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Effect of Rebon Shrimp-Based Supplementary Feeding on Height of Stunted Children

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ABSTRACT

In Indonesia, as other developing countries, stunting is still prevalent especially in children. Stunting significantly affects person's development in future. Stunting occurs about 162 million children under 5 years worldwide. It is generally caused by insufficient nutritional intake mostly on children from underprivileged families. Rebon-shrimp is a nutritious and inexpensive local food, but its utilization is still low. It is potential to be an additional food for children. This study aims to determine the effectiveness of rebon-shrimp based supplementary feeding on weight and height in malnourished children aged 24-60 months. This study is a quasi-experimental design, involving 88 malnourished children, divided into 2 groups, intervention (n=44) and control (n=44). The intervention group received rebon-shrimp based supplementary food for 90 days, while the control group received a placebo. Height was assessed at baseline and monthly follow-ups until endline at Day 90. The results were analyzed by repeated-measures anova test. There was a statistical difference ($p<0.0001$) in height gain on both groups, but the increase in height of children who received rebon products (3.94cm) was greater than children who did not receive rebon products (2.92cm). It was concluded that supplementary food made from rebon-shrimp was beneficial for increasing height of stunted children.

Keywords: rebon-shrimp; supplementary food; stunted

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INTRODUCTION

Malnutrition is one of the most worrisome global health problems. At least, almost half of deaths in children under 5 years are caused by malnutrition. This situation places children at risk of dying from common infectious diseases, where malnutrition in these children will increase the morbidity and mortality of infections, and hinder the recovery process (WHO, 2019). The interaction between malnutrition and infection can be a deadly cycle that has the potential to worsen disease and nutritional status. Poor nutritional intake in the first 1,000 days of a child's life will cause stunted growth, impaired cognitive abilities, and reduce performance in school and work in the future (Who and Bank, 2019).

Some of the malnutrition conditions that have the most impact on children under the age of 5 are stunting, wasting, and underweight. Stunting in childhood is one of the conditions that significantly affects a person's development in the future. Stunting occurs in about 162 million children under 5 years worldwide (Antonio and Weise, 2012). Stunting is one of the global health problems that becomes a very important point to be addressed immediately. Data 2018 shows that stunting is estimated to occur in around 21.9% or around 149 million children under the age of 5 years (Who and Bank, 2019).

The first five years of a child's life is a very important golden age, especially for physical growth. At this time, 90% of a child's brain cells grow and develop. If this period is neglected, especially in terms of nutrition and health, it will cause serious health problems for the toddler, both at this time and in the future. One of the health indicators is the nutritional status of children under five. Nutritional status is a measure of the condition of a person's body which can be seen from the food consumed and the use of nutrients in the body. Assessment of nutritional status can be measured directly and indirectly. Direct assessment includes anthropometry (W/U, TB/U, and BW/TB), biochemistry (albumin, hemoglobin, immunoglobulin A), biophysics, and clinical. Meanwhile, indirect assessment includes food surveys, vital statistics, and ecological factors (Denas Symond, Fadil Oenzil, Eriyati Darwin, 2016).

Nutritional status based on anthropometry is more associated with macronutrient intake (carbohydrates, protein and fat). Whereas the role of macronutrients will not be optimal without the presence of micronutrients (specific vitamins and minerals). Minerals that include micronutrients include iron, zinc, copper, selenium, chromium, iodine, fluorine, manganese, molybdenium, nickel, silicon, vanadium, arsenic and cobalt. Lack of intake of these specific minerals, one of which is zinc, can interfere with growth (Herman, 2009; Yuniar Rosmalina, 2010).

Nutritional intake of toddlers can be obtained from the family food menu and supplementary feeding. Supplementary Feeding is intended to help meet the needs of under-fives who are malnourished. Rebon-shrimp as a local food in coastal areas has the potential for good nutritional content, especially high protein and calcium content. Dried rebon-shrimp protein per 100g reaches 66.4g or equivalent to 2-3 times beef protein and 3-4 times egg protein, and contains 4 mg calcium or equivalent to 10 times beef calcium (PERSAGI, 2009). Rebon-shrimp has the potential to be an alternative source of animal protein, which cheap and can be used as a natural protein and calcium supplement for toddlers (Anis Abdul Muis, Uun Kunaepah, Alina Hizni, 2017).

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Compared to other shrimp, rebon is cheaper in price and has a high nutritional content so that it can be processed into highly nutritious food, but the utilization of these products is still low. Rebon is only used in the manufacture of shrimp paste. Efforts need to be made to process rebon as a cheap, quality and affordable processed product. The potential of rebon-shrimp local food can be used as additional food for malnourished children.

