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The effect of nutritional assistance "Gammara'Na" on food acceptance and nutritional status of children in South Sulawesi, Indonesia

Nadimin NADIMIN[1], Sirajuddin SIRAJUDDIN[1], Sella Nur AFIFAH[1], Veny HADJU[2], Bohari BOHARI[3]

1 Department of Nutrition, Poltekkes Kemenkes Makassar, Makassar, Indonesia.
2 Department of Nutrition, Hasanuddin University, Makassar, Indonesia.
3 Department of Nutrition, Universitas Sultan Ageng Tirtayasa, Serang, Indonesia.

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ABSTRACT

Background: Nutritional deficiencies are a public health issue requiring serious attention in Indonesia. This study evaluates the impact of the Gammarana Program on infant and child feeding practices and nutritional status in South Sulawesi. The program includes nutritional education and counseling provided by Village Nutrition Assistants (TPGD) in stunting-prone villages. The study aimed to assess the program's effectiveness in improving feeding frequency, dietary diversity, food acceptance, and overall nutritional status of children.

Methods: A pretest-posttest design without a control group was used, involving 114 stunting-prone villages and 2,148 families. Over six months, TPGD provided education and counseling on infant and child feeding, growth monitoring, and supplementary feeding. Data were collected through interviews and anthropometric measurements and analyzed using McNemar's test to determine changes before and after the intervention, with significance set at $p<0.05$.

Results: Results showed a 12.1% increase in feeding frequency, a 27.1% increase in dietary diversity, and a 25.3% improvement in food acceptance. The proportion of underweight children decreased by 1.2%, stunted children by 5.4%, and underweight children by 2.6%. Significant improvements were observed in feeding frequency, dietary diversity, and stunting reduction. Additionally, the increase in average nutritional Z-scores indicated an overall improvement in children's nutritional status.

Conclusion: The Gammarana Program effectively improved feeding practices and reduced stunting rates in South Sulawesi.

KEYWORDS

Childhood, Community Nutrition, Nutrition Education.

INTRODUCTION

Nutritional deficiencies are a public health issue requiring severe attention in Indonesia. The 2022 SSGI analysis showed an increase in the prevalence of stunting from 13.7% to 22.4% among infants aged 6-11 months and children aged 12-23 months[1]. This is linked to poor nutrition during the first two years of life, significantly influenced by inadequate infant and young child feeding practices. Proper feeding practices during the first two years are crucial for achieving good nutrition, protecting undernutrition and overweight in both the short and long term[2].

Globally, there is an agreement on the global indicators for infant and young child feeding practices[3], which include three key components: minimum meal frequency (MMF), dietary diversity score (DDS), and acceptable diet (AD)[4,5]. Nutritional assistance can improve children's feeding practices, nutritional status, and growth. Since 2020, the Indonesian government has implemented a national program to accelerate stunting reduction. Following this national program, the South Sulawesi provincial government launched the "Gammarana" program, a stunting reduction acceleration program through targeted family nutritional assistance by Village Nutrition Assistants (TPGD). The main focus of this program is infant and young child feeding (IYCF) and growth monitoring. This program is a flagship initiative of the South Sulawesi government to improve the nutritional status of children under five

Correspondencia:
Nadimin
nadimin@poltekkes-mks.ac.id

and accelerate stunting reduction. In this context, we evaluated the program's impact on children's food acceptance (IYCF) and the nutritional status of children under five.

The research problem in this study is the high prevalence of malnutrition in South Sulawesi, particularly stunting, wasting, and underweight, despite the region's potential as a food producer. This study aims to evaluate the impact of nutritional assistance by TPGD on children's food acceptance (IYCF) and the nutritional status of children under five in South Sulawesi. This objective is based on evidence that proper feeding practices during the first two years of a child's life are crucial for preventing malnutrition. This research is expected to provide further understanding of the effectiveness of the nutritional assistance program in improving children's feeding practices and the nutritional status of children under five in the region.

