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Giving Baby Porridge Made from Moringa Leaves and Snakehead Fish to Toddlers in Yogyakarta, Indonesia

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Abstract

Problems in toddlers who are inadequate in MP-ASI consumption, one of the effects is stunting. Stunting is a major health problem for people in developing countries. This study aims to determine the effect of giving baby porridge complementary foods made from moringa leaves and snakehead fish on body weight. The research method uses a randomized controlled trial (RCT) that investigates the effect of feeding baby porridge supplementation made from moringa leaves and snakehead fish on the weight of toddlers. The sample size calculated was 30 respondents. The sample size of 30 toddlers aged 1-12 months was divided into 15 toddlers who were given treatment and 15 toddlers who were not given treatment. The results showed that the percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while the control group only reduced from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly ($p<0.000$).

Introduction

Complementary foods for breast milk (MP-ASI) are additional foods given to babies after the baby is 6 months old to the baby is 24 months old. So in addition to Complementary Foods, Breast Milk must still be given to babies, at least until the age of 24 months, the role of complementary foods for breast milk is not to replace breast milk at all but only to complement breast milk, so in this case complementary foods for breast milk are different from weaning foods given when the baby no longer consumes breast milk.(Mc Govern et al., 2017). Problems in toddlers who are inadequate in MP-ASI can cause stunting. Stunting is a major health problem in people in developing countries. Indonesia is the fifth country with the largest prevalence of stunting. Stunting or short growth is a condition of failure to grow in infants (0-11 months) and children under five (12-59) months. Malnutrition occurs from the time the baby is in the womb and in the early days after the baby is born, but stunting conditions will be seen after the child is 2 years old (Aguayo & Menon, 2016). The United Nations International Children's Emergency Fund (UNICEF), explained that the number of stunted children under five in 2020 increased by 26.7 million compared to 2000 which reached 20.6 million (UNICEF, 2021). 80% of stunted children under five are spread across 14 countries around the world and

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Indonesia is ranked fifth in the country with the highest number of stunting (Beal et al., 2018). According to WHO (2018) in Indonesia, there are 37% of children who are stunted (World Health Organisation (WHO), 2018). Stunting data in Indonesia shows that the prevalence of stunting has increased from 35.6% (2010) to 37.2% (2013). This condition illustrates that around 8.9 million Indonesian children experience suboptimal growth or one in three children is stunted.

According to the Ministry of Health, in the results of the 2021 Indonesian Nutrition Status Study (SSGI), the study's results on the number of chronic nutritional problems or stunting decreased by 3.3% to 24.4% from the 2019 data. According to SSGI 2021 data, the prevalence of stunting in Sleman reached 16 percent below the prevalence rate of Yogyakarta province, which was 17.3 percent. Currently, the prevalence of stunting in Indonesia reaches 24.4 percent, targeted to drop to 14 percent by 2024. Meanwhile, in Sleman Regency it is still at 16 percent. Factors that affect stunting include low exclusive breastfeeding, low protein energy intake, feeding toddlers, poor MP-ASI feeding, low family income, and complete immunization. Giving MP-ASI that does not follow the baby's age and needs can impact the health and nutritional status of toddlers. Toddlers who are given exclusive breastfeeding and complementary foods according to their needs can reduce the risk of stunting. Another impact of the lack of nutritional intake of toddlers will be susceptible to infectious diseases that can interfere with linear growth by first affecting the nutritional status of children under five. This happens because infectious diseases can decrease food intake, interfere with nutrient absorption, cause direct loss of nutrients, and increase nutrient needs. Infectious diseases that often occur in children are COPD and diarrhea. ISPA and diarrhea can make children have no appetite so there is a lack of the amount of food and drink that enters their body which can result in malnutrition. Furthermore, toddlers will experience short-term growth and development disorders (Al Rahmad, 2016; Fitriahadi et al., 2021; Najib et al., 2023). Toddlers can also experience brain disorders, physical growth disorders, and metabolic disorders in the body. Long-term impact, toddlers who experience stunting are more likely to experience stunting in adulthood. Data from Basic Health research shows that the prevalence of stunting has decreased from 37.2% in 2013 to 30.8% in 2018. However, the decline is still far from the government's expectations and targets that stunting will fall to 14% by 2024 (de Onis & Branca, 2016; Tanjung et al., 2020) (Santosa et al., 2022; Woldeamanuel & Tesfaye, 2019).