LITERATURE REVIEW

Rebon-shrimp (Acetes sp.) has a smaller size when compared to another shrimp. Keer et al. (2018) reported that fresh rebon (Acetes sp.) contained 12.26% protein, 83.55% water, 0.6% fat, and 2.24% ash. Dried rebon-shrimp contain 19.00% water, 48.29 crude protein, 16.05% ash, and 3.62% crude fat (Balange et al., 2017). Rebon-shrimp are usually processed into shrimp paste fermented products (Keer et al., 2018; Wijayanti and Swastawati, 2019).

Shrimp contains high protein and calcium which are needed for the growth process. In addition, shrimp also contain bioactive compounds such as chitosan and chitin. The results showed that chitosan and chitin are beneficial for the body. Both of these substances function to suppress cell aging, prevent circulatory diseases, strengthen the immune system, increase cholesterol secretion in the body, suppress cancer cell proliferation and reduce excess body weight (Trivedi et al., 2016).

Nutritional status (nutritional status), is a condition caused by a balance between nutrient intake from food and the nutritional needs needed for body metabolism. Each individual requires a different intake of nutrients between individuals, this depends on the person's age, gender, body activities in a day, weight, and others (Harjatmo et al, 2017). Indicators of nutritional status, are signs that can be known to describe a person's nutritional status. Someone who suffers from anemia as a sign that iron intake is not in accordance with their needs, obese individuals as a sign of intake of food sources of energy and fat content exceeds the requirement.

Anthropometric method can be interpreted as measuring the physical and parts of the human body. In assessing nutritional status with the anthropometric method is to make the size of the human body as a method to determine nutritional status. The basic concept that must be understood in using anthropometry to measure nutritional status is the basic concept of growth. Nutritional status is a measure of the fulfillment of nutritional needs obtained from the intake and use of nutrients by the body. The assessment of nutritional status using anthropometric data includes weight for age (WFA), height/body length for age (HFA), weight according to height (WFH) and body mass index according to age (BMI) (Hardinsyah, 2017).

The growth of children can be observed by using the card towards healthy (KMS). KMS serves as a growth monitoring tool. If normal growth is not reflected in the KMS, then other indicators need to be checked such as thickness of subcutaneous fat, body circumference or determination of bone age (Arisman, 2009).

Stunting condition is a child's nutritional status which is assessed based on the index of Body Length for Age (PB/U) or Height for Age (TB/U). Stunting children are children with nutritional status based on length or height according to age who have a z-score value of less than -2SD categorized as short children, and if the z-score value is less than -3SD categorized as very short (Kemenkes RI, 2020).

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The World Health Organization (WHO) recommends anthropometric measurements of infants and toddlers using charts developed by WHO and the Centers for Disease Control and Prevention (CDC). The graph uses the z-score indicator as the average standard deviation and the median percentile. Growth indicators are used to assess a child's growth by considering various age factors and the results of measurements of height and weight, head circumference, chest circumference and upper arm circumference. Common indices used to determine the nutritional status of infants and toddlers (Supariasa, 2001; Hardinsyah, 2017).

RESEARCH METHOD

This study is a quasi-experimental design, with pre-test and post-test with control group design. The sample in this study were stunted children (z-score <-2). This study involved 88 samples of children who were divided into 2 groups, the intervention group and the control group, each with 44 children. In this study anthropometry was assessed at baseline (day 0) and monthly follow-ups (day 30, day 60) until endline at Day 90. The control group will get a placebo product (nuggets, fish stick) which are made from low-protein flour, while the intervention group received rebon-shrimp based supplementary food. Both groups received the product for 90 days. Rebon-Based supplementary food is an additional food made by researchers, made from rebon shrimp into nuggets, fish stick, fried otak-otak, and meatballs. This rebon product has been tested for proximate and mineral testing. The serving size for nuggets, fish stick, and fried otak-otak is 3 pieces (25gr/pcs)/day, while meatball products are 8 pieces (10gr/pcs)/day.

