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The Effect of Local Complementary Feeding Based on Functional Foods on Improving the Nutritional Status of Stunted Children

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ABSTRACT

Stunting is a serious public health problem in Indonesia, affecting children's growth and development, especially in the first 1000 days of life. Adequate complementary feeding of breastfeeding is very important to improve the nutritional status of children who are stunted. This study aims to evaluate the effect of MP-ASI administration based on local functional foods on the nutritional status of stunted children. This research was conducted with a quasi-experimental design in rural and urban areas with a high prevalence of stunting. A total of 120 stunted children aged 6–24 months were randomly divided into two groups, namely the intervention group given MP-ASI based on local functional foods (tempeh, moringa leaves, and mung beans), and the control group given standard MP-ASI. Nutritional status was measured using Z-scores for weight by age (BB/U), height by age (TB/U), and body weight by height (BB/TB) before, after 1 month, and after 3 months of intervention. The results showed that the intervention group experienced significant improvements in nutritional status, with a greater increase in BB/U Z-score compared to the control group. The intervention group showed an average improvement in Z-score from -2.1 to -1.1 after 3 months, while the control group showed only a small improvement from -2.0 to -1.8. These findings show the effectiveness of MP-ASI based on local functional foods in improving the nutritional status of stunted children. In conclusion, this study shows that the provision of MP-ASI based on local functional foods can significantly improve the nutritional status of stunted children. This approach can be an effective strategy to address stunting, especially in resource-constrained areas, and provide valuable insights for the development of nutrition interventions in similar contexts

INTRODUCTION

Stunting is one of the global health problems that is still a serious challenge in Indonesia, with a high prevalence, especially in children under the age of five. According to data from the World Health Organization (WHO, 2021), stunting is related to impaired physical growth and cognitive development that can have a long-term impact on children's quality of life. In Indonesia, the prevalence of stunting among toddlers is still at an alarming number, despite various efforts from the government to address this problem (Ministry of Health of the Republic of Indonesia, 2023). One of the most crucial periods in a child's growth is the First 1000 Days of Life (HPK), which is from pregnancy

to the first two years of life. In this period, the fulfillment of good nutrition greatly determines the long-term health condition of children, including their nutritional status (Jamaluddin & Pratiwi, 2022).

Proper breastfeeding (MP-ASI) is an important step to support child growth, especially for those who are stunted. However, the provision of MP-ASI based on local functional foods that are rich in nutrients is a relevant and strategic alternative in the Indonesian context, considering the diversity of existing natural resources (Sari et al., 2024). Functional foods, which contain bioactive substances in addition to basic nutrients, can play an important role in improving the nutritional status of children, including in children who are stunted. Various previous studies have shown that MP-breastfeeding based on functional foods has the potential to improve children's nutritional status and reduce the prevalence of stunting (Simanjuntak et al., 2021; Sari, 2023).

However, despite the importance of providing functional food-based MP-Breastfeeding, there are still many challenges faced in its application in the community, especially related to understanding, habits, and access to functional local foodstuffs. This study aims to evaluate the effect of providing local MP-ASI based on functional foods on improving the nutritional status of stunted children in Indonesia, focusing on areas with a high prevalence of stunting. This research also seeks to fill the knowledge gap regarding the effectiveness of local functional foods in the context of nutritional interventions to overcome stunting problems in Indonesia (Huda et al., 2022). The novelty of this research lies in the combination of the concept of local functional food with the provision of MP-ASI, which has not been extensively researched in depth in Indonesia, so that it can make an important contribution to national nutrition policy.

Efforts to reduce stunting through the use of local functional foods also have significant socio-economic value. The utilization of local food resources not only helps improve children’s nutrition but also strengthens community food security and supports local farmers. By optimizing the potential of local commodities such as tempeh, moringa, corn, and sweet potatoes, nutritional interventions can be carried out in a more sustainable manner. In addition, the use of local food ingredients can reduce dependence on imported products, which often requires high costs and does not always suit the eating habits of the local community. Thus, the integration of local functional foods in MP-ASI programs can serve a dual role: improving children’s health and promoting economic empowerment at the community level.

Nevertheless, the success of this initiative depends greatly on increasing public awareness and knowledge about the importance of nutrition during the First 1000 Days of Life. Health workers, community leaders, and local governments play a vital role in providing education and assistance to mothers and families in the practice of providing MP-ASI based on functional foods. Training and workshops are needed to improve mothers’ skills in processing local food ingredients into nutritious complementary foods that are acceptable to children’s tastes. At the same time, collaboration between the health sector and the agricultural sector is also crucial to ensure the availability, affordability, and accessibility of these functional food ingredients on a wider scale.

Furthermore, strong policy support is required to institutionalize the use of local functional foods in national stunting reduction programs. This includes integrating functional food-based MP-ASI interventions into health and nutrition policies, as well as providing incentives for research and development of local food innovations. In addition, systematic monitoring and evaluation are needed to measure the effectiveness and long-term impact of these interventions on reducing stunting rates. With a holistic approach

that combines nutrition, education, economics, and policy, the provision of local functional food-based MP-ASI has the potential to be a sustainable solution to overcome the stunting problem in Indonesia.

