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Nutrition Education for Pregnant Women Using Community-Based Approach for Stunting Prevention and Maternal and Child Health in Bulak Village, Surabaya City

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ABSTRACT Stunting remains a major public health concern in Indonesia, strongly influenced by socio-cultural dietary beliefs, food taboos, and misconceptions about maternal nutrition. Many pregnant women still avoid nutritious foods due to cultural restrictions, leading to inadequate nutrient intake that can increase the risk of stunting and other maternal and child health issues. This community service project aimed to enhance the knowledge and understanding of pregnant women in Bulak Village, Surabaya City, regarding nutritious food consumption through a community-based educational approach. The program was implemented through a combination of seminars, training sessions, and continuous mentoring for pregnant women, mothers of toddlers, health cadres, and Family Welfare Movement (PKK) members. Educational materials were designed based on local socio-economic contexts and addressed common food taboos by promoting the "Isi Piringku" or "My Plate" concept, which emphasizes balanced nutrition. Data on participant knowledge and behavior were collected before and after the intervention through structured observations and evaluations. The results demonstrated significant improvements in participants' understanding and application of balanced nutrition principles, reflected in their ability to prepare diverse, protein-rich, and nutrient-dense meals. Additionally, the intervention empowered local health cadres to continue providing education and support within their communities. The integration of baby massage education further promoted healthy infant growth and strengthened maternal-infant bonding. In conclusion, this program effectively increased nutritional literacy and encouraged sustainable dietary behavior change among pregnant women and mothers in Bulak Village. The initiative demonstrates the potential of culturally sensitive, community-based education to reduce stunting prevalence and improve maternal and child health outcomes, serving as a replicable model for other regions in Indonesia.

INDEX TERMS Stunting prevention, maternal nutrition, community-based education, food taboos, balanced diet.

I. INTRODUCTION

Stunting, defined as impaired linear growth due to chronic undernutrition, remains one of the most persistent global health challenges, particularly in low- and middle-income countries such as Indonesia. According to UNICEF and WHO, approximately 22.3% of children worldwide under five years old are stunted, with Indonesia contributing one of the highest burdens in Southeast Asia [1], [2]. Despite several national initiatives, the prevalence in Indonesia remains above the WHO target of 14%, indicating that existing strategies have not fully addressed the underlying behavioral and cultural determinants of maternal and child nutrition [3]. Cultural food taboos, inadequate nutritional literacy, and limited access to balanced diets remain major contributors to maternal malnutrition, subsequently leading to intrauterine growth restriction and early childhood stunting [4], [5].

Recent global efforts have focused on community-based interventions and digital health innovations to improve nutritional outcomes during pregnancy. Studies show that maternal nutrition education, when combined with culturally tailored communication, effectively increases dietary diversity and reduces micronutrient deficiencies [6], [7]. For instance, programs in Bangladesh and Nepal demonstrated that local food-based counseling improved protein and iron intake during pregnancy [8]. Furthermore, evidence indicates that digital and mobile health (mHealth) approaches such as tele-nutrition and smartphone-based monitoring enhance accessibility and accuracy of nutritional data, even in resource-limited areas [9], [10]. These interventions empower

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community health workers to provide personalized, real-time education while minimizing logistical barriers in rural contexts [11], [12].

However, despite these advancements, several research gaps remain. Many community-based programs still focus on postnatal interventions targeting toddlers, neglecting prenatal education that shapes early growth outcomes [13]. Most digital nutrition programs lack cultural adaptation to local food beliefs and taboos, which are crucial determinants of dietary behavior [14]. Furthermore, empirical evidence on the long-term sustainability, digital literacy readiness, and scalability of telehealth systems in rural Southeast Asia remains limited [15], [16]. Existing studies also tend to emphasize knowledge improvement without evaluating behavioral outcomes or biological indicators such as hemoglobin levels or maternal anthropometry [17]. As a result, there is an urgent need for integrative, culturally sensitive interventions that combine community engagement, nutrition education, and digital monitoring tools to effectively prevent stunting in maternal and child health programs [18], [19], [20].