METHOD

Design, Location, and Time

This study is part of the stunting reduction acceleration program in South Sulawesi Province. The program was conducted in specific stunting locations spread across 24 districts/cities in South Sulawesi in 2021. Each district and city was allocated 10 villages for nutritional assistance. The program was implemented through community intervention with a pretest-posttest study approach without a control group.

The study was conducted in 114 specific stunting locations across 24 districts/cities in South Sulawesi Province, Indonesia. The determination of stunting locations was based on local government decisions, with criteria including a higher-than-average proportion of stunting, a higher-than-average number of stunted children, and below-average nutrition service coverage (average less than 50%)[6]. Subsequently, the proposed stunting locations for each district/city were established through a decree by the Governor of South Sulawesi, prioritizing implementing nutritional assistance activities. The study sample consisted of families with children under five in the stunting locations targeted for nutritional assistance in 2022. Sample selection was based on the following inclusion criteria: complete baseline (pretest) and final evaluation (posttest) data, including family characteristics, anthropometric data, child feeding data, and residency in the stunting location during the assistance period. If more than one child under five was found in a family, the youngest child was selected. The total sample meeting the criteria was 2.148 children

Intervention Program

The nutritional intervention began with recruiting Village Nutrition Assistants from graduates of nutrition vocational education (Diploma 3/Diploma 4), nutrition undergraduates, or public health nutrition majors. They underwent one week of training before being placed in their respective villages. The training materials included Infant and Young Child Feeding (IYCF), growth monitoring, early detection and management of severe malnutrition, local food-based supplementary feeding, specific and sensitive interventions for accelerating stunting reduction, micronutrient supplementation, data collection, data entry techniques, and data analysis using ePPGBM. Nutritional assistance was provided for six months by TPGD through nutrition education and counselling activities about IYCF, growth monitoring, local food-based supplementary feeding, and micronutrient supplementation. These activities were conducted in groups at posyandu (integrated health posts) and individually through home visits. Pretest and posttest evaluations of nutritional status and child feeding practices were conducted before and after the nutritional assistance intervention.

Data Collection Methods

Quantitative data were collected through face-to-face interviews using structured, validated, and reliable questionnaires. Data types collected included sociodemographic information (parents' education and occupation), child height or length, minimum meal frequency, dietary diversity, and food acceptance. Enumerators in this study were the nutrition assistants, trained in data collection techniques, including interviews and anthropometric measurements for eight hours. All enumerators were graduates of D3, Bachelor of Applied Nutrition, or Public Health with a nutrition specialization. Researchers supervised data collection.

Assessment of IYCF Practices

Minimum Meal Frequency (MMF) is the proportion of children who received complementary feeding with a minimum frequency according to recommendations, three times for breastfed children aged 12-36 months and four times for non-breastfed children, recalled in the last 24 hours. Children meeting these recommendations are categorized as having good MMF, while those not meeting them are categorized as not good. Dietary Diversity Score (DDS)[7], is considered good if children aged 12-36 months are fed from at least four of seven food groups. The seven food groups are: (1) grains, (2) legumes, (3) dairy products, (4) flesh foods, (5) eggs, (6) vitamin A-rich fruits and vegetables, and (7) other fruits and vegetables. Children meeting at least four groups are categorised as having good DDS, and those not meeting four groups are categorized as not good. Acceptable Diet (AD) is measured based on MMF and DDS. Children meeting both good MMF and good DDS are categorised as having an adequate diet, while those not meeting either or both criteria are categorised as not having an acceptable diet.

Nutritional Status Assessment

The length measurement was done with the child lying down using a fiberboard (longboard) produced by the Indonesian Ministry of Health in 2021. Two people took measurements, one at the head and one at the feet. Each child was

measured twice, and the average value was recorded. This method was used for children aged 12-23 months, while children aged 24-59 months were measured standing using a stadiometer produced by the Indonesian Ministry of Health. Height measurements were taken by one person, with two repetitions recorded, and the average value was used. Both measuring instruments have an accuracy of 0.1 cm. Stunting was assessed by calculating the height-for-age z-score using the WHO Anthro 2006 software. The process involved entering the child's identity, measurement date, sex, measurement method (standing or lying), oedema status (yes or no), and height or length in centimetres. According to the height-for-age index (HAZ), nutritional status categories are stunted if the HAZ z-score is <-2 SD and standard if the HAZ z-score is >=-2 SD[8]. The acceptable z-score range is between -5 SD and +5 SD; data outside this range were excluded.

