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Effectiveness Of Community-Based Nutrition Education Interventions On Linear Growth In Children Under Two Years: A Systematic Review And Meta-Analysis Of Randomized Control Trials

Azira Isnaini Salsabilla[1], Yolanda Safitri[2], Azira Panji Dewa Daru[3], Nabilla Syaharani[1], Vivi Saharani Saputri[1], Nur Khalisha Yahya[1]

[1]Medical Program, Faculty of Military Medicine, Indonesia Defense University, Bogor, Indonesia, [2]Faculty of Medicine, Muhammadiyah University Prof. Dr. Hamka, Tangerang, Indonesia, [3]Dentistry Program, Faculty of Dentistry, Airlangga University, Surabaya, Indonesia,

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ABSTRACT

Stunting in children under two years of age is a serious nutritional problem that impacts health, cognitive development, and long-term productivity. Community-based nutrition education is widely implemented to improve child feeding practices, but its effectiveness on linear growth is still inconsistent.

A literature search was conducted on PubMed, Scopus, and Cochrane for publications from 2020–2025, following PRISMA guidelines. Of the 160 articles identified, three cluster-RCT studies from Indonesia, Tanzania, and Kenya met the inclusion criteria. Interventions include nutritional classes, cooking demonstrations, counseling, and home visits. All studies reported length-for-age Z-scores (LAZ/HAZ) as an outcome.

The results of the meta-analysis using a random effects model showed that community-based nutrition education did not provide a significant improvement in linear growth (Mean Difference 0.04; 95% CI –0.22 to 0.30; $p = 0.75$). Heterogeneity between studies was quite high ($I^2 = 80\%$), influenced by variations in intervention intensity, duration, and population characteristics.

In conclusion, community-based nutrition education has not been proven to have a significant impact on linear growth when implemented as a single intervention. However, this intervention remains important as a supporting component in a multi-component strategy for preventing stunting.

Keywords : Community nutrition education, Children under two, Linear growth, Stunting prevention

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INTRODUCTION

Linear growth in the first two years of life is an important indicator of a child's nutritional status and a major predictor of long-term health, cognitive development, and adult productivity.[1] During the first 1,000 days of life, growth disorders such as stunting are common due to a combination of factors including inadequate nutritional intake, suboptimal feeding practices, recurrent infections, and unfavorable environmental conditions.[2] Globally, it is estimated that approximately 148 million children experienced stunting in 2022, with the highest burden in low- and middle-income countries.[3] This situation indicates that efforts to prevent stunting still face significant challenges, particularly among children under two years of age, who are the most vulnerable to growth disorders.[4] Community-based nutrition education interventions have emerged as a key approach to improving feeding practices, health behaviors, and healthcare utilization.[5] This approach is designed to empower caregivers through increased knowledge, behavior change, and social support from the local community. Some studies show that nutrition education can improve dietary diversity, feeding frequency, and proper

breastfeeding practices. [6,7] This approach is also considered more sustainable because it involves local health workers, mothers' groups, and existing community support mechanisms.

However, despite the widespread implementation of community-based nutrition education programs, the effectiveness of these interventions on linear growth in children under two years of age still shows varying results.[8] Some studies report significant improvements in length-for-age/height-for-age (LAZ/HAZ) after intensive education for mothers or caregivers,[9] while other research indicates that behavioral changes do not always lead to meaningful improvements in linear growth.[10] This variation in results can be influenced by the intensity of the intervention, the duration of support, the quality of material delivery, population characteristics, and environmental factors such as sanitation and the mother's health status.[11]

Additionally, most previous reviews combined educational interventions with other programs such as supplementation, complementary feeding, or developmental stimulation interventions, making it difficult to isolate the specific effects of community-based nutrition education alone.[12] Recent evidence from randomized controlled trials (RCTs) that rigorously evaluate pure nutritional education interventions in communities has begun to emerge in the last five years.[13] However, the findings from these studies have not been comprehensively synthesized to determine the magnitude of the intervention's effect on linear growth. Therefore, there is still an evidence gap that needs to be addressed through systematic reviews and meta-analyses.