Several studies have reported an increase in the prevalence of morbidity and mortality due to nutritional status disorders, especially stunting in toddlers compared to normal toddlers in the same age group. According to UNICEF's conceptual framework on the determinants of malnutrition, food intake is one of the determinants of nutritional status (Almuneef et al., 2019) (UNICEF., 2021). Poor food intake in most toddlers is caused by a dysfunction resulting from oro-motor disorders, as a characteristic of stunting conditions. Therefore, strategies that increase nutrient density in food can help increase nutrient intake in stunted toddlers. The weight status of toddlers in the control group did not differ significantly between baseline and endline ($p = 0.109$). A significant difference in the prevalence of pain rates between the two groups was also observed at the end line ($p = 0.003$) with a prevalence of 24.6% and 51.8% on toddlers in the intervention and control groups, respectively, with the conclusion that consumption of moringa leaf-enriched porridge significantly increased body weight in children under five.

The consumption of moringa leaves and snakehead fish in toddlers as a fortificant in various food formulations including soups and complementary foods for breast milk has been the subject of research due to their high nutritional value and is widely recognized in the literature. Improvement in protein malnutrition and calcium and iron deficiency in toddlers has been reported after intervention with moringa leaves. In related publications, the authors have also reported the potential of moringa leaf fortification to increase protein and vitamin A content in fermented finger millet porridge (Farzana et al., 2017; Sandeep

et al., 2019) (Zongo, 2018) (Malla et al., 2021). The Food and Agriculture Organization (FAO) is currently promoting the use of local plants that are easily found in different regions as an economically sustainable strategy to improve food security and address community welfare (Thompson & Amoroso, 2014). However, there are still few studies that discuss the feasibility of local food-based nutrition to overcome malnutrition in the context of disease, especially stunting. The lack of rigorous and systematic testing of nutrition from local food fortification materials to reduce malnutrition in stunted toddlers is a gap that this study seeks to address. This study was conducted to determine the effect of giving baby porridge supplementation made from moringa leaves and snakehead fish on toddler weight.

Method

The research was conducted at the Dewi Sartika Posyandu located in Sidoarum District, Sleman Regency, Yogyakarta, Indonesia from February to April 2023. Posyandu Dewi Sartika is a posyandu (community clinic) for toddlers that has many toddler patients. Sidoarum District is one of the densest and largest informal settlements in Sleman Regency and has a large number of toddlers with more than 50% of mothers under five as housewives. The design of this study uses a randomized controlled trial (RCT) that investigates the effect of infant porridge supplementation made from moringa leaves and snakehead fish on the weight of toddlers at the Dewi Sartika Posyandu. This study consisted of two study groups: the control group (did not receive baby porridge made from moringa leaves and snakehead fish) and the intervention group (received baby porridge made from moringa leaves and snakehead fish). This research was approved by the Ethics Committee of Aisyiyah University Yogyakarta with No. 2884/KEP-UNISA/V/2023. Trials whose results are published have been retrospectively registered. This is due to limited prior knowledge about trial registration. However, this did not affect the reporting of findings and the methodology of the study. The authors confirm that all ongoing and related trials for this intervention have been enrolled.

This study adopts the formula of Noordzij M et al (2010) for the calculation of sample size in the study. Sample size calculation is based on primary results (moringa leaves and snakehead fish); The test strength is 80% and the significance level is 5% ($\alpha = 0.05$) according to the recommendation. Population averages and variances were obtained from the results of a pilot study conducted for this study. The sample size calculated was 30 respondents. The sample size (Noordzij et al., 2010) of 30 toddlers aged 1-12 months was divided into 15 toddlers who were given treatment and 15 toddlers who were not given treatment.

After recruitment, the researchers randomly allocated toddlers in a 1:1 ratio into two study groups (control and intervention). Randomization is performed by an independent biostatistician using a computerized random number function in Microsoft Office Excel 2008. The resulting numbers are printed on a piece of paper, folded flat, and the toddler's mother is asked to choose one. Toddlers are placed into groups depending on the number that the mother of the toddler chooses and that has been allocated through a randomization process. A total of 30 toddlers were recruited and randomized in this study. All participants from the intervention group completed all infant porridge and follow-up interventions for three months during the study period (February-April 2023). Baby porridge (baby porridge made from moringa leaves and snakehead fish) is well tolerated. There were no adverse reactions caused by the baby porridge products during the study period.