Data Quality Control Measures

Quality control in this study was carried out through several steps, including selecting enumerators from D3 and Bachelor of Applied Nutrition graduates who have competency certificates verified by registration certificates, training in anthropometry and interview techniques, explaining and practising child feeding interviews (MMF, DDS, and AD), and practising anthropometric measurements. Researchers conducted supervision during data collection, with random location selection, without notifying enumerators. Daily briefings and discussions were held with enumerators before and after data collection to anticipate technical issues during data collection. Different data entry personnel performed anthropometric data entry into the WHO Anthro software twice. Discrepancies were checked against hardcopy instruments to ensure accurate measurement values. The data entry was excluded if extreme z-scores (<-5 SD or >+5 SD) were found.

Data Processing and Analysis

Data were input into SPSS using a numeric system, and all categorical data were named and numbered according to SPSS guidelines published by SPSS Inc., Chicago. Bivariate McNemar analysis assessed changes in children's food acceptance and nutritional status before and after nutritional assistance. The impact of food acceptance variables on children's nutritional status post-nutritional assistance was analysed using an independent sample t-test. Conclusions for both statistical tests used an alpha of 5%.

Ethical Approval

This study received approval from the Ethics Committee of the Health Polytechnic of Makassar (No. 0625 / KEPK-PTKMS/X /2021). All data collection procedures adhered to the Helsinki Declaration. Each interviewee signed an informed consent form approved by the ethics committee. Respondents signed the informed consent form after the Enumerator had read the Explanation Consent Form (PSP) carefully.

RESULTS

Characteristics of Children and Parents

The gender distribution among children in the study population is approximately equal between boys and girls. The age distribution reveals that the largest cohort comprises children under two years of age, accounting for 40.9% of the sample. This is followed by children over three years old (32.3%) and those between two and three years of age (26.8%). Regarding parental education, the most prevalent level for both mothers and fathers is completion of elementary school. However, it is noteworthy that a subset of parents has not completed formal elementary education. Interestingly, mothers generally exhibit higher educational attainment compared to fathers. In terms of occupation, the majority of fathers (68.2%) are employed in primary sector jobs such as farming, fishing, or manual labor (Table 1). Conversely, a significant proportion of mothers (86.4%) are primarily engaged in household management as homemakers.

Table 1. Characteristics of Children and Parents

Variables	n	%
Gender:		
Male	1068	49.7
Female	1080	50.3
Age (months):		
6-11	315	14.7
12-23	563	26.2
24-35	576	26.8
36-47	470	21.9
48-59	224	10.4
Mother's Education:		
Did not finish elementary school	99	4.6
Completed elementary school	706	32.9
Completed junior high school	502	23.4
Completed senior high school	580	27.0
Higher education	261	12.2
Father's Education:		
Did not finish elementary school	128	6.0
Completed elementary school	852	39.7
Completed junior high school	431	20.1
Completed senior high school	568	26.4
Higher education	169	7.9

Table 1 continuation. Characteristics of Children and Parents

Variables	n	%
Mother's Occupation:		
Civil servant/State-owned enterprise (SOE)	58	02.7
Government contract worker	63	02,9
Housewife	1855	86.4
Employee/Private sector	70	0,32
Trader	48	02,2
Farmer/Fisherman/Laborer	45	02.1
Others	9	00.4
Father's Occupation:		
Civil servant/State-owned enterprise (SOE)	47	2.2
Employee/Private sector	365	17.0
Trader	59	2.7
Farmer/Fisherman/Laborer	1464	68.2
Others	213	9.9
Total	2148	100.0