RCT based meta-analysis is crucial because RCTs are considered the gold standard in evaluating the effectiveness of public health interventions. This approach allows researchers to obtain more accurate effect estimates, minimize bias, and assess the consistency of findings across studies.[14] With increasing global focus on achieving Sustainable Development Goal (SDG) 2.2 on eliminating all forms of malnutrition, synthesizing the latest evidence on the effectiveness of community nutrition education on children's linear growth is becoming increasingly relevant.[15]Strong evidence is expected to help determine the most effective, contextually relevant, and feasible community-based interventions for widespread implementation, especially in developing countries.

Based on the above description, this study aims to conduct a systematic review and meta-analysis of randomized controlled trials (RCTs) that assess the effectiveness of community-based nutrition education interventions in improving linear growth in children aged 0–23 months. This approach is expected to provide evidence-based understanding of the contribution of educational interventions to improving children's height and support more effective policy decision-making.

MATERIALS AND METHODS

Search Strategy

The literature search for this systematic review followed the PRISMA 2020 guidelines. A thorough search was carried out across three major electronic databasesthat are Cochrane, PubMed, and Scopus limited to studies published within the past five years. Six researchers conducted independent searches using the PICO. The searches were performed using a combination of relevant MeSH terms and free keywords, the details of which are presented in table 1.

All search results from the three databases were combined, then duplicate articles were automatically and manually removed before the screening process. In the first stage, the researchers reviewed the titles and abstracts to assess suitability based on the established inclusion and exclusion criteria. Relevant articles then proceed to the full-text review stage to determine whether the study meets the criteria and contains LAZ/HAZ data that can be extracted. Any differences in assessment between researchers are resolved thru discussion until consensus is reached. The complete selection process is shown in the PRISMA diagram in figure 1.

Eligibility Criteria

Studies eligible for inclusion were Randomized Controlled Trials (both individual and cluster) involving children aged 0–23 months and mothers/caregivers as intervention recipients. The intervention should be community-based nutrition education focusing on complementary feeding/IYCF (Infant and Young Child Feeding) practices, conducted at the community level, and compared to standard care or

minimal education. Only studies that reported LAZ or HAZ along with mean and standard deviation values, published in full text in Indonesian or English within the last five years, were included.

Studies were excluded if the intervention involved food supplementation, food aid, fortification, or was conducted in a clinical/hospital setting. Studies were also excluded if the population was children >24 months old or children with severe medical conditions, and if they did not report LAZ/HAZ or did not provide extractable data.