Toddlers in the control group received baby porridge. The porridge is prepared by caterers and cooks, follows standard procedures, and is given to toddlers. Each child received a daily serving of porridge equivalent to 250 ml in a cup in the morning, five days a week, for three months. Toddlers in the intervention group received porridge made from moringa leaves and snakehead fish. As presented in articles related to publications. The same procedure was used for the control group followed in the preparation and administration of enriched porridge for toddlers in the intervention group.

This study targets toddlers aged 1-12 months who are at risk of weight loss, who live

in the Sidoarum Godean area, Sleman Regency, Yogyakarta, Indonesia, and mothers of toddlers. Mothers who have toddlers aged 1-12 months who are willing to be respondents and are not sick are included in this study. Toddlers who met the inclusion criteria and mothers of toddlers were willing to participate in the study by giving their consent and were randomly put into the intervention or control group by the researchers. Two cooks with Diploma III education in midwifery were recruited and trained on porridge recipe standards and serving portions. They were trained in their role of preparing porridge and weighing portions as well as weighing and recording the remaining portions of each research participant. The cooks work closely with the data collector. Four data collectors with a minimum of midwifery diploma were recruited into the research team. Previous experience in surveys is an added advantage. Data collectors were trained for 2 days by researchers regarding their roles and expectations; research ethics; recruitment of research participants; how to manage data collection tools and all data collection procedures.

Result And Discussion

Basic socio-demographic and economic characteristics by study group, no differences were found in the socio-demographic and economic characteristics of the participants of the two groups in the initial study, which is an indication that randomization was successful.

Based on Table 1, it is known that the respondents under five at the Dewi Sartika Sidoarum Godean Posyandu in this study were dominated by 60% female, while 40% were male. Based on Table 2, shows that the weight gain of toddlers who were given the intervention before the administration of baby jellyfish made of moringa leaves and snakehead fish reached a mean figure of 6513.33, and after the administration reached a mean figure of 6706.67 within 3 months of the study, there was an increase of 193.34 body weight. Table 2 also shows that there was a weight gain of toddlers who were used as a control group reaching a mean figure of 6500.00 during 3 months of research reaching 6586.67, with an increase of 86.67, this shows that the control group also experienced weight gain but not significantly as in the intervention group, where

Table 1. Sample Distribution By Gender

No	Gender	n	%
1	Male	12	40
2	Female	18	60
	Total	30	100

Table 2. Weight Gain Before and After the Intervention Group and Control Group

Body Weight	Intervention Mean	Control Mean
Body weight before (gr)	6513.33	6500.00
Body weight after (gr)	6706.67	6586.67

Table 3. The Effect of Baby Porridge Made from Moringa Leaves and Snakehead Fish on Weight Gain in Toddlers

Body Weight	Given		Not Given		p-value
	n	%	n	%	0.000
Increase	14	93,3	0	0	
Not Increase	1	6,7	15	100	
Total	15	100	15	100	

the intervention group achieved an increase of 193.34.

Based on Table 3, after 3 months of giving the baby jellyfish made of moringa leaves and snakehead fish, body weight results were obtained in 15 toddlers in the intervention group, 14 toddlers experienced weight gain, It presented an average of 93.3% of respondents experienced weight gain, and there was only 1 toddler with an average of 6.7% who did not experience weight gain that reached the normal limit of weight gain at the age of 1-12 months. The results of the statistical test using the chi-square test obtained a chi-square value of 22,634, while based on df = 1 chi-square price table = 3,841 and p-value: 0.000. According to the provisions, if the price of chi-square is calculated to be greater than the H0 dining table, it is rejected and Ha is accepted. This means that there is an effect of giving baby jellyfish made from moringa leaves and snakehead fish on the weight gain of toddlers.

This study was conducted to determine the administration of MP-ASI baby porridge made from moringa leaves and snakehead fish on the weight of toddlers. Randomization was successful because the intervention and control groups had similar basic characteristics. The nutritional intake of toddlers in this study initially did not show a significant difference in the intake of moringa leaf pulp and snakehead fish between the two research groups. Meanwhile, in the final stage, significant differences are observed. A study in Uganda reported that the average daily nutrient intake from other foods outside the treatment (unfortified finger millet porridge and finger millet porridge enriched with 7% M. oleifera leaf powder or 17% C maxima meat) consumed by toddlers did not show any significant differences between the groups because the toddlers sampled were drawn from similar socio-economic characteristics (Evyline Isingoma et al., 2018).

