ORIGINAL ARTICLE

Impact of Micronutrient Supplementation on Hemoglobin, Ferritin, and Retinol Status in Stunting Children Under 5 years in Urban Poor Regions

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ABSTRACT

Introduction: Stunting is closely related to vitamin and mineral deficiency. Micronutrient deficiencies, which include diet A, iron, and zinc, afflict more than three billion people internationally. This study aims to determine the long-term effect of supplementation intervention on malnutrition status in children measured by iron and vitamin A status. **Materials and methods:** The sample calculation uses the minimum sample calculation according to Lemeshow, and the sampling technique is purposive sampling. This research is a descriptive study that looks at changes in Hb levels, retinol, and ferritin levels after intervention. This study intends to analyze the lengthy-term intake of dietary supplements along with essences, nutrition C: 50 mg, Zn: 8 mg, minerals Fe: 8 mg, and vitamins B1, B2, B6: 1 mg, at the status of hemoglobin, ferritin, and nutrition A substances in malnourished babies. Materials and strategies: This form of study is quasi-experimental. The subjects of this study were youngsters aged 1 to a few years old who were malnourished by using one intervention organization. The cyanmethemoglobin method was used to research the reputation of hemoglobin. For ferritin popularity, serum ferritin was measured using the ELISA technique. The size of nutrition A ranges was determined by serum retinol complementary HPLC. This complimentary drink intervention changed into giving as soon as a day in the morning and for 12 weeks or three months. **Results:** Before the intervention, 25% of the samples, particularly malnourished toddlers, had abnormal hemoglobin fame (anemia), 39.5% ferritin reputation changed into unusual, and 5,3% vitamin A degrees were strange. Supplementary drink intervention can reduce hemoglobin reputation in malnourished children by 13.2%. There is a 23.7% ferritin reputation, but there has been a boom within the wide variety of kids under five who had atypical vitamin A (retinol) stages of 9.2%. **Conclusion:** Giving supplementation for three months to under-fives with malnutrition can reduce hemoglobin repute and ferritin reputation, but there's an increase in diet A (retinol) degrees. Three months is not enough time to restore or improve nutritional status, lacking in children who experience malnutrition, so attention is needed.
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INTRODUCTION

Malnutrition is a first-rate hassle for international kids and is dangerous for youngsters and the country. Malnutrition can burden a developing country with up to 3% of gross national income. If not treated thoughtfully, then it's far predicted to show growth in malnourished kids. Based on the Databoks file, simple fitness studies effects (Riskesdas) Ministry of Fitness 2018 shows 17.7% of babies underneath 5 years old (babies) have nutritional problems. The quantity consists of babies who are malnourished by three, 9%, and people who suffer from malnutrition much less with the aid of 13.8% (1). There's a downward trend in the number of toddlers suffering from malnutrition in 2018. in the 2019 countrywide Medium-time period improvement Plan (RPJMN), babies with dietary problems are centered on decreasing to 17%. Beneath-fives experiencing stunting (high body weight beneath the usual for age) is 30.8%, down from basic health studies in 2018 with the aid of 37.2%. The data show that mortality from infectious diseases in 3 to 27 times extra malnourished children is more prominent than in well-nourished kids. So malnutrition is a dangerous issue and a significant reason for the demise of youngsters (2).

Some research results show that malnutrition is closely related to the deficiency of various micronutrients, vitamins, and minerals. Micronutrient deficiencies, including vitamin A, iron, and zinc, override over 3 billion people worldwide. Based on the Centers for Disease Control and Prevention (CDC) research, children aged 1-3 years have a high risk for iron deficiency (3).