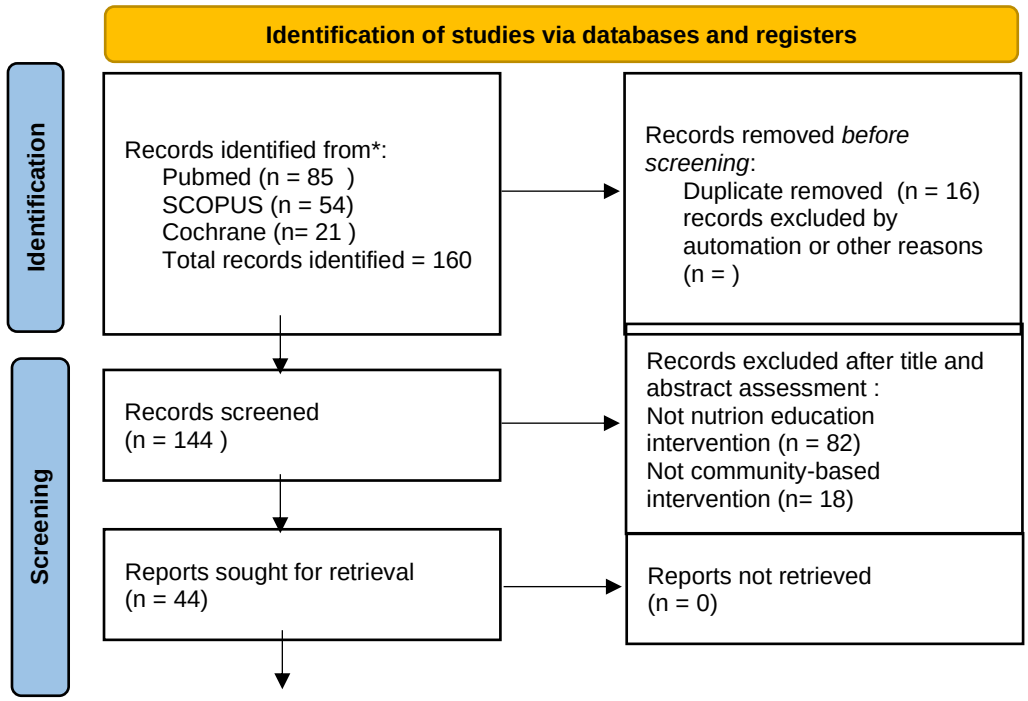
Quality Assessment

The quality evaluation of the research was conducted using the Risk of Bias 2 (ROB-2) tool which are presented in figure 2. The assessment process utilized the Cochrane ROB-2 instrument, which includes five main aspects used to evaluate potential bias that may arise from: the randomization process, deviations from intervention implementation, data loss, outcome measurement, and selection of reported outcomes. The responses provided included the categories low risk, unclear risk and high risk. The quality assessment of the research was conducted by six independent reviewers, and the results were obtained thru collective discussion until consensus was reached.

Table 1. Search strategy

Search Strategy	Details	
Search string	("child" OR "infant" OR "children under 2") AND ("nutrition education" OR "nutrition counseling") AND ("community-based") AND ("linear growth" OR "length for age")	
Inclusion Criteria	Population	Children under two years (0–23 months) and mothers/caregivers
	Intervention	community-based nutrition education
	Comparations	Standard care/ minimal education /no intervention
	Outcome	Linear growth (Length-for-Age Z-Score
Databases	Pubmed, Scopus, Cochrane	
Time filter	2020 - 2025	
Language filter	Indonesia, English	
Study Design	Randomized Control Trials	

Figure 1. PRISMA diagram.



