical test "Spearman Correlation" processed with Statistical Product and Service Solution (SPSS). The probability value (p) is 0.015. It is stated that the p value <0.05, it can be concluded that there is a significant correlation, this indicates that there is a relationship between hemoglobin levels and the incidence of recurrent diarrhea. So it can be decided that Ha is accepted and H0 is rejected.

**Table 2. Results of the Test of the Relationship between Compliance with Zinc Consumption and the Incidence of Recurrent Diarrhea at the Jaury Jusuf Putera Academic Hospital Makassar 2024**

| Spearman's rho | N | Correlation Coefficient | Sig. (2-tailed) |
|---|---|---|---|
| Compliance Zinc Drinking | 32 | 1.000 | . |
| Recurrent Diarrhea Occurrence | 32 | 0.497 | 0.004 |

Source: Secondary Data, 2024

From the calculation using the statistical test "Spearman Correlation" processed with Statistical Product and Service Solution (SPSS). The probability value (p) is 0.004. It is stated that the p value <0.05, it can be concluded that there is a significant correlation, this indicates that there is a relationship between compliance with zinc consumption and the occurrence of recurrent diarrhea. So it can be decided that Ha is accepted and H0 is rejected.

**a. Relationship between Hemoglobin Levels and Recurrent Diarrhea**

Anemia in children is most often caused by poor nutritional status and/or poor health conditions. Malnutrition or excess nutrition can trigger anemia because sometimes the cause of anemia is a lack of micronutrients. Some causes of iron deficiency anemia include acute and chronic infections, low iron intake, poor iron absorption, and infectious diseases. Diseases such as gastrointestinal ulcers, varicose veins, polyps, colitis, hereditary telangiectasia, and gastric ulcers can cause anemia. Intestinal parasites can also cause iron loss from the digestive system, either by reducing nutrient absorption or bleeding. Inflammatory bowel disease can cause IDA, either due to bleeding or chronic malabsorption (Mentari & Nugraha, 2023).

Humans have a well-developed defense mechanism, namely the immune system. This defense aims to protect humans from noxious agents, namely foreign objects that can be infectious. The environment around humans contains various elements that are pathogenic, such as bacteria, viruses, fungi, protozoa and parasites that can cause infection. The immune response to pathogenic elements is highly dependent on the ability of the immune system to recognize foreign molecules or antigens found on the surface of microorganism elements and the ability to provide the right reaction or response to recognize, neutralize, metabolize or eliminate without causing damage to the tissue itself. The mechanism of this reaction is determined by the components of the immune system which are organized in the form of lymphoid cells and tissues (Darwin et al., 2021).

In children, there is hypofunction of the immune system, so this group is susceptible to infection. Anatomical structures and physiological functions, such as skin, mucous membranes, cilia in the epithelium of the digestive tract, gastric acid, enzymes and urine flow, are barriers

to invasion of pathogenic elements. If there is a disturbance in this barrier system, a person will very easily suffer from infection (Darwin et al., 2021)

Thus, researchers can conclude that if the body is exposed to foreign antigens, an immune response will occur. While hemoglobin levels play a role in the immune system or immune system, the better the hemoglobin levels, the better the immune system. So the better the body's immune system, the better it will be in providing defense or response to the entry of microorganisms, or fighting infections and vice versa. With normal hemoglobin levels, it is still possible for diarrhea to recur but with a lower prevalence of occurrence compared to those with lower hemoglobin levels. Because good hemoglobin levels are only one of the builders of good immunity. Researchers can prove the assumption that hemoglobin levels are related to the occurrence of recurrent diarrhea in toddlers at the Jaury Jusuf Putera Makassar Academic Hospital. As indicated by the probability value (p) of 0.015, meaning the p value < 0.05.

**b. Relationship between Compliance with Zinc Consumption and Recurrent Diarrhea**

Compliance with taking zinc is the extent to which the behavior of parents of toddlers with diarrhea follows the rules or directions given by health workers regarding the treatment of diarrhea, in this case taking zinc for 10 consecutive days, to prevent recurrent diarrhea for the next 2-3 months (Aini et al., 2023).

Based on a WHO study, research that has been conducted for 20 years has shown that treating diarrhea with ORS accompanied by zinc is effective and has been proven to reduce mortality in children by up to 40%. The benefits of zinc as a treatment for diarrhea are reducing the prevalence of diarrhea by 34%, the incidence of pneumonia by 26%, the duration of acute diarrhea by 20%, and the duration of persistent diarrhea by 24% (Rosyida et al., 2022)

Thus, researchers can conclude that zinc supplementation consumed according to the rules will provide high effectiveness in preventing recurrent diarrhea. Zinc functions to increase immunity so that it can accelerate healing and defense against intestinal pathogens that cause diarrhea. And functions in the epithelialization of the intestinal wall so as to increase the absorption of water and electrolytes and increase the regeneration of the intestinal epithelium which restores the normal intestinal mucosa.

As for 100% compliance with taking zinc, it does not mean that it will prevent recurrent diarrhea 100% because the use of zinc is only to prevent or reduce the prevalence of recurrent diarrhea. This is due to many factors that can influence the occurrence of recurrent diarrhea, including: infection factors (bacteria, viruses, parasites, etc.), malabsorption factors (lactose

intolerance, protein intolerance, fat intolerance), malnutrition factors, hygiene factors, certain disease factors and use of drugs as well as immunization adequacy factors and others.

According to Anggraini & Kumala (2022), in children with diarrhea, zinc is given for 10-14 consecutive days even though the child has recovered from diarrhea. The dose of zinc for children under 6 months: 10 mg (1/2 tablet) per day and for children over 6 months: 20 mg (1 tablet) per day. The same as that conveyed by Dr. Jusli Aras, Sp.A (K)., M.Kes as a pediatrician at the Jaury Jusuf Putera Makassar Academic Hospital that if the use of zinc medication is interrupted or not consecutive, then zinc administration can be continued without repeating the initial calculation but continued until the 14th day. Researchers can prove the assumption that compliance with taking zinc is related to the incidence of recurrent diarrhea in toddlers at the Jaury Jusuf Putera Makassar Academic Hospital. Which is indicated by the probability value (p) of 0.004, meaning the p value <0.05.

## 5. CONCLUSION AND SUGGESTIONS

There is a relationship between hemoglobin levels and the occurrence of recurrent diarrhea with a probability value (p) of 0.015 and there is a relationship between compliance with zinc consumption and the occurrence of recurrent diarrhea with a probability value (p) of 0.004.

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