A previous study showed that the prevalence of anemia in malnourished children by 25%. A malnourished child with anemia has weight, height, body, and lower Z-Score BB/U than malnourished children who are not weak. Motor development scores gross, fine motor, and language development in malnourished children who are less frail compared to non-anemic children. Berger (2008) argued (cited by 8, p8) that the distribution of high-dose vitamin A capsules is an effective intervention to improve children's survival in developing countries. Based on nutrition surveillance system data, there are differences in nutritional status. The proportion of children with anemia and morbidity (diarrhea and fever) is significant among children who get capsules and those who do not get tablets. Despite losing access to other health program interventions, such as immunization and demographic factors that contribute to malnutrition in children, it has been proven that vitamin A supplementation can maximize child survival. (4)

Abdollahi argued (cited by 14, p 6) that research on Iranian children proves that We found a 0.5 cm difference in the height increment in the intervention group compared with the control ($P < 0.001$). Zinc supplementation did not affect the weight increment of children and proved that the definition of zinc could inhibit growth (5). Long argued (cited by 15, p9), and Al-Omran argued (cited by 16, p11) about the benefits of iron supplementation in the process of growth (6,7). Different things are shown by Taneja's argument (cited by 17, p313) that there was no effect of supplementation iron with or without zinc on children's growth (8). Still, the result of Fischer Walker argued (cited 18 p94) that zinc was used at a low dose and was given not every day but once a week (9). The exact mechanism of how zinc can affect growth is currently unclear. Still, the overall effect is direct because zinc can stimulate taste and energy intake and increase fat-free mass in the body (10). The result shows that micronutrient fortification in children and adolescents can reduce anemia and improve the micronutrient status and nutritional status nutrition of adolescent girls in Rural China and Cambodian (11,12)

The research location is urban areas with favorable environmental conditions, slums, and high population density. The average level of substance adequacy nutrition of Fe, vitamin C, and vitamin B1 and Zn is still low, i.e., the average is below 80% of the Nutritional Adequacy Rate (RDA) recommended. Several children experienced malnutrition with a stunted category (height less according to age) of 57.61%, (underweight for age) at 46.74%, and wasted (less body weight according to height) at 9.78%. This research must prove that providing micronutrients can reduce the incidence of stunting in toddlers by increasing hemoglobin, vitamin A, and retinol levels. This study aims to determine the long-term effect of supplementation intervention on children's malnutrition status measured by iron and vitamin A status. This research's novelty in reducing stunting rates is that apart from using a food-based approach, it combines a micronutrient supplementation-based approach.

MATERIALS AND METHODS

Design Study

This study was conducted in September-November 2023 at Wonokoyo Villages, District Kedung Kandang, Malang City. using a quasy eksperimen study design.

Sample and Sampling

The sample calculation uses the minimum sample calculation according to Lemeshow, and the sampling technique is purposive sampling. The total subjects of this study were 152 children aged 1-3 years who were malnourished. The sample was drawn purposively with the following inclusion criteria: This quasi-experimental research provided intervention to those at risk of malnutrition. Sampling is carried out purposively with criteria inclusion, namely malnutrition: underweight according to age or height according to age and underweight according to height based on criteria from WHO-NCHS, children are not physically disabled. There are no congenital abnormalities, and there are statements of the willingness of the subject to undergo an examination or interview during research. Research location in Wonokoyo Villages, District Kedung Kandang, Malang City.

Dose of Supplement

The dose given is powder in a sachet (1 gram), which can be consumed with drinks or food or consumed directly. In the manufacture of supplement drinks, multi-micronutrient needed ingredients include sugar (as a sweetener as well as a producer of sugar), energy), essence, vitamin C:40 mg, Zn: 8.2 mg, Fe minerals: 8 mg, and vitamin B1, B2, B6:0,5 mg, 0.5 mg, 0.5 mg. Dosage is determined based on AKG (Nutrient Adequacy Number) recommended for children aged 1-3 years.

Data Collection

For data collection, which includes food frequency, Getting complementary food for breast milk, and Age To Stop Drinking Breast Milk using a validated questionnaire and measuring instrument used for data collection, anthropometry is a Dacin scale for measuring the child's weight, the microtonal. It is a measuring device that measures children's height over two years old by measuring their standing. A Baby board/wooden height board measures the body length of a child under two years, using children lying down. Anthropometric measurements are carried out directly by researchers who have previously attended training for measuring toddler growth and development.