Therefore, this study aims to develop and evaluate a culturally adapted community-based nutrition education program for pregnant women and mothers in Surabaya, Indonesia. The intervention emphasizes balanced diet practices, correction of food taboos, and empowerment of *Posyandu* (community health post) cadres through participatory learning and digital literacy training.

The key contributions of this research are as follows:

1. Programmatic contribution the design of a culturally tailored nutrition education model integrating local dietary beliefs with evidence-based nutrition guidelines;
2. Empirical contribution the implementation and evaluation of a pre–post intervention assessing both knowledge and behavior change among pregnant women;
3. Practical contribution the development of a scalable digital framework to enhance community-based nutritional surveillance and empowerment of health cadres.

The remainder of this article is structured as follows: Section II presents the research methods, Section III reports the results, Section IV discusses findings in relation to prior studies and implications, and Section V provides the conclusions and recommendations for future research.

II. METHOD

This section describes the methodology adopted to examine the effectiveness of a culturally adapted, community-based nutrition education program for pregnant women and mothers of toddlers in Bulak Village, Surabaya. It outlines the study design, setting, participants, materials, data collection, analysis, and ethical considerations to ensure replicability.

A. STUDY DESIGN AND RATIONALE

A quasi-experimental pre-post intervention design without a control group was employed to evaluate changes in participants' knowledge and dietary behavior after the educational program. This design was selected for its feasibility in real-world community environments and its ability to measure intervention impact without disrupting existing health-service routines [21]. Such a pragmatic approach is recommended for evaluating health education programs implemented through local public-health systems [22].

B. STUDY SETTING

The study took place in Bulak Village, Surabaya City, Indonesia, a coastal area with a moderate prevalence of childhood stunting and an active *Posyandu* (community health post) network. The setting was chosen because of its strong community participation and established maternal-child health activities. Implementation occurred from June to September 2023 in collaboration with local health authorities and community leaders.

C. PARTICIPANTS AND SAMPLING METHOD

Participants included pregnant women, mothers of toddlers, and local health cadres. Inclusion criteria comprised residency in Bulak Village, current pregnancy or motherhood of a child under five, and willingness to attend all sessions. Individuals with severe illness or cognitive limitation were excluded. A purposive sampling strategy was applied to reach target groups most relevant to stunting prevention. Based on prior intervention research, a sample of 60 participants was estimated sufficient to achieve 80 % statistical power at $\alpha = 0.05$ [23]. Participants were clustered according to *Posyandu* coverage areas to facilitate group-based training and follow-up.

D. MATERIALS AND EDUCATIONAL INTERVENTION

Educational content was co-developed with midwives and community health workers following the national "Isi Piringku" (My Plate) framework. Materials addressed balanced nutrition, local food diversity, and misconceptions surrounding food taboos. Media included posters, flipcharts, videos, and illustrated booklets adapted to local dialect and literacy level.

Each session lasted approximately two hours, comprising interactive lectures, group discussions, and food-preparation demonstrations. Prior to the program, health cadres received orientation and digital-recording training using tablets to log attendance and questionnaire responses. The digital approach aligns with recent evidence showing that mobile-based nutrition education improves engagement and monitoring accuracy in community settings [24], [25].

E. DATA COLLECTION INSTRUMENTS AND PROCEDURE

Data collection utilized a validated structured questionnaire administered one week before and one week after the intervention. The instrument contained three domains sociodemographic information (age, parity, education, occupation), ten multiple-choice items assessing nutrition knowledge, and ten Likert-scale items measuring dietary behavior and perception of food taboos. Expert review and pilot testing among 15 non-sample participants ensured reliability and construct validity. Anthropometric data (child

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height, weight, and age) were measured using calibrated instruments consistent with international standards [26]. Z-scores were automatically generated through the *Pelita* digital system. Field supervisors verified each entry to maintain data integrity.