Child Feeding

The frequency of child feeding exhibited a notable increase of 12.1% following the implementation of the nutritional assistance program. Concurrently, dietary diversity demonstrated a substantial improvement of 27.1%. Food acceptance, a composite variable encompassing both feeding frequency and dietary diversity, also showed a significant enhancement of 25.3%. The specific magnitudes of changes across various categories for each child feeding variable are comprehensively presented in the accompanying table. This investigation revealed both positive and negative fluctuations in child feeding frequency. Notably, the proportion of cases showing improved feeding frequency (24.12%) surpassed those exhibiting a decrease (11.96%). Statistical analyses confirmed that the nutritional assistance program had a significant positive impact on child feeding frequency (p=0.000). The family's capacity to provide a diverse range of foods to their children showed a more pronounced tendency towards improvement (29.56%) compared to decline (3.87%). Statistical evaluations corroborated that the nutritional assistance program significantly enhanced the family's ability to offer varied nutritional options to their children (p=0.000). Child food acceptance demonstrated a more frequent increase (33.71%) than decrease (8.43%) following the implementation of the nutritional assistance program. Statistical analyses further substantiated that the program significantly improved child food acceptance (p=0.000) (Table 2).

Table 2. Changes in Child Feeding Practices Before and After the Nutritional Assistance Program

Before	After			Sig*
	Good	Poor	Total	
Feeding Frequency				
Good	1048 (48.79%)	257 (11.96%)	1305 (60.8%)	0.000
Poor	518 (24.12%)	325 (15.13%)	843 (39.2%)	
Total	**1566 (72.9%)**	**582 (27.1%)**	**2148 (100%)**	
Dietary Diversity				
Good	1254 (58.38%)	83 (3.83%)	1337 (62.24%)	0.000
Poor	635 (29.56%)	176 (8.19%)	811 (37.76%)	
Total	**1889 (87.94%)**	**259 (12.06%)**	**2148 (100%)**	
Food Acceptance				
Good	728 (33.89%)	181 (8.43%)	909 (42.32%)	0.000
Poor	724 (33.71%)	515 (23.97%)	1239 (57.68%)	
Total	**1452 (66.61%)**	**696 (32.49%)**	**2148 (100%)**	

Nutritional Status

The nutritional assistance program resulted in a 1.2% decrease in the proportion of underweight children. Additionally, after the program implementation, there was a 5.4% reduction in stunted children and a 2.6% decrease in underweight children. Fluctuations in children's nutritional status for each index were observed. Notably, the recovery rate from wasting (5.31%) exceeded the incidence rate (4.09%). Statistical analysis revealed a significant difference in wasting prevalence before and after the program ($p < 0.05$). Similarly, the recovery rate from stunting (13.64%) surpassed the incidence rate (8.19%), with statistical tests indicating a significant reduction in stunted children post-intervention ($p < 0.05$). The recovery rate from underweight status (10.20%) also exceeded the incidence rate (7.68%), and statistical analysis confirmed a significant reduction in underweight children following the program ($p < 0.05$) (Table 3).

Children exhibiting good food acceptance demonstrated higher average Z-scores for nutritional status. Significant differences in nutritional status Z-scores were observed between children with good food acceptance and those with poor food acceptance. These differences were evident across multiple indices, including weight-for-height ($p < 0.05$), height-for-age ($p < 0.05$), and weight-for-age ($p < 0.05$), as revealed by statistical analyses (Figure 1).

DISCUSSION

The nutritional assistance program, which includes nutritional counselling through home visits, the provision of nutritional intervention packages, and growth monitoring, has significantly impacted the frequency of children's meals. This increase demonstrates the program's effectiveness in improving children's eating patterns, which is crucial for ensuring adequate nutrient intake for their growth and development. Programs that provide direct and personalised nutrition education enable parents to understand their children's nutritional needs better and adopt healthier and more consistent eating practices. Furthermore, a study by Wang et al. (2021) found that dietary interventions, including the provision of healthy food packages, can improve families' access to nutritious foods, ultimately increasing children's meal frequency[9]. The food packages provided help families ensure adequate and regular meals for their children.