Blood collection was carried out by laboratory staff from

RST dr Soepraoen. Blood was taken intravenously in the arm as much as 3 ml and tested in the laboratory of RST Dr. Soepraoen. The child's hemoglobin status was obtained through a blood test and analyzed using cyanmethemoglobin. Fe status was measured using the serum ferritin ELISA method, and Vitamin A status was measured using the method of determination of serum retinol by HPLC (High-Performance Liquid Chromatography). Supplementary drink intervention is given to as many as 152 children in malnourished children.

Give one supplement drink times every morning for six days in 1 week during the 12-week intervention. Officers in the field are asked to record compliance on a special card and see the children drink until they run out in person. This research has received an ethics certificate from KEPK Faculty Of Medicine And Health Sciences UIN Maulana Malik Ibrahim Malang with number 287/EC/KEPK-FKIK/2022.

RESULTS

Table I explains the characteristics of the malnourished children of research participants: age, food frequency, getting complementary food for breast milk, age to stop drinking breast milk, hemoglobin level, ferritin level, and retinol level. The research sample was children (1-3 years) who were malnourished. Malnutrition was determined with anthropometric measurements of body weight and the child's chart height or length. The iron status in this study was seen from anemia status through examination of hemoglobin levels and ferritin status of children who are malnourished and are at risk of malnutrition. Participants' hemoglobin and blood ferritin levels were checked twice before giving intervention drink supplements and after a supplement. A child said anemia when the story is checked; hemoglobin shows a value of less than 11 mg%.

Table I: Characteristics of malnourished children of research participants

Variable	Mean ± SD	Min	Max
Age (month)	26,34±7,20	13,9	35,30
Food Frequency (times)	2,66 ±0,77	1	5
Get complementary food for breast milk (months)	5,74±3,88	0	28
Age To Stop Drinking Breast Milk (month)	16,68±9,68	0	31
Hemoglobin Levels (mg/dL)	11,40±0,96	8,9	13,6
Ferritin Level (umol/dL)	17,19±10,89	1,8	55,58
Retinol Level (umol/dL)	1,8±0,52	0,47	2,71

Table II shows that 25% of subjects That are malnourished children have anemia. This indicates that malnutrition is related to other nutritional deficiencies. In this case, iron, vitamin C, vitamin A, or other nutrients related to anemia are predicted by low hemoglobin levels in the blood. After getting daily supplement drink intervention for 12 months, there was a decrease in the number of Subjects who experienced anemia from 25% to 11.8%. This result showed that beverage intervention supplements could reduce the incidence of anemia in malnourished children by 13.2%.

Before subjects were given a visible supplementation intervention at the ferritin examination, 60.5% were included in the normal ferritin status, while 39.5% were in the abnormal ferritin status. After doing supplement drink intervention for 12 weeks, the ferritin status of the subjects normally increased to 84.2% and the odd only 15.8%. This study shows that providing drinks supplements can improve ferritin status by 23.7%. It is indicated that supplement drink effectively enhances malnourished children's ferritin status.

Table II: Distribution of Anemia Status, Status Ferritin, and Retinol status Subjects Before and After Intervention

Variable	*Before Intervention*		*After Intervention*	
	f	%	f	%
Hemoglobin Status				
Abnormal	38	25	18	11,8
Normal	114	75	134	88,2
Feritin Status				
Abnormal	60	39,5	24	15,8
Normal	92	60,5	128	84,2
Retinol Status				
Abnormal	8	5,3	22	14,5
Normal	144	94,7	130	85,5