RESULT

Table 1. Comparison of Children's Height (cm) in The Intervention Group

	Min	Max	Mean	Std. Deviasi	Δ	Nilai *p*
Height Day 0	76.00	100.50	88.5841	6.49415	3.9386	0.0001
Height Day 30	77.50	104.00	90.7500	6.42352		
Height Day 60	78.50	105.00	91.5795	6.42392		
Height Day 90	79.50	106.00	92.5227	6.46813		

*repeated-measures anova test

Table 2. Comparison of Children's Height (cm) in The Control Group

	Min	Max	Mean	Std. Deviasi	Δ	Nilai *p*
Height Day 0	79.00	98.50	87.7159	5.40499	2.9205	0.0001
Height Day 30	80.50	99.00	88.9659	5.44465		
Height Day 60	81.00	100.00	89.8386	5.49114		
Height Day 90	81.50	101.00	90.6364	5.54827		

*repeated-measures anova test

Table 1 shows an increase in children's height in the intervention group. Observation of day 0 found the mean value (mean±SD) of children's height was 88.58±6.49. Observations at the day 90 showed an increase in the mean value (mean±SD) of children's height of 92.52±6.47. In table 2 the control group also shows an increase in the mean (mean±SD) of children's height by 87.72±5.90 at day 0, and the mean value (mean±SD) of children's height by 90.64±5.55 at day 3. Each group has a p value <0.05 which indicates there is a significant difference in pre and post intervention. Both groups

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also experienced an increase in the mean height, but the height gain in the intervention group (3.94 cm) was higher than the control group (2.92 cm).

DISCUSSION

Nutritional intake of toddlers can be obtained from the family food menu and supplementary feeding. Supplementary Feeding is intended to help meet the needs of under-fives who are malnourished. Rebon shrimp as a local food in coastal areas has the potential for good nutritional content, especially protein and calcium. Dried rebon-shrimp protein per 100g reaches 66.4g or equivalent to 2-3 times beef protein and 3-4 times egg protein, and contains 41 mg calcium or equivalent to 10 times beef calcium (PERSAGI, 2009). Rebon-shrimp in coastal areas is quite abundant and cheap. Rebon-shrimp has the potential to be an alternative source of animal protein, which is cheap and can be used as a natural protein and calcium supplement for toddlers (Anis Abdul Muis, Uun Kunaepah, Alina Hizni, 2017). Keer et al. (2018) reported that fresh rebon contained 12.26% protein, 83.35% water, 0.6% fat, and 2.24% ash. Dried rebon-shrimp contain 19.00% water, 48.29 crude protein, 16.05% ash, and 3.62% crude fat (Balange et al., 2017).

The results of this study showed that there was a significant difference in height in children who received rebon-shrimp based supplementary food, with the average increase in height of 3.93 cm. Based on the mineral test, rebon-shrimp supplementary food products have a good zinc content. The rebon nugget product contains 6mg Zn (per serving), rebon fish stick contains 3.04 mg Zn (per serving), fried otak-otak contains 1.95mg Zn (per serving), and meatballs 5.16 mg Zn (per serving). Zinc is one of the most important micronutrients for various enzyme processes, transcription, and the formation of protein structures. Zinc has a critical role in biological processes such as cell growth, differentiation and metabolism. Zinc deficiency can interfere with the growth of children and reduce resistance to infection (Lestari, 2018). Zinc plays an important role in normal linear growth through mechanisms involving the release of growth hormone, insulin-like growth factor I, chondrogenesis, collagen synthesis, osteoblast function, and bone calcification (Krebs and Hambridge, 1986). Many studies state that zinc supplementation has a positive relationship to linear growth in children. Meta-analysis research by Robert & Stein (2017) states that zinc supplementation can increase height gain and PB/U. The study included studies conducted in South Asia, Africa, Latin America, and the Middle East with a daily dose range of 5-40 mg/day for 2 to 12 months (Robert and Stein, 2018). Another meta-analysis study showed that giving a single zinc supplementation with a zinc dose of 10 mg/day for 24 weeks caused an increase in height of 0.37 cm in children who received zinc supplementation compared to children who did not receive zinc supplementation (Imdad & Bhutta, 2011). Other results in this study found a positive effect of single zinc supplementation on linear growth in developing countries (Imdad & Bhutta, 2011). Research by Rerksuppaphol and Rerksuppaphol (2018). showed that giving zinc supplementation at school age can increase height and z-score height for age with zinc supplementation for 6 months.

CONCLUSION

Based on the results of this study, rebon-shrimp supplementary food is useful to help height gain in stunted children. Rebon-shrimp as a local product can be a nutritious and affordable alternative to local food for the community, especially for families with malnourished children. Rebon-shrimp supplementary food is highly relevant to improve nutrition intervention in Indonesia.

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DECLARATION OF CONFLICTING INTERESTS

The authors state that there are no potential conflicts of interest in this work, authorship, or publication.

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