In this study, we observed an improvement in children's dietary diversity indicators. This indicates that the nutritional assistance program effectively enhances the variety of foods consumed by children. Research by Ali et al. (2020) confirms that nutritional counselling through home visits greatly increases parents' knowledge about the importance of dietary diversity[10]. Such interventions provide personalised education, allowing parents to understand and implement a more

Table 3. Changes in Nutritional Status of Children Before and After the Program

Before	After			Sig*
	Malnutrition (+)	Normal (-)	Total	
Weight-for-Height:				
Malnutrition (+)	41 (1.91%)	114 (5.31%)	155 (7.2%)	0.000
Normal (-)	88 (4.09%)	1905 (88.69%)	1993 (92.8%)	
Total	**129 (6.0%)**	**2019 (94.0)**	**2148 (100%)**	
Height-for-Age				
Stunted (+)	373 (17.36%)	293 (13.64%)	666 (31.0%)	0.000
Normal (-)	176 (8.19%)	1306 (60.81%)	1482 (69.0%)	
Total	**549 (25.6%)**	**1599 (74.4%)**	**2148 (100%)**	
Weight-for-Age				
Underweight (+)	227 (10.57%)	219 (10.20%)	446 (20.8%)	0.000
Normal (-)	165 (7.68%)	1537 (71.55%)	1702 (79.2%)	
Total	**392 (18.2%)**	**1756 (81.8%)**	**2148 (100%)**	