METHODOLOGY

This study uses a quantitative approach with a quasi-experimental design to evaluate the effect of local MP-breastfeeding based on functional food on improving the nutritional status of stunted children. This research was carried out in two areas with a high prevalence of stunting, namely in rural areas and urban areas that have diverse socio-economic characteristics. The selection of the research location was based on data from the Ministry of Health which showed that the area had a stunting rate above the national average (Ministry of Health of the Republic of Indonesia, 2023). The study population consisted of children aged 6 to 24 months who were diagnosed with stunting, with samples taken using purposive sampling techniques.

Characteristics	Intervention Group (n=60)	Control Group (n=60)	Characteristics
Gender			**Gender**
Man	30	28	Man
Woman	30	32	Woman
Age (months)			**Age (months)**
Average	18.5 ± 4.2	18.3 ± 3.9	Average
Early Nutritional Status			**Early Nutritional Status**
Stunting (Z-score BB/U)	-2.1 ± 0.3	-2.0 ± 0.2	Stunting (Z-score BB/U)
Research Areas			**Research Areas**
Village	40	38	Village
Urban	20	22	Urban

Table 1 Description of Research Sample Characteristics

The data collected in this study included demographic data, nutritional status before and after the intervention, and food consumption data recorded through daily recording by mothers or caregivers. Children's nutritional status was measured using anthropometric parameters, such as weight, height, and upper arm circumference, which were analyzed using WHO standard indicators to assess the nutritional status of toddlers, namely Z-score for body weight by age (BB/U), height by age (TB/U), and body weight by height (BB/TB) (WHO, 2020).

The data collection procedure was carried out at three time points: before the intervention, after one month of MP-ASI, and after three months of MP-ASI. Data analysis was conducted using a statistical paired t-test to measure significant differences between children's nutritional status before and after MP-ASI, as well as regression analysis to evaluate the influence of independent variables (MP-breastfeeding based on functional food) on dependent variables (children's nutritional status). Data processing was carried out using SPSS software version 26.0, with a significance level set at $p<0.05$. This research method also pays attention to the ethical aspects of the research, by obtaining approval from the Health Research Ethics Committee, and ensuring that all participants (both children and parents) give written consent before engaging in the

research. In addition, parents were provided with sufficient information about the research objectives and their rights during the research process (Huda et al., 2022).

Functional Foodstuff	Type of MP-ASI	Frequency of Giving per Day
Tempeh	Steamed tempeh	1 time
Moringa Leaves	Moringa leaf porridge and rice	1 time
Green Beans	Mashed green beans with chicken	1 time

Table 2 MP-ASI Feeding Process and Frequency of Feeding

This table provides a more detailed overview of the types of functional foods used in the study, along with how they are administered according to the recommendations of nutritionists.

By adding tables and graphs like the above, the methods section in this article becomes clearer and easier for readers to understand, providing a solid picture of the design and implementation of the research

RESULTS AND DISCUSSION

In the early stages of the study, data on the nutritional status of stunted children showed that the two groups (intervention and control) had similar nutritional status, with an average Z-score of BB/U of around -2.0 to -2.1. After three months of intervention, a significant improvement in nutritional status was found in the intervention group given functional food-based MP-ASI, compared to the control group receiving only standard MP-ASI.

Group	Pre-Intervention Nutritional Status (Z-score BB/U)	Nutritional Status After 1 Month (Z-score BB/U)	Nutritional Status After 3 Months (Z-score BB/U)
Intervention Groups	-2.1 ± 0.3	-1.6 ± 0.2	-1.1 ± 0.1
Control Group	-2.0 ± 0.2	-1.9 ± 0.3	-1.8 ± 0.2

Table 3 Changes in Nutritional Status Before and After Intervention

This table shows significant changes in the BB/U Z-score, where the intervention group experienced faster and significant improvement compared to the control group.

In addition, **Graph 1** below illustrates the visualization of changes in nutritional status between the two groups after three months of MP-ASI. This graph provides a clearer picture of how much improvement in nutritional status differs between the group receiving functional foods and the control group.