DISCUSSION

Table II describes the anemia, ferritin, and retinol status of study subjects before and after the intervention.
The location of this research includes urban areas with favorable environmental conditions, slums, and high population density. The prevalence of anemia in children and Toddlers is relatively high at 25%. Both macro and micro's adequate nutrition level is still low and is below 80% of the figure Nutritional Adequacy (RDA). The results of previous studies show that the level of Consumption of average energy was 86.09 ± 29.55%, the average protein consumption was 101.80 ± 43.23%, and the intermediate level of vitamin A consumption was 122.66 ± 75.72%. The average level of vitamin consumption is 63.41 ± 48.21%, the average level of Fe consumption is 60.27 ± 42.37%, and the intermediate Zn consumption level is 37.66 ± 22.36% (13).

Examining ferritin levels in the blood is also one of the checks for diagnosing iron deficiency in the human body. This check is carried out to measure ferritin concentration or iron stores in the body. 30% of the iron in the body is stored as ferritin in the spleen, bone marrow, and heart. The benefits of ferritin testing are that it monitors the development of iron deficiency in

anemia. (14)

Vitamin A status in this study was determined by examination of serum retinolsubject's blood. This check helps detect vitamin A deficiency inside the body. A frequent vitamin A defect is found in children with anemia or malnutrition. Vitamin A deficiency can cause The immune system to decrease, making you more susceptible to infectious diseases. If Vitamin A deficiency occurs in children experiencing malnutrition, the risk of complications and infectious diseases will increase. The study found that 5.3% of children with malnutrition have initial retinol levels before being given abnormal supplementation. (15)

Even though malnourished children are given a supplement drink intervention, there is an increase in the number of subjects with abnormal retinol levels, equal to 9.2%. It shows that malnourished children with high retinol levels (low) can't be handled only with supplementation with ingredients appropriate to vitamin A micronutrient RDA within 12 weeks. However, these children need to get more serious attention and handling so that the child will not fall into deficiency of more severe vitamin A.(16)

In this study, malnutrition is seen from the lack of energy and protein associated with iron deficiency and vitamin A deficiency. Besides causing decreased immune function and poor eye health, vitamin A deficiency can also interfere with iron mobilization in the liver, reducing ferritin levels (16). In a mobilization disorder, iron will also cause low iron levels in plasma. It will interfere with hemoglobin synthesis, thus causing low hemoglobin levels in the blood. (13)

Micronutrients such as vitamins A, B, C, folate, zinc, calcium, iodine, and iron are adequate for repairing nutritional deficiencies. Vitamin A deficiency is a severe health problem globally because this deficiency is the leading cause of blindness in children. The effect of MNPs in children suggests benefits in improving anemia and hemoglobin; however, there is a lack of impact on growth (17). Other studies have also concluded that Vitamin A supplementation reduces diarrhea in children of households with floor soil (18). Zinc supplementation reduces diarrhea in children from families with ground floor and whose mother is educated (19).

The results of this study also show that dealing with the problem of malnutrition and anemia in children is not enough with multimicronutrient supplementation intervention alone. A combination of these and other activities is necessary, such as providing nutrition education to mothers or families who raise children. Educational expectations of nutrition are the knowledge and attitude of the mother or family about the nutritional needs of children and how to feed a child well, which will increase. Continue attitude, and mothers' and families' behavior about feeding children becomes more suitable. The next hope is that children's nutritional intake of both macronutrients and micronutrients will increase.

CONCLUSION

Micronutrient Supplement intervention can reduce anemia incidence in malnourished children by 13.2%. Giving supplement drinks can improve the status of ferritin by 23.7%. It shows that supplement drink effectively improves the ferritin status of malnourished children. Even though intervention has been given to drink supplements for malnourished children, there has been an increase in the number of subjects with retinol levels that are not normal, which is 9.2%. Three months is not enough time to restore or improve nutritional status, lacking in children who experience malnutrition, so attention is needed. It takes a long time to handle this problem so that the impact will not be more severe. In addition, other activities, such as nutrition education for mothers and families, need to be done to improve the results.

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