



Effectiveness of a Local Food–Based Balanced Nutrition Guide (LFBNG) in Improving Knowledge of Community Health Cadres and Stakeholders for Stunting and Anemia Prevention

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Abstract:

Background: Stunting and anemia among children aged 6-23 months remain a priority health problem in Indonesia, with a prevalence of 21.6% in 2022. A local food-based balanced nutrition guideline (PGS-PL), developed using Optifood Linear Programming, was introduced as an evidence-based, locally adapted nutrition education tool for the Talun Community Health Center working area, Cirebon Regency.

Aim: This study aimed to evaluate the effectiveness of PGS-PL education in improving the knowledge of cadres and local stakeholders as a feasibility step prior to community-wide implementation.

Methods: A one-group pre-test post-test design was applied to 17 participants (cadres, civil servants, police officers, village officials, and entrepreneurs) using a Google Form-based knowledge questionnaire before and after the education session.

Results: The mean knowledge score increased from 76.2 to 87.1 (an 11-point gain); 76.5% of participants showed improved scores, and the proportion achieving the passing standard (≥ 80) rose from 41.2% to 88.2%.

Conclusions: PGS-PL education effectively improved participants' knowledge related to local food-based balanced nutrition for children under two.

Implication: These findings support the feasibility of PGS-PL as an education tool that can be integrated into Posyandu and Puskesmas nutrition promotion programs and scaled up in the subsequent effectiveness trial phase.

Keywords: stunting; anemia; clowns; PGS-PL; Cadre knowledge



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INTRODUCTION

Stunting and anemia in children under two years old (clown) are still a priority challenge for health development in Indonesia. Although the prevalence of stunting shows a downward trend, the figure is still at an alarming level, as shown by data from the Indonesian Nutrition Status Survey (SSGI) in 2019 of 27.7%, in 2021 it was 24.4%, and in 2022 it was 21.6%. Stunting and anemia in the First 1,000 Days of Life (HPK) period have a wide impact on linear growth, cognitive development, immunity, learning capacity, long-term productivity, and health financing burden.

One of the main determinants of stunting and anemia is the low quality of nutritional intake and improper child feeding practices. Nutrition education programs have been widely implemented, but replication and scaling up are still constrained by the limitations of guidelines that are truly local-specific, easy to understand, affordable, and evidence-based. Nutrition education that is not accompanied by food recommendations aligned with local availability and purchasing power tends to be difficult for families and health workers in the field to implement consistently, so the program's impact is less optimal.

The Local Food-Based Balanced Nutrition Guide (PGS-PL) was developed using the Optifood Linear Programming approach to produce realistic food recommendations based on consumption patterns, prices, local food availability, and the socio-cultural context of the community in the working area of the Talun Health Center, Cirebon Regency. Before being widely implemented to the target clients and their caregivers, PGS-PL needs to be tested for feasibility through education to Posyandu/PKK cadres and cross-sector stakeholders, as part of the development stage of evidence-based interventions. This education is important because cadres and stakeholders play a role as the spearhead of the dissemination of nutrition information at the community level, so their level of understanding of PGS-PL will determine the success of program replication at the next stage.

This study aims to analyze the effectiveness of PGS-PL education on increasing the knowledge of cadres and stakeholders in the work area of the Talun Health Center, as a basis for improving the modules and educational media before being applied to a broader scale effectiveness test against the target of children aged 6-23 months.

Recent research on stunting and anemia prevention shows that nutritional interventions are increasingly directed at using evidence-based food recommendations based on nutritional needs and considering the availability and consumption patterns of local food. The Optifood Linear Programming approach has been used to identify problematic nutrients

and develop locally based food recommendations for vulnerable groups, including pregnant women, toddlers, and school-age children.

Previous research has also shown that education on balanced diet recommendations can improve maternal knowledge, adherence in feeding, and energy, protein, iron, and zinc intake in children. However, most of these studies focused more on mothers or caregivers as direct recipients of the intervention. Studies that place Posyandu cadres, PKK cadres, village officials, cross-sector officers, and local stakeholders as the initial target of testing nutrition guidelines are still limited.

This article places cadres and stakeholders as dissemination agents before PGS-PL is applied to the community. The guide used not only provides general nutrition messages, but also contains local food recommendations, clown nutritional conditions, sample menus based on age groups, and communication media in the form of modules, leaflets, and posters.