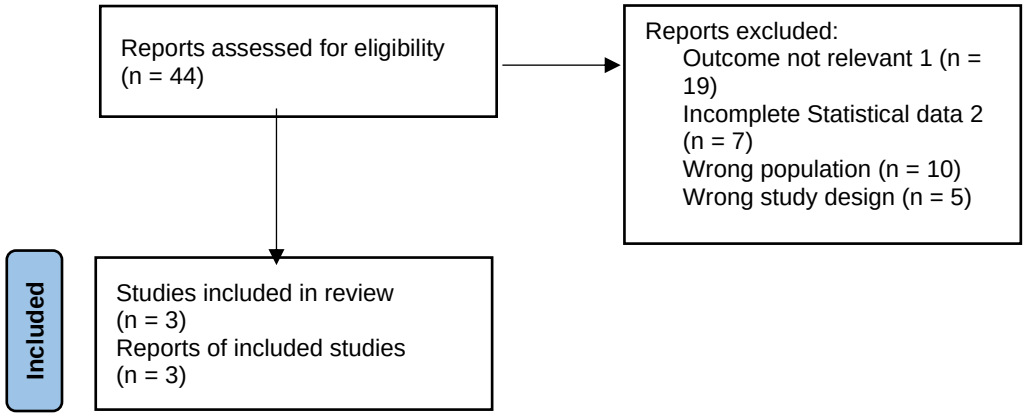


Table 2. Characteristics of studies that meet the selection criteria

Author/year	Study type	Participants		Interventions	Outcome
		Intervention	Control		
Effendy et al, 2020 (Indonesia)	Cluster-Randomized Control Trials (18 villages/ clusters)	126	116	- Specific type of intervention: Nutrition classes and home visits - Target population: Caregivers of children aged 6-17 months - Content of education: Complementary feeding and dietary diversity - Delivery method: In-person at community venue and home visits - Duration and frequency: Nutrition classes over two weeks, home visits monthly for 4 months	- Specific Z-scores measured: HAZ - Baseline and endpoint measurements: HAZ decreased in both groups (-1.13 ± 1.00 to -1.52 ± 0.83 in intervention; -1.33 ± 1.08 to -1.73 ± 0.91 in control) - Statistically significant changes in Z-scores: Not significant for HAZ (P = 0.112) - Prevalence of stunting before and after intervention: Stable at 19.8% in intervention; increased from 28.4% to 36.2% in control
Kulwa et al, 2023 (Tanzania)	Cluster-Randomized Control Trials (14 villages / clusters)	118	128	- Specific type of intervention: Group education, counseling, cooking demonstrations - Target population: Infants aged 6-12 months and their mothers - Content of education: Feeding practices, nutrient intakes (likely includes complementary feeding) - Delivery method: In-person, community-based (regular home visits) - Duration and frequency: Six months, regular home visits	- Specific Z-scores measured: Length-for-age z-scores - Baseline and endpoint measurements: Not mentioned - Statistically significant changes in Z-scores: Mean change in length-for-age z-scores (β = 0.20, P = 0.02) - Prevalence of stunting before and after intervention: Not mentioned

Nyamasege et al, 2020 (Kenya)	Cluster-Randomized Control Trials (22 Posyandu in 14 villages)	1737	1868	- Specific type of intervention: Monthly nutrition education and counselling (NEC) - Target population: Mothers - Content of education: Not explicitly mentioned, but likely includes complementary feeding and nutrition practices - Delivery method: Home-based - Duration and frequency: Monthly during pregnancy and infancy	- Specific Z-scores measured: Length-for-age z-scores - Baseline and endpoint measurements: From birth to the 13th month and at the 55th month - Statistically significant changes in Z-scores: Decreased from birth to the 13th month , increased by the 55th month - Prevalence of stunting before and after intervention: Control group (33.5% at 13th month, 16.5% at 55th month), Intervention group (28.6% at 13th month, 8.3% at 55th month)

RESULTS

A systematic review search across three major databases, namely PubMed, Scopus, and Cochrane, yielded a total of 160 articles related to community-based nutrition education interventions and linear growth in children. Following the removal of 16 duplicate records, 144 articles underwent title and abstract screening. During this process, 82 articles were excluded for not focusing on nutrition education, and an additional 18 were removed for failing to meet the criteria for community-based interventions. A total of 44 articles were then reviewed in full-text form, and 41 of them were excluded because the outcomes were not relevant, the statistical data were incomplete, the population was not appropriate, or the study design did not meet the criteria. Finally, this reasearch included three cluster-RCT studies that met all inclusion criteria.

The three studies that met the inclusion criteria were cluster-randomized controlled trials conducted in Indonesia, Tanzania, and Kenya, with a total of over four thousand mothers and children aged 0–23 months, which can be seen in table 2. The forms of nutritional education intervention vary, including nutrition classes, counselling, home visits, and cooking demonstrations, all of which are delivered within a community context. The duration of the intervention ranges from two weeks to several months, with the frequency of implementation varying from monthly to intensive weekly sessions. All studies reported linear growth outcomes using LAZ/HAZ. Two studies showed consistent increases in LAZ in the intervention group, while one study showed non-significant results but still demonstrated a trend toward improved growth status. Overall, the three studies suggest that community-based nutrition education has the potential to improve linear growth, although the magnitude of the effect varies depending on the duration, intensity, and delivery method of the intervention.

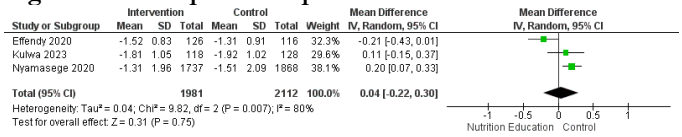
Based on the analysis results from the forest plot in figure 3, it is evident that the community-based nutrition education intervention did not show a significant effect on the linear growth of young children. The high heterogeneity value ($I^2 = 80\%$) indicates substantial variation between studies, so a random effects model was used. Almost all confidence intervals (95% CI) in each study crossed the "line of no effect," indicating that the difference between the intervention and control groups was not

statistically significant. Overall, the results of the meta-analysis showed a Mean Difference of 0.04 (95% CI: -0.22 to 0.30; p = 0.75), suggesting that nutrition education did not lead to a statistically significant enhancement in linear growth when compared with the control group.

