

## The Effect of Neoalgae Spirulina Supplements Intakes on Increasing Body Height and Weight of Stunting Children in Mranggen, Sukoharjo, Central Java

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### ABSTRACT

**Background:** Children who are stunted have a higher risk of experiencing health and brain development disorders, and have a lower likelihood of achievement and a bright future. Spirulina is one of the food sources enriched with nutrients that affect the nutritional status of children. The study aims to discover the effect of the administration of Spirulina Neoalgae supplements on increasing the height and weight of stunting toddlers in Mranggen village.

**Subjects dan Method:** The study used a quasi-experimental design conducted in Mranggen Village, Sukoharjo, Central Java. A total of 100 toddlers selected using total sampling were included in this study. The independent variable in this study was the intervention of Spirulina Neoalgae supplements and the dependent variables in this study were body weight and height. Toddlers were given supplement interventions for 4 weeks. The collected data were subsequently analyzed using the Paired-Test.

**Results:** Before the intervention the average height was (Mean= 82.92; SD = 8.77) and body weight was (Mean= 9.97; SD= 2.09). After the supplement intervention for 2 weeks, the average height was (Mean= 83.56; SD = 8.61) and body weight was (Mean= 10.11; SD= 2.07). Average height (Mean= 84.56; SD= 8.57) and body weight (Mean= 11.04; SD = 2.10) in week four increased and the result was statistically significant ( $p < 0.001$ ).

**Conclusion:** The administration of neoalgae supplements affects increasing height and weight in stunted children in Mranggen Village, Sukoharjo, Central Java.

**Keywords:** Supplements, Neoalgae, Nutritional Status, Height, Weight, Stunting

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### BACKGROUND

Quality human resources are physically tough, mentally strong, intelligent, creative,

and in excellent health. Nutrition is one of the factors that can determine the quality of human resources, If there are nutritional

disorders at the beginning of life, it will affect the quality of life in the future. Childhood malnutrition is always associated with specific vitamin mineral deficiencies and is associated with certain micronutrients and macronutrients. In recent years, there have been a lot of studies on the impact of nutritional deficiencies, starting from the increased risk of infectious diseases and death that can inhibit growth and mental development. Stunting is a physical growth disorder characterized by a decrease in growth speed and is the impact of nutritional imbalance (Apriluana and Fikawati, 2018)

Stunting is a condition where children have a shorter body size than normal children in their age and have delays in thinking, this also fails to grow in the child's physical and brain due to malnutrition for a long time. Stunting is associated with an increased risk of morbidity and mortality, decreased physical capacity, and impaired development and functioning of children's motor and mental conditions. Efforts have been made by the Government through the Integrated Health Center (Posyandu), but it has not involved all aspects of the community. Health cadres and traditional birth attendants are an important part of the community that is strategic enough to be involved in this activity because it is very close to mothers and the community (Nugroho et al., 2021).

Another factor in the occurrence of stunting is poor parenting, especially in feeding children, If the mother does not provide good nutrition, especially breastfeeding the baby after birth until 6 months, it will result in a malnourished baby. The maternal factor is that women who were malnourished during their adolescence will greatly affect the growth of their future children's bodies and brains when they are married and pregnant (Hizriyani and Aji, 2021). Toddlerhood is part of the age group

that is vulnerable to nutritional problems and diseases. One of the problems faced by the world, especially in poor and developing countries was stunting. Stunting is considered a threat to the quality of Indonesian people and is also considered a threat to the nation's competitiveness. Stunting is an indicator of the accomplishment of public welfare, education, and income (Pangesti and Saputri, 2022).

According to WHO (2021), in 2020, wasting continues to threaten the lives of around 6.7% or 45.4 million children under 5 years old globally. Stunting affected an estimated 22% or 149.2 million children under 5 years globally in 2020. According to the WHO (2023), Around 149.2 million or 22% of children under the age of 5 worldwide were estimated to be stunted by 2020. This figure decreased by 27% compared to two decades before in 2000. Southeast Asia region has a stunting prevalence reaching 30.1% and the Eastern Mediterranean region with 26.2%. Based on the Asian Development Bank (ADB) report in (Nada, 2023), the stunting prevalence rate in Indonesia reached 31.8% in 2020. Timor Leste was in the first position with a stunting prevalence rate of 48.8%. Meanwhile, Laos ranked third after Indonesia with a prevalence of 30.2%. Followed by Cambodia at 29.9%, Philippines at 28.7%, Myanmar at 25.2%, and Vietnam at 22.3%.

From the results of the Dissemination of Growth Measurement of Sukoharjo Regency Health Office in November 2022, it is discovered that the Sukoharjo area, especially Polokarto Village, Sub-District of Polokarto, is the highest stunting area. The three Community Health Centers (CHC) with the highest stunting cases are CHC Polokarto (13.6%), CHC Mojolaban (12.5%), and CHC Nguter (11.1%) (Dinkes Sukoharjo, 2022). Based on data from the e-PPGBM application of CHC Polokarto (2023), the results

of the most updated input data in December 2022, showed that the highest stunting cases are in Mranggen Village with 97 cases of stunting (H/A), 80 cases of under weight (W/A) and 37 cases of wasting (W/H) (Puskesmas Polokarto, 2022).