State of the Art Table

Aspects of the study	Previous research findings or trends	The position of this research
Nutritional intervention approach	Nutrition education is used to improve feeding knowledge and practices	Testing PGS-PL education as a feasibility stage before widespread implementation
Food recommendation base	A number of studies have used Optifood to identify nutrient problems and formulate food recommendations	Turning the results of Optifood's analysis into operational guides and educational media
The context of local food	Local food is starting to be considered because it is more available, affordable, and in accordance with the culture of the community	Recommendations are adjusted to consumption patterns, prices, availability, and socio-cultural conditions in the Talun Health Center area
Objectives of the intervention	Generally, mothers of toddlers, pregnant women, caregivers, or children	Posyandu/PKK cadres and stakeholders across sectors
Research outputs	Knowledge, compliance, diet, and nutrient intake	Knowledge, changes in individual values, and achievement of competency standards
Development stages	Many studies apply interventions directly to the end goal	Carry out a feasibility test for prospective dissemination agents before the effectiveness test on clowns and caregivers

LITERATURE REVIEW

Optifood is an application developed by the World Health Organization (WHO) to analyze nutritional intake problems in certain age groups and serves as a basis for preparing local food recommendations that are promoted to address nutritional problems in the target group. The Linear Programming (LP) approach uses two sets of reference data, namely the Food Composition Table (FCT) and the recommended nutrient intake (RNI). FCT is used to estimate the nutritional content of a diet, while RNI is used to evaluate and compare alternative Food Based Recommendations (FBR) to identify nutritional gaps and develop food recommendations that meet the optimal nutritional needs of the target (Fahmida et al., 2022).

PGS-PL is an information guide on balanced nutrition based on local food based on the results of the Optifood analysis and adjusted to the food diversity of certain populations. This guide contains information on nutritional conditions in an area according to age groups, how to increase it, examples of menu recipes with local food, as well as educational media such as leaflets and meal guide posters that are specific to the clown age group (Nasution et al., 2021).

Several studies have shown the effectiveness of the Optifood-based approach and local food-based nutrition education. Education on balanced diet recommendations for three months in stunted mothers under five in Surabaya has been proven to increase maternal knowledge and compliance in providing a better diet and intake of energy, protein, iron, and zinc to children (Taufiqurrahman et al., 2021). Optifood's analysis of ten stunting priority districts in Indonesia also showed that the nutritional problems identified through the LP approach were in line with the problems of stunting and anemia that occurred in toddlers and pregnant women in the region (Ministry of Health of the Republic of Indonesia, 2022). These findings strengthen the basis that PGS-PL-based education has the potential to increase the knowledge and readiness of cadres and stakeholders in supporting efforts to prevent stunting and anemia at the primary service level.

Based on the studies in the article, there are several research gaps. First, various nutrition education programs have been implemented, but the recommendations used are often still general and have not fully adjusted to consumption patterns, prices, purchasing power, food availability, and the culture of the local community. As a result, families may find it difficult to apply nutritional messages consistently.

Second, the use of Optifood in previous studies was more directed toward identifying nutritional problems and preparing food recommendations. Research that translates the results of the analysis into an educational guide package consisting of modules, leaflets, posters, and examples of age-specific menus is still limited, and it has not yet evaluated initial acceptance.

Third, previous research has generally focused on mothers, caregivers, children, or groups who directly experience nutritional problems. Evidence on the effectiveness of Optifood-based education for health cadres and cross-sector stakeholders as agents of change at the community level is still inadequate.

Fourth, there is still limited research that conducts a feasibility test for program implementers and supporters before interventions are widely implemented. In fact, the knowledge of cadres and stakeholders determines the quality of information delivery, program acceptance, and sustainability of interventions.

Fifth, a study on the local context of the work area of the Talun Health Center, Cirebon Regency, which integrates stunting and anemia problems, Optifood-based local food recommendations, and cadre capacity building has not been widely reported.