Figure 2. Risk of bias RCT ROB 2



Figure 3. Forest plot of Impact of Nutrition Education for Length for Age



DISCUSSION

The results of a meta-analysis of three cluster-randomized controlled trials (cluster-RCTs) showed that community-based nutrition education interventions did not significantly improve linear growth in children under two years of age. This finding is supported by a Mean Difference value of 0.04 (95% CI: –0.22 to 0.30; p = 0.75), indicating that the average difference in LAZ/HAZ between the intervention and control groups is very small and statistically insignificant. Additionally, the high heterogeneity (I^2 = 80%) indicates substantial variation in intervention design, implementation context, population characteristics, and measurement quality across studies. These findings are consistent with several previous reviews stating that nutrition education alone is often not strong enough to produce significant changes in linear growth indicators, particularly in low and middle income countries that encounter multiple determinants of malnutrition at the same time. [16]

Nevertheless, the results from each study show an interesting pattern. Two out of three studies (Kulwa 2023; Nyamasege 2020) showed a trend of improvement in LAZ scores in the intervention group, although not all of these improvements were statistically significant. Differences in the intensity and duration of interventions could potentially affect outcomes. For example, interventions lasting several months with periodic home visits appear to have more promising effects compared to short-term interventions such as two-week nutrition classes, as conducted in the Effendy 2020 study. This aligns with previous evidence that behavioral interventions require a sufficiently long duration, repetition of messages, and the emotional and social involvement of mothers to produce significant changes in practice.[17]

Besides intervention factors, a number of non-intervention factors also have the potential to influence linear growth outcomes. Linear growth is an outcome influenced by various complex determinants, including the mother's health status, environmental sanitation, recurrent infections, the

family's economic conditions, and the diversity of food within the household.[18] Thus, although nutrition education improves knowledge and some feeding behaviors, these changes may not always overcome larger structural challenges such as limited access to nutritious food or high risk of infection. This explains why nutrition education as a single intervention tends to produce small effects on LAZ scores in the short term.

Variations in socio-cultural context can also affect the effectiveness of nutrition education. The studies in this meta-analysis were conducted in three countries with different backgrounds (Indonesia, Tanzania, and Kenya). Family support, child feeding norms, access to healthcare services, and the capacity of community health workers or personnel can vary significantly between locations. Previous studies have emphasized that the success of nutrition education is highly dependent on adapting to the local context, including language, cultural beliefs, and integration with existing community programs.[19]

The high heterogeneity in this meta-analysis indicates the need for more consistent intervention implementation standards and more uniform evaluation methodologies. Various forms of education (classes, home visits, cooking demonstrations, and counselling) have different characteristics in terms of intensity and mechanisms of behavior change. Literature indicates that combining education with other supportive interventions, such as supplementation, improved sanitation, or food security strengthening programs, is more likely to result in tangible growth changes.[20]

However, the studies included in this review specifically evaluated nutrition education as a single intervention, so it is natural that its effect on linear growth tends to be limited.Although the overall findings of the meta-analysis were not significant, the direction of improvement in LAZ scores in the two studies suggests that nutrition education still holds value as an important component in stunting prevention strategies. From a public health perspective, community-based nutrition education builds social capital, increases mothers' knowledge, and strengthens the capacity of community health workers, which are important prerequisites for the success of multisectoral interventions.[21] Thus, these results confirm that nutrition education should not stand alone, but rather be part of a more comprehensive intervention package.

Strength and limitations

This study has strengths because it only includes randomized controlled trials (RCTs) and uses a systematic literature search procedure according to PRISMA. However, the limited number of studies and high heterogeneity between studies limit the generalizability of the results. Additionally, variations in intervention duration and methods, as well as the lack of supporting data reports, increase the potential for bias and affect the consistency of findings.

CONCLUSION

This meta-analysis indicates that community-based nutrition education does not significantly improve linear growth in children under two years of age. Nevertheless, some studies show a slight improvement trend, making this intervention still important as part of a stunting prevention strategy, especially when combined with other nutrition and health interventions.

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CONFLICT OF INTEREST

No conflicts of interest are declared by any of the authors.

ETHIC CONSIDERATION

Ethical approval was not needed for this research since it is a systematic review.

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AUTHOR CONTRIBUTION

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