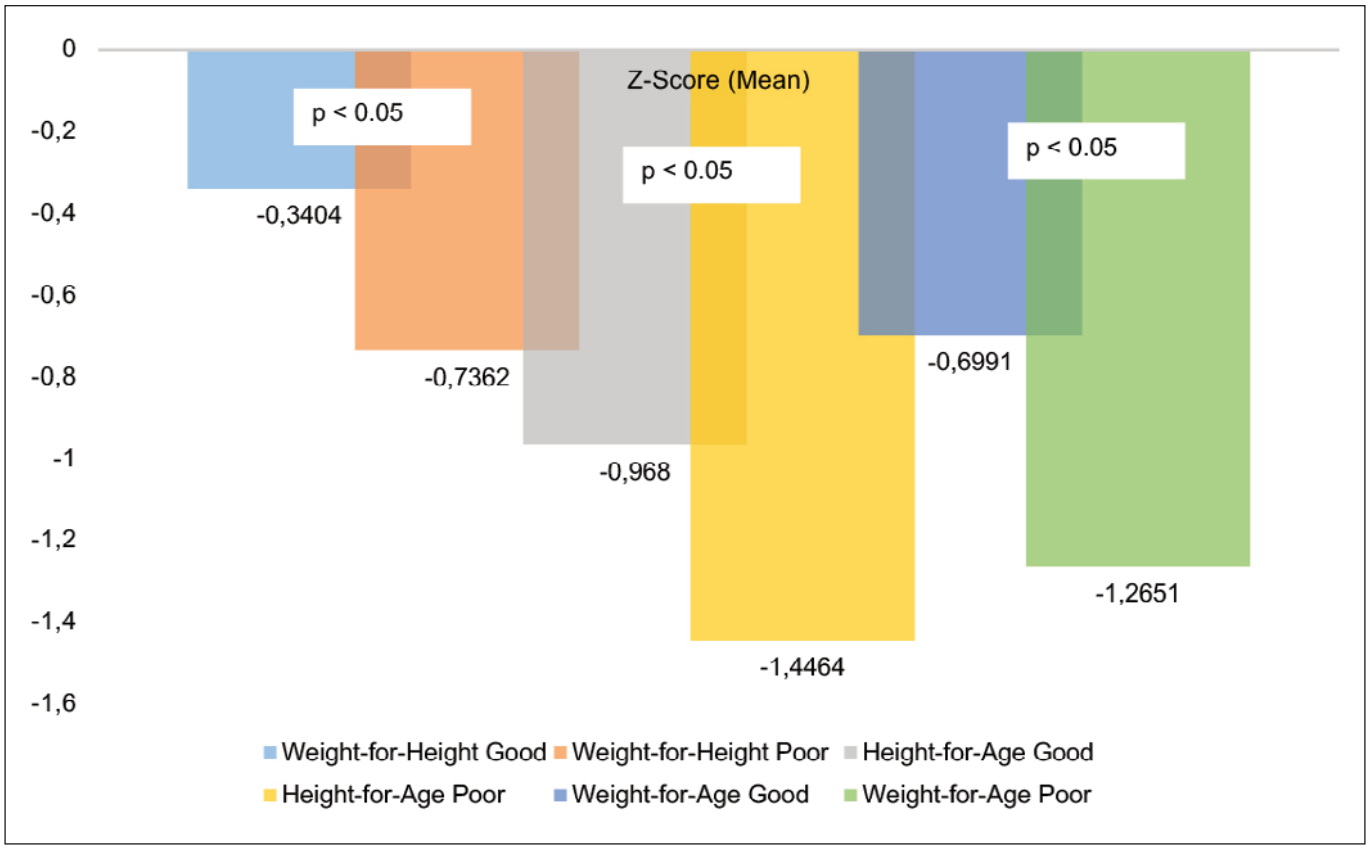

Figure 1. Average Z-Score of Nutritional Status Based on Child Food Acceptance

varied and balanced diet for their children. Additionally, research by Black et al. (2021) shows that providing food packages that include various types of healthy foods can improve families' access to nutritious foods, which is crucial for enhancing children's dietary diversity[11].

Another study by Miller et al. (2022) emphasises that consistent growth monitoring and sustained nutritional interventions significantly improve children's dietary diversity[12]. Structured and ongoing assistance programs enable early detection of nutritional problems and timely interventions, ensuring that children receive a more varied and sufficient diet to meet their dietary needs. Continuing nutrition education is needed to change family eating behaviour and increase children's food diversity[13]. Intensive and ongoing education allows families to continue adopting healthy eating patterns even after the intervention program ends. A study by Smith et al. (2021) also shows that sustained nutritional support can increase parents' awareness and nutritional practices, positively impacting children's dietary diversity[14].

This study found that children's food acceptance increased by 25.3%, from 42.3% before to 67.6% after nutritional assistance. Compared to studies conducted in various countries such as Kenya[14], Ghana[15], and Uganda[16], where food acceptance was 48.5%, 29.9%, and 23.9%, respectively, the food acceptance in this study was higher due to different sample designs. Our study used a sample of children aged 6-59 months, affecting the frequency and diversity of foods and directly influencing children's food acceptance[17]. This contrasts with previous studies that mostly used samples of children aged 6-23 months[18]. The nutritional assistance program in this study has been proven to increase meal frequency and improve families' ability to provide diverse foods for their children, thus increasing children's food acceptance. Previous research also found consistent results, showing that after nutrition education, parents could make healthier choices for their children, even if they did not apply these choices adequately to their food choices. Parents pay more attention to providing nutritious food for their children after receiving nutrition education.

We believe that the messages delivered through nutritional education and counselling during the assistance can enhance parents' knowledge. Nutritional counselling can also increase mothers' nutritional knowledge, affecting their practices in providing food for their children. A study conducted by Hoo-lihan et al. (2021) investigating the relationship between parents' knowledge and children's food consumption found an increase in healthy food consumption for their children alongside the rise in parents' nutri-

tional knowledge[19]. Nutritional education and counselling through the nutritional assistance program significantly impact increasing meal frequency, dietary diversity, and children's food acceptance. Research by Miller et al. (2020) shows that nutritional counselling delivered directly at home through home visits effectively increases parents' knowledge and dietary practices, directly impacting children's infant and young child feeding (IYCF) practices[20].