According to Rahmidini (2020), Children who are stunted are 11.98 times more likely to have below-average motor development. Children who are stunted have a higher risk of impaired health and brain development and can affect the quality of life of society as a whole because stunted children have a lower potential to contribute to social and economic development. Therefore, handling stunting must be priority for the government, society, and all parties involved in children's health and well-being.

According to a study by Ruma et al. (2017) Spirulina has a very high content of macro and micronutrients, essential amino acids, proteins, lipids, vitamins, minerals, and antioxidants. Spirulina is considered a complete dietary supplement to fight malnutrition in developing countries. Spirulina is a multicellular and filamentous Cyanobacteria that has achieved considerable popularity in the health sector, food industry, and aquaculture.

Spirulina can be harvested and processed easily. Spirulina is considered safe for human consumption as substantiated by its long history of food use and recent scientific findings. In recent years, Spirulina has garnered great attention from the research fraternity as well as industry as a growing source of nutraceuticals and pharmaceuticals to overcome nutritional problems such as stunting (Ruma et al., 2017). Based on this background, the author is interested in conducting an intervention to prove the effect of the administration of Spirulina Neoalgae supplements on increasing the height and weight of stunting children.

## SUBJECTS AND METHOD

### 1. Study Design

This was a quasi-experimental study design conducted in Mranggen Village, Sukoharjo, Central Java. The intervention conducted in this study was Spirulina Neoalgae supplements 2 times a day (morning and evening) to childrens who were classified as stunted. The administration was conducted for 1 month. The first measurement was taken after taking the supplement for 2 weeks and the second measurement was taken after another 2 weeks.

### 2. Population and Sample

The population of this study was children in Mranggen Village, Sukoharjo, Central Java. The study used a total sampling technique. A total of 100 stunted children under five were included in this study.

### 3. Study Variables

The independent variable in this study was the Neoalgae Spirulina supplement intervention and the dependent variables in this study were body weight and height.

### 4. Operational Definition of Variables

**Stunting:** Children with a shorter body size than normal children their age

**Height:** is the height of toddlers measured before and after being given neoalgae multi-vitamins in the study (cm)

**Weight:** is the weight of toddlers measured before and after being given neoalgae multi-vitamins in the study (kg).

### 5. Study Instruments

After giving neoalgae supplements for 2 weeks, childrens were measured in height using a stadiometer and weight using body scales. Afterward, the administration of neoalgae supplements was continued for 2 weeks and subsequently was followed by the measurement of height and weight.

### 6. Data Analysis

The collected data included respondents' characteristics, Height, and Weight before

and after the intervention which were checked and analyzed using the T-test. The data were analyzed using SPSS version 20.

**RESULTS**

**1. Sample Characteristics**

Based on Table 1 before the intervention of spirulina neoalgae supplements the average

height was (Mean= 82.92; SD = 8.77) and body weight was (Mean= 9.97; SD= 2.09). After the supplement intervention for 2 weeks, the average height was (Mean= 83.56; SD = 8.61) and body weight was (Mean= 10.11; SD= 2.07). Average height (Mean= 84.56; SD= 8.57) and body weight (Mean= 11.04; SD = 2.10).

**Table 1. Characteristics of stunting toddlers in Mranggen Village, Sukoharjo, Central Java before and after the intervention**

Variables	Mean	SD	Min	Max
Baseline height	82.92	8.77	62	101
Height After 2-week Intervention	83.56	8.61	62	101
Height After 4-week Intervention	84.56	8.57	64	101
Baseline weight	9.97	2.09	6.10	14.90
Weight After 2-week Intervention	10.11	2.07	6.30	15
Weight After 4-week Intervention	11.04	2.10	6.30	15.50

Based on Table 2, showed that the highest number of children who experienced weight gain after 4 weeks of intervention was 87

children while height gain after 4 weeks of intervention was 98 children.

**Table 2. Development of height and weight of stunting toddlers in Mranggen Village, Sukoharjo, Central Java before and after the intervention**

Variables	Category			
	Increased		Constant	
	(n)	(%)	(n)	(%)
Baseline weight	0	0	100	100
Weight after 2-week Intervention	59	59	41	41
Weight after 4-week intervention	87	87	13	13
Baseline height	0	0	100	100
Height after 2-week Intervention	48	48	52	52
Height after 4-week Intervention	98	98	2	2

**2. Bivariate Analysis**

Based on Table 3, it is known that the mean value between body weight given a 2-week intervention was higher compared to those given a 4-week intervention. There was an

effect of weight change between week 2 and body weight in week 4 after spirulina neoalgae supplement intervention and the result was statistically significant (p<0.001).