In this study, the significant differences observed between the groups at the end of the study could be attributed to the differences in the nutritional content of the porridge given to each group. Groups are compared to the size of the portion consumed. Research in Uganda also observed that toddlers who were given porridge with the addition of moringa leaves and snakehead fish provided protein needs for toddlers. Therefore, giving nutrient-rich food to toddlers is very important to compensate for the usually insufficient food intake and feeding challenges that are characteristic of toddlers. With this, maximizing nutrient intake by providing additional moringa leaves and snakehead fish is very important for the health of toddlers (Evyline Isingoma et al., 2018).

Effect of consumption of porridge enriched with moringa leaves and snakehead fish on the weight of toddlers. This study was designed to test the effect of MP-ASI baby porridge made from moringa leaves and snakehead fish on the weight of toddlers. The results of this study showed that the consumption of MP breast milk porridge enriched with moringa leaves and snakehead fish increased the weight of toddlers. This is in line with previous research that by adding moringa leaves to baby porridge increases protein (Akirov et al., 2017; Bharadwaj et al., 2016).

A significant increase was observed at the end among the intervention group compared to the control research group, mentioning the effectiveness of moringa leaves and snakehead fish in increasing the weight of toddlers so that the nutritional status of children improved. The addition of MP-ASI enriched with moringa leaves and snakehead fish can also increase serum vitamin A levels after consumption for 3 months of research. During the 3-month intervention, it may be too short to show the effects of the treatment. Another study conducted in Burkina Faso reported that after 6 months of intervention with moringa leaf powder, the proportion of toddlers with weight increased significantly in the control and treatment study group (Boateng et al., 2018).

However, there was no significant difference between the groups in the later stages thus linking the toddlers' weight gain to other factors besides the intervention. Our study eliminated known confounding factors by random placement of study participants in a study group (Randomized Clinical Trials). In addition, the randomization process in this study was successful because the research groups had similar basic characteristics. This

suggests that significant differences observed between groups in the late stages concerning the weight of toddlers can be attributed to the intervention. In related publications, the authors have reported an increase in the nutritional content of MP-ASI porridge enriched with moringa leaves and snakehead fish which has the potential to reduce malnutrition among nutrient-vulnerable populations (Zongo, 2018) (Malla et al., 2021).

The effect of MP-ASI porridge consumption enriched with moringa leaves and snakehead fish on the weight of toddlers in the study BMI scores for age Z of toddlers in the two research groups differed significantly at the end of the study (p-value: 0.000). The percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while in the control group only decreased from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly (p<0.000) compared to the control group which did not experience significant changes (p = 0.109). The observed increase in the weight status of toddlers in the intervention study group was due to the consumption of MP-ASI, moringa leaf-enriched porridge, and snakehead fish in toddlers. The findings of this study show the effectiveness of the consumption of MP-ASI baby porridge enriched with moringa leaves and snakehead fish in increasing BMI scores for age Z in toddlers.

The effect of consumption of MP-ASI with moringa leaf and snakehead fish enriched porridge on the prevalence of morbidity in toddlers, a significant difference in morbidity status between groups was observed at the end of the study with toddlers in the intervention group, showing a significant improvement in morbidity status compared to the control group which did not show significant changes. However, in studies in other countries, records from Volunteer Health Coaches showed that healthcare-seeking habits in all groups did not differ significantly. The findings of the current study consolidate the relationship between food intake, disease, and nutritional status, especially body weight, as contained in the literature. Another factor that becomes uncertain concerning nutritional intake in toddlers following the Healthy Society Framework is economic factors where economic factors and environmental factors are two factors that have an impact on nutritional intake for toddlers (Evyline et al., 2018; De Vita et al., 2019; Smith & Lawrence, 2015; UNICEF., 2021; Nugroho et al., 2023).

Conclusion

The effect of consumption of MP-ASI porridge enriched with moringa leaves and snakehead fish on the weight of toddlers in the study BMI scores for age Z of toddlers in the two research groups differed significantly at the end of the study (p-value: 0.000). The percentage of underweight children in the intervention group decreased from a mean of 6513.33 to 6706.67 while in the control group only decreased from a mean of 6500.00 to 6586.67. Overall, the weight status of toddlers in the intervention group changed significantly (p<0.000) compared to the control group which did not experience significant changes (p = 0.109). The observed increase in the weight status of toddlers in the intervention study group was due to the consumption of MP-ASI, moringa leaf-enriched porridge, and snakehead fish in toddlers. The findings of this study show the effectiveness of the consumption of MP-ASI baby porridge enriched with moringa leaves and snakehead fish in increasing BMI scores for age Z in toddlers.

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