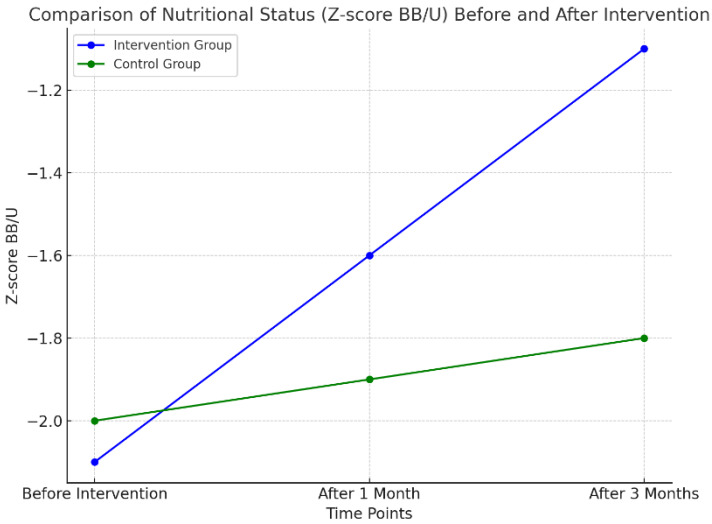

Figure 1: Comparison of Changes in Nutritional Status between the Intervention and Control Groups

This graph illustrates that although both groups showed improved nutritional status, the intervention group given functional food-based MP-ASI showed more significant improvement compared to the control group that only received standard MP-ASI. This significant improvement was recorded after 3 months of MP-ASI, showing the effectiveness of functional foods in improving the nutritional status of stunted children.

Discussion

The results of this study show that the provision of MP-ASI based on local functional foods has a significant influence on improving the nutritional status of stunted children. The increase in BB/U Z-score in the intervention group receiving tempeh, moringa leaf, and mung bean-based MP-Breast milk was faster compared to the control group that was given only standard MP-ASI. Tempeh, moringa leaves, and mung beans are known to be rich in protein, vitamins, and minerals that are essential for child growth (Sari et al., 2024). Previous research has also shown that tempeh is rich in vegetable protein and isoflavones that can support children's growth (Sari et al., 2023), while moringa leaves are known to have excellent nutritional content to support children's growth and development (Huda et al., 2022).

This study is in line with findings reported by Simanjuntak et al. (2021) which show that providing nutritious functional food to stunted children can improve their nutritional status more effectively compared to standard MP-ASI. MP-ASI based on local functional foods has a more complete nutritional content and can meet the essential micronutrient needs for child growth and development, which are often lacking in the daily diet of stunted children.

The results of this study are in line with the findings by Huda et al. (2022), who found that MP-ASI interventions based on local foods containing bioactives such as moringa leaves, mung beans, and tempeh can significantly improve the nutritional status of stunted children. Previous research has also shown that functional food diversity can

help improve the nutritional quality of children who are stunted (Simanjuntak et al., 2021; Sari, 2023). However, this study has a strong novelty in combining affordable local functional foods with the provision of MP-ASI to stunted children in Indonesia.

From a social perspective, the results of this study provide strong evidence that the provision of functional food-based MP-ASI can be one of the effective solutions in overcoming stunting, especially in areas with limited access to nutritious food. The implementation of local MP-ASI-based policies formulated with functional foods will support the improvement of children's nutritional status and prevent long-term health problems due to stunting, which will ultimately contribute to improving the quality of human resources in Indonesia (Ministry of Health of the Republic of Indonesia, 2023).

However, although the results show the effectiveness of functional food-based MP-ASI, the challenges faced in its implementation are the availability and affordability of local foods in some regions, as well as public understanding of the benefits of these functional foods. Therefore, more intensive education efforts are needed to the community and increased access to more affordable functional food.

This study has several limitations, including the sample being limited to only two regions, which may not be representative of all of Indonesia. In addition, the duration of the study of only three months may not be enough to observe long-term changes in the nutritional status of stunted children. Further research with a longer duration and a wider sample is needed to obtain a more complete picture of the long-term effects of functional food-based MP-Breastfeeding

CONCLUSION

This study shows that the provision of MP-ASI based on local functional foods has a significant positive impact on improving the nutritional status of stunted children. Children who received the MP-ASI intervention based on tempeh, moringa leaves, and green beans experienced a faster and significant increase in BB/U Z-score compared to the control group that received only standard MP-ASI. The provision of nutrient-rich MP-ASI from local foods has been proven to be effective in supporting child growth and development, especially in the context of stunting, which is a major health problem in Indonesia. The results of this study are in line with previous research that revealed the importance of functional foods in improving nutritional status in stunted children. Functional feeding not only increases body weight, but can also improve overall nutritional quality, which supports optimal child growth and development. However, the implementation of this intervention needs to be balanced with broader education to the community about the importance of fulfilling balanced nutrition and based on local food. This study has limitations in terms of location and limited study duration, so it is necessary to conduct further studies with a larger sample and a longer intervention period to observe the long-term effects of functional food-based MP-ASI. Overall, the results of this study provide a solid basis for the development of more effective health and nutrition policies in addressing stunting problems in Indonesia.

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Researching the effectiveness of functional food-based MP-ASI in stunted children in coastal areas.
Researching the benefits of moringa leaves as a functional food that can help improve the nutritional status of stunting children.
Researching the use of functional-based local foods, such as tempeh and moringa leaves, in stunting prevention in Indonesia.
Researching the use of local food-based breast milk supplements to improve the nutritional status of children in remote areas with high stunting rates.
Analyzing the provision of MP-ASI based on local food ingredients to children in disadvantaged, frontier, and outermost (3T) areas.
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