The findings showing increased child feeding practices (IYCF) after the nutritional assistance program have essential implications for nutrition improvement programs and stunting prevention in Indonesia. Increased frequency and dietary diversity in children directly contribute to better nutrient intake essential for growth and development. A study by Nisbett et al. (2020) shows that increasing diverse food intake can reduce stunting risk as children receive enough micronutrients to support their optimal growth[21]. As described in this study, effective nutritional assistance programs can serve as models for nutrition initiatives across Indonesia to reduce the high prevalence of stunting in some regions. Moreover, enhancing parents' nutritional knowledge and practices through counselling and home visits plays a vital role in the success of stunting prevention programs. Research by Bhutta et al. (2019) emphasises the importance of sustained nutrition education to ensure parents can make informed decisions about children's feeding[22]. Thus, a holistic and integrated approach, as found in this study, can be more widely applied to strengthen existing programs. Nutrition interventions that include education, growth monitoring, and providing nutrition packages can significantly reduce stunting rates in vulnerable populations[23]. With adopting and adapting these strategies, Indonesia can accelerate achieving the stunting reduction targets set by the government.

The proportion of children experiencing malnutrition decreased between before and after the nutritional assistance program, including wasting, stunting, and underweight. Interestingly, the stunting rate reduction was higher than that of wasting and underweight. The proportion of underweight in Gresik Regency decreased from 32.2% to 22.6% after intensive nutritional assistance[24]. Nutritional assistance increases meal frequency, dietary diversity, and food acceptance, ultimately improving children's nutritional status. Children consuming diverse foods have better linear growth and can prevent stunting in those children[25].

We found that the specific nutritional interventions implemented in the nutritional assistance program were carried out according to the program's objectives, although not achieved optimally. The interventions included nutrition education and counselling on infant and young child feeding (IYCF), growth monitoring, local food-based supplementary feeding, and micronutrient supplementation[26]. Several studies on interventions in the nutritional assistance program have reported positive impacts on nutritional status. Among them, the provision of Taburia increases immunity to prevent illness, boosts appetite, prevents nutrient deficiencies, and prevents anemia[27]. Providing local food-based supplementary feeding affects improving the nutritional status of undernourished children[28]. Early growth and development detection activities can avoid growth disorders, thereby improving children's nutritional status.

The nutritional status changes show that the proportion of malnourished children who became normal (from wasting, stunting, and underweight to normal) was relatively high during the nutritional assistance program. However, the number of new malnutrition cases during the assistance period was not effectively controlled. This indicates the intensity of curative efforts in the assistance program, such as screening, searching, and managing malnourished children. Curative efforts seem stronger than promotive and preventive efforts. The same phenomenon was found in the evaluation results of the nutrition program in Buton Regency, Southeast Sulawesi, which showed a more significant reduction in stunting rates compared to underweight and wasting[29]. This differs from previous findings, such as the comprehensive nutrition program intervention in rural Malawi, which reported a higher reduction in wasting cases (18%) than stunting cases (7%)[30]. We believe this difference occurs because the proportion of stunting in our study location is higher, reaching four times the amount of wasting and two-thirds of the amount of underweight.

The findings show that the improvement in children's nutritional status after the nutritional assistance program has significant implications for efforts to improve nutritional status and prevent stunting in Indonesia. Improving children's nutritional status through comprehensive dietary interventions can help reduce the prevalence of stunting, one of the leading health problems in Indonesia. Nutrition interventions, including nutrition counselling and the provision of nutritious food packages, can significantly reduce the prevalence of stunting in high-risk communities.

STUDY LIMITATIONS

The limitations of this study include the absence of a control group, making it difficult to attribute changes solely to the intervention. The study's reliance on self-reported data might introduce bias. Additionally, the six-month intervention period may not be sufficient to observe long-term effects on nutritional status. Variability in the data quality collected by different enumerators might also affect the results.

CONCLUSION AND RECOMMENDATIONS

Efforts in nutritional education and counselling by Village Nutrition Assistants can sustainably improve the frequency,

diversity, and acceptance of children's food. Implementing the Nutritional Assistance Program in stunting-prone villages can help accelerate efforts to reduce stunting and improve the nutritional status of children under five in South Sulawesi.

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