Formulation of Research Gap in the Form of a Table

Available knowledge	Limitations of previous research	The gaps that the research fills
Optifood can be used to prepare food recommendations based on nutrient needs	Many studies stop at the stage of needs analysis and formulation of recommendations	Converting the results of Optifood into PGS-PL that is ready to be used for education
Balanced diet education can improve mothers' knowledge and feeding practices	Target more mothers or caregivers	Testing cadres and stakeholders as potential dissemination agents
Local food has the potential to support nutritional improvement	Recommendations are often not packaged in an easy-to-use medium	Integrate recommendations into modules, leaflets, posters, and sample menus
Nutrition interventions can be carried out through Posyandu and Puskesmas	The stage of preparedness of implementers before widespread implementation is rarely evaluated	Assess initial eligibility through changes in knowledge and graduation rates of participants
Prevention of stunting and anemia requires contextual interventions	Local evidence in the Talun Health Center area is still limited	Provide preliminary evidence specific to the context of Cirebon Regency

METHODS

This research is part of the feasibility test stage of PGS-PL development, using a *one-group post-test design*, to evaluate changes in participants' knowledge before and after participating in educational activities. The research was carried out in the working area of the Talun Health Center, Cirebon Regency.

The research subjects totaled 17 people, consisting of Posyandu/PKK cadres and cross-sector stakeholders, including State Civil Apparatus (ASN), members of the Indonesian National Police (Polri), village officials, and self-employed people in the work area of the Talun Health Center. Subjects were selected by total sampling from participants who attended educational activities. Participants' educational backgrounds varied, ranging from high school/equivalent to a master's degree (S2).

The research instrument is a Google Form-based knowledge questionnaire that participants complete before (pre-test) and after (post-test) participating in the PGS-PL educational session. Educational materials are delivered using Communication, Information, and Education (KIE) modules and media in the form of leaflets and posters containing information on clowns' nutritional conditions, local food recommendations from Optifood analysis, and sample meal menus according to age groups. The data on the results of the pre-test and post-test were analyzed descriptively to see the change in the average score, the distribution of individual grade changes, and the graduation rate of participants with a graduation score limit of ≥ 80 .

DISCUSSION

The evaluation of educational activities was carried out using Google Form-based pre-test and post-test instruments to determine changes in participants' knowledge levels before and after participating in PGS-PL educational activities.

Table 1. Respondent Characteristics

Characteristics	Categories	Frequency (n)	Percentage (%)
Education Level	High School/Equivalent	7	41,2
	Diploma (D3)	1	5,9
	Bachelor (S1)	7	41,2
	Master (S2)	2	11,8
	Total	17	100,0

Source: Research Data

Based on Table 1, the educational background of the respondents consisted of high school/equivalent (41.2%), D3 (5.9%), S1 (41.2%), and S2 (11.8%), and came from various professions such as ASN, the National Police, village officials, self-employed, and cadres.

Table 2. Recapitulation of Pre-Test and Post-Test Evaluation Results

Indicator	Pre-Test	Post-Test
Number of participants	17	17
Average score	76,2	87,1
Highest score	95	100
Lowest value	45	30
Average increase	-	11 points

Source: Research Data

Based on Table 2, the results of the evaluation showed that the average score of participants increased from 76.2 in the pre-test to 87.1 in the post-test, resulting in an average increase of 11 points. The highest value increases from 95 to 100, while the lowest value changes from 45 to 30. This shows that in general there is an increase in participants' knowledge after participating in PGS-PL educational activities.

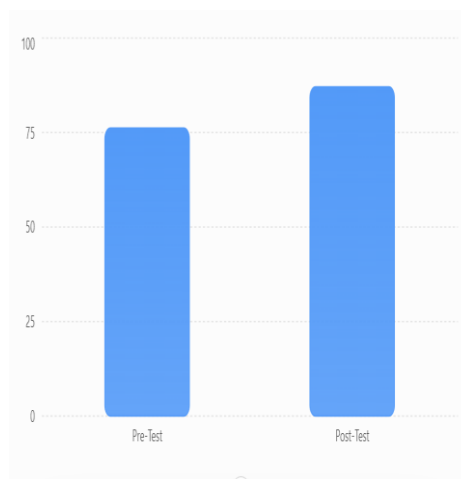


Figure 1. Comparison of Pre-Test and Post-Test Average Scores

Table 3. Analysis of Changes in Participant Values

Category Changes	Quantity (n)	Percentage (%)
Increased value	13	76,5
Fixed value	1	5,9
Decreased value	3	17,6
Total	17	100

Source: Research Data

Based on Table 3, the analysis of changes in individual grades showed that 76.5% of participants experienced an increase in grades after participating in educational activities,

while 5.9% obtained a fixed grade and 17.6% experienced a decrease in grades. This change indicates that most participants understood the PGS-PL material well.