**Table 3. The effect of spirulina neoalgae supplements on increasing weight for stunting toddlers in Mranggen Village, Sukoharjo, Central Java**

Weight	Mean	SD	p
Pre Intervention (2 weeks)	10.11	2.07	<0.001
Post Intervention (4 weeks)	11.04	2.10	

Based on Table 4, showed that the mean value between body height given a 2-week

intervention was higher compared to those given a 4-week intervention. There was an

effect of height change between week 2 and body weight in week 4 after spirulina

neoalgae supplement intervention and the result was statistically significant ( $p < 0.001$ ).

**Table 4. The effects of spirulina neoalgae supplements on increasing height of stunting toddlers in Mranggen Village, Sukoharjo, Central Java**

Tinggi Badan	Mean	SD	p
Pre Intervention (2 weeks)	83.57	8.62	<0.001
Post Intervention (4 weeks)	84.56	8.57	

### DISCUSSION

Based on the results of this study, supplementation in toddlers can improve nutritional status (weight and height). One of the supplements to improve nutritional status is neoalgae with consumption of 4 capsules per day consumed in the morning and in the evening. Neoalgae supplements given to toddlers have gone through BPOM clinical trials and Halal certificates. Neoalgae supplement is one of the supplements that contains Spirulina Platensis which has many benefits. Spirulina is a species of blue-green algae (*Cyanophyta*) known as a human health food, producer of single-cell protein (SCP), and source of various nutrients needed by the body. As a producer of SCP, spirulina is very suitable as a food source because it is easily digested by the body (Erlania, 2009).

Based on the results of the Paired Sample Test analysis, the results of the average weight difference were obtained after 2 weeks of intervention (Mean = 10.11; SD= 2.07) and 4 weeks of intervention (Mean= 11.04; SD= 2.10) and the result was statistically significant  $p < 0.001$ . Differences were also found in average height after 2 weeks of intervention (Mean= 83.57; SD= 8.62) and 4 weeks of intervention (Mean= 84.56; SD= 8.57) and the result was statistically significant  $p < 0.001$ . This showed the effect on body weight and height changes at week 2 with weight and height at week 4 after the administration of neoalgae supplement intervention.

According to Kabinawa (2014), The nutritional content of Spirulina in neoalgae supplements is good with 67.5% to 70% protein with complete essential amino acids, has NPU 62 and 95% digestibility test, the cell wall is mucopolysaccharide and as a source of  $\beta$ -carotene, phycocyanin, vitamins B12, and natural dyes. Spirulina is a healthy food and biological herb which is very beneficial for health.

Based on the results of the study by Armaini et al. (2020), the Student Creativity Program (PKM) carried out with a food supplementation program in the form of *Spirulina platensis*, nutrient-rich foods on the daily menu of toddlers, can improve nutrition and immunity. The result shows an increase in height in all toddlers and an increase in nutritional status in 3 toddlers from short to normal and 1 toddler from very short to short. Based on the results of the body weighing on the toddlers conducted using digital body scales, observed every week for 6 weeks of treatment with *Spirulina platensis* capsules, the weight gain shows significant results and generates an increase in the nutritional status of toddlers from undernutrition in 3 toddlers to good nutrition and an increase in nutritional status of 2 toddlers from malnourished to under nutrition.

The results of Kabinawa's study (2014) state that the protein content of Spirulina varied, consisting of 67.5% local strains of INK and 70% of other Spirulina strains. The content is higher when compared to

Chlorella, which is 58% or 9.5-12% smaller than Spirulina. Spirulina as a food and biological herb is very beneficial for health, especially in overcoming malnutrition, and cholesterol disorders, maintaining intestinal bacterial health, sources of GLA, losing weight, kidney poisoning problems, and various cancers.

Some studies show that algae such as spirulina also have the potential to strengthen the human immune system. Algae contain various nutrients including proteins, fats, carbohydrates, and bioactive compounds (Pratiwi and Pratiwy, 2021). Spirulina is a microscopic plant that grows in water, rich in nutrients, such as protein, iron, calcium, and B-complex vitamins. Spirulina can help improve a child's growth and development because it contains essential nutrients needed by the body, such as essential amino acids, which help repair body cells. In addition, spirulina can also speed up the recovery process after illness. The content of carotenoids found in spirulina can help increase endurance, as well as iron and calcium which are important for healthy bones and teeth. Although it can treat stunting, consuming spirulina must also be balanced with a healthy and balanced diet, as well as adequate physical activity. In a study by Lafarga et al. (2020), Spirulina also has antioxidant, pain-relieving, anti-inflammatory, and brain-protective properties.

These days most use microalgae as a marketing strategy or a coloring agent. However, Spirulina and the compounds derived from it show potential to be used as ingredients in the development of new foods, which is one of the top trends in the food industry. Several intervention studies suggest the potential of Spirulina to be used in the prevention or treatment of disorders related to stunting.

#### **AUTHOR CONTRIBUTION**

All the authors contributed to the research.

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#### **CONFLICT OF INTEREST**

There was no conflict of interest.

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