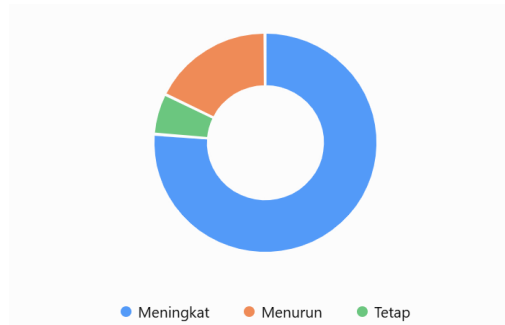


Figure 2. Distribution of Participant Value Change

Table 4. Participant Graduation Rate Analysis

Categories	Pre-Test	Post-Test	Changes
Pass (≥ 80)	7 (41,2%)	15 (88,2%)	↑ 47 percentage points
Not yet graduated (< 80)	10 (58,8%)	2 (11,8%)	↓ 47 percentage points

Source: Research Data

Based on Table 4, there was a considerable increase in the graduation rate of participants after participating in educational activities. Before the intervention, only 7 participants (41.2%) obtained a score of ≥ 80 , while 10 participants (58.8%) had not reached the graduation limit. After the educational activities, the number of participants who passed increased to 15 participants (88.2%), while the participants who did not graduate decreased to 2 participants (11.8%). These findings show that PGS-PL educational activities can increase participants' competency achievement related to balanced nutrition based on local food.

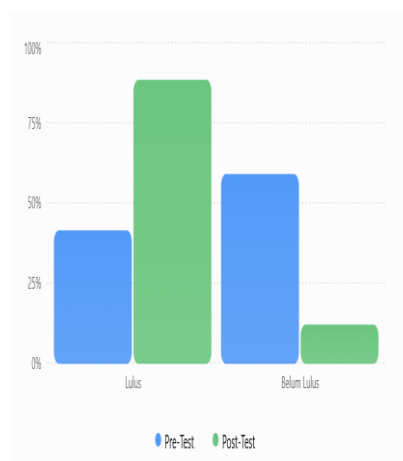


Figure 3. Comparison of Participant Graduation Percentages

Based on Figure 3, there is a clear change in the graduation rate of participants after participating in educational activities. The percentage of participants who reached the pass

category (≥ 80) increased from 41.2% in the pre-test to 88.2% in the post-test, while the percentage of participants who did not pass (< 80) decreased from 58.8% to 11.8%. This change shows that most participants have increased their understanding of the PGS-PL material provided, enabling them to achieve the set competency standards.

The results of the study show that PGS-PL educational activities have a positive impact on increasing the knowledge of cadres and stakeholders. This is shown by the increase in the average score from 76.2 to 87.1, with an increase of 11 points. This increase indicates that the PGS-PL material, which is compiled based on Optifood analysis and delivered through standardized KIE modules and media, is able to increase participants' understanding of balanced nutrition based on local food.

Analysis of individual value changes showed that 13 of 17 participants (76.5%) experienced an increase in grades. These findings show that the method of delivering materials, learning media, and interaction during educational activities is quite effective in helping participants understand PGS-PL material. However, three participants still experienced a decrease in scores, and one participant's score remained unchanged. These conditions are allegedly influenced by internal factors, such as participants' concentration and motivation to learn, as well as external factors, such as conditions when doing post-tests.

The success of educational activities can also be seen from the increase in the percentage of participants' graduation, from 41.2% to 88.2%, or an increase of 47 percentage points. These findings are in line with the results of previous research showing that local food-based nutrition education is able to increase knowledge and compliance with targets in implementing a better diet (Taufiqurrahman et al., 2021). Overall, these results support the feasibility of PGS-PL to proceed to the trial stage limited to clown and caregiver targets, as well as being the basis for improving training modules and educational media before the effectiveness test on a wider scale.

The novelty of this research lies in testing the Local Food-Based Balanced Nutrition Guide developed using Optifood Linear Programming with health cadres and cross-sector stakeholders as a feasibility test stage before implementation in clowns and caregivers.

Unlike previous research, which generally tested direct education to mothers or caregivers, this study first builds the readiness of the ecosystem implementing the program. Participants not only consisted of Posyandu or PKK cadres, but also involved civil servants, members of the police, village officials, and self-employed. This cross-sectoral approach is

the basis for the development of a nutrition dissemination model that is not only based on health services, but also supported by local actors.

Another novelty is the integration of the results of Optifood's analysis with practical educational media packages, namely modules, leaflets, posters, local food recommendations, and sample menus according to age groups. Effectiveness was initially assessed through three indicators, namely changes in average knowledge, changes in individual scores, and changes in the proportion of participants who achieved a passing score of ≥ 80 . The results of the article showed that the average score increased from 76.2 to 87.1, as many as 76.5% of participants experienced an increase in scores, and the proportion of participants who passed increased from 41.2% to 88.2%.

Research Novelty Table

Novelty dimension	Forms of research novelty
Target novelty	Cadres and stakeholders across sectors were placed as the initial targets of the intervention
Stage novelty	Education is carried out as a feasibility test before implementation to clowns and caregivers
The novelty of the approach	Integrating Optifood Linear Programming with local food-based nutrition education
Product novelty	Produce PGS-PL packages in the form of modules, leaflets, posters, food recommendations, and sample menus
Contextuality	Recommendations are prepared based on consumption patterns, prices, food availability, and local culture of the Talun Health Center
Novelty of the evaluation	Assessing grade point averages, changes in individual scores, and achievement of competency standards ≥ 80
Implementability novelty	Provide a basis for the integration of PGS-PL into the nutrition promotion program of Puskesmas and Posyandu

State of the Art and Research Gap

The local food-based nutrition education approach is increasingly being developed as a strategy to prevent stunting and anemia because it can adjust recommendations to the needs of nutrients, consumption patterns, purchasing power, and food availability of the community. The use of Optifood Linear Programming has been shown to help identify problematic nutrients and generate locally-based food recommendations for vulnerable groups. Previous research has also shown that education on balanced diet recommendations can improve knowledge, feeding adherence, and children's energy and nutrient intake.

However, most studies still focus on mothers, caregivers, or end-target groups. Research testing the readiness of health cadres and cross-sector stakeholders as dissemination agents before implementing interventions in the community is still limited. In addition, the results of Optifood's analysis have not been widely developed into practical educational packages that integrate modules, leaflets, posters, local food recommendations, and sample menus specific to each age group.

The novelty of this research is the development and initial testing of the Local Food-Based Balanced Nutrition Guide, which was prepared using Optifood Linear Programming for Posyandu/PKK cadres and cross-sector stakeholders in the work area of the Talun Health Center. This study did not directly place mothers or caregivers as the target of the intervention, but first evaluated the increase in knowledge and readiness of prospective dissemination agents as part of the feasibility test stage. Thus, this study offers a model for the development of a phased nutrition intervention that links evidence-based food recommendations, local food contexts, cadre capacity building, and implementation readiness in primary services.

State of the art: Cutting-edge research shows that Optifood Linear Programming and local food-based nutrition education can produce food recommendations that meet nutritional needs and improve feeding knowledge and practices.

Research gap: Previous research has focused more on mothers or caregivers and has not evaluated the readiness of cadres and cross-sector stakeholders as dissemination agents before interventions are applied to the community.

Novelty: This study tested the Optifood-based PGS-PL package to cadres and stakeholders across sectors as a feasibility test stage, by evaluating changes in individual knowledge scores and the achievement of competency standards before wider implementation.

CONCLUSION

The Local Food-Based Balanced Nutrition Guide (PGS-PL) education was effective in increasing the knowledge of cadres and stakeholders in the working area of the Talun Health Center, Cirebon Regency, which was shown by an increase in the average value of knowledge by 11 points, an increase in scores in 76.5% of participants, and an increase in the graduation rate from 41.2% to 88.2%. These results show that PGS-PL educational materials, modules, and media compiled based on Optifood analysis can be well understood

by cadres and stakeholders across sectors as the main driver of the dissemination of nutrition information at the community level.

Implications

This finding provides implications for the academic world in the form of preliminary evidence of the feasibility of the Optifood approach in compiling local food-based nutrition guidelines that can be replicated in areas with similar characteristics. For Puskesmas and Posyandu, these results support the use of PGS-PL as routine educational materials that can be integrated into primary services through Posyandu/PKK cadres and nutrition personnel. For policymakers at the district and national levels, the results of this study are the basis for consideration to support the expansion of the implementation of PGS-PL as one of the strategies to accelerate the reduction of stunting and anemia in children.

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