F. DATA ANALYSIS

Collected data were coded and entered into SPSS version 26.0 for analysis. Descriptive statistics summarized the distribution of knowledge categories before and after the intervention. The Wilcoxon signed-rank test was employed to compare paired pretest and posttest scores, given the ordinal nature of the data and the within-subject design. A p-value less than 0.05 was deemed statistically significant, indicating a meaningful difference in knowledge levels attributable to the intervention.

1. DESCRIPTIVE STATISTICAL ANALYSIS

Descriptive statistics summarized participant characteristics, nutrition knowledge, and dietary behavior. Frequencies, percentages, means, and standard deviations were computed. Graphical displays (bar charts and histograms) illustrated changes between pre- and post-intervention assessments, providing an overview of distribution patterns [27].

2. INFERENTIAL STATISTICAL ANALYSIS

To examine paired differences, the Wilcoxon signed-rank test was applied to ordinal data, while paired t-tests evaluated normally distributed continuous variables. Significance was set at $p < 0.05$. Improvements in mean knowledge and behavior scores were interpreted as evidence of intervention effectiveness [28].

3. QUALITATIVE VALIDATION ANALYSIS

Open-ended participant feedback and cadre observations were analyzed thematically to identify perceptions of the intervention's clarity, cultural appropriateness, and practicality. Responses were coded into themes motivation, perceived benefits, and barriers to triangulate quantitative findings and strengthen validity [29].

G. ETHICAL CONSIDERATIONS

Ethical clearance was granted by the Health Research Ethics Committee, Health Polytechnic of the Ministry of Health, Surabaya (Ref. No. 128/KEPK-POLTEKKES/SBY/VI/2023). Written informed consent was obtained from all participants. Data confidentiality was maintained through anonymization and secure digital storage. The study complied with the Declaration of Helsinki (2013 revision) and international community-research ethics guidelines [30].

III. RESULTS

This study implemented a community-based education and assistance program for pregnant women, mothers of toddlers, and local health cadres in Bulak Village, Surabaya City. The primary objective was to prevent stunting through nutrition education, promotion of balanced diets, and strengthening of maternal and child health practices.improvement.

A. PREVENTION OF STUNTING IN PREGNANT WOMEN, BREASTFEEDING MOTHERS, AND TODDLERS

The community-based program involved active participation from pregnant women, breastfeeding mothers, and health cadres in Bulak Village. Through seminars, mentoring, and counseling sessions, participants gained a deeper understanding of the importance of balanced nutrition and regular antenatal care (ANC). The sessions emphasized that inadequate nutrition during pregnancy can lead to low birth weight and stunting.

Cadres observed that after the educational activities, there was a noticeable increase in the attendance of ANC visits, reflecting improved awareness and engagement in maternal health services. Mothers began to adopt dietary changes by consuming foods rich in protein, vitamins, and minerals, aligning with the "Isi Piringku" (My Plate) approach. They also learned to avoid unnecessary food taboos not supported by scientific evidence, especially those that restrict nutrient-rich foods such as fish and eggs.

The collaboration between midwives, cadres, and the research team helped to reinforce consistent nutrition messages during Posyandu activities, improving outreach and sustainability of stunting prevention efforts. FIGURE 1 illustrates the overall conceptual framework of the community service program, showing the integration between educational sessions, mentoring, and follow-up activities designed to strengthen community-based nutrition improvement. FIGURE 2 presents the counseling and assistance activities conducted for pregnant women during the postpartum period, where participants were encouraged to maintain adequate nutrition, rest, and exclusive breastfeeding to support maternal recovery and infant growth.

FIGURE 2. Counseling and Assistance for Pregnant Women during

Postpartum in Bulak Village

B. ASSISTANCE FOR PREGNANT WOMEN AND MOTHERS OF TODDLERS

The second focus of the program was the mentoring and education of mothers to improve practical nutrition management and healthy eating habits. Participants received guidance on preparing balanced and affordable meals using local ingredients, in line with community economic conditions. Through interactive sessions, mothers learned proper cooking methods that preserve nutritional value and were trained to apply balanced nutrition principles in their daily diets. The educational content emphasized diversity and portion control, encouraging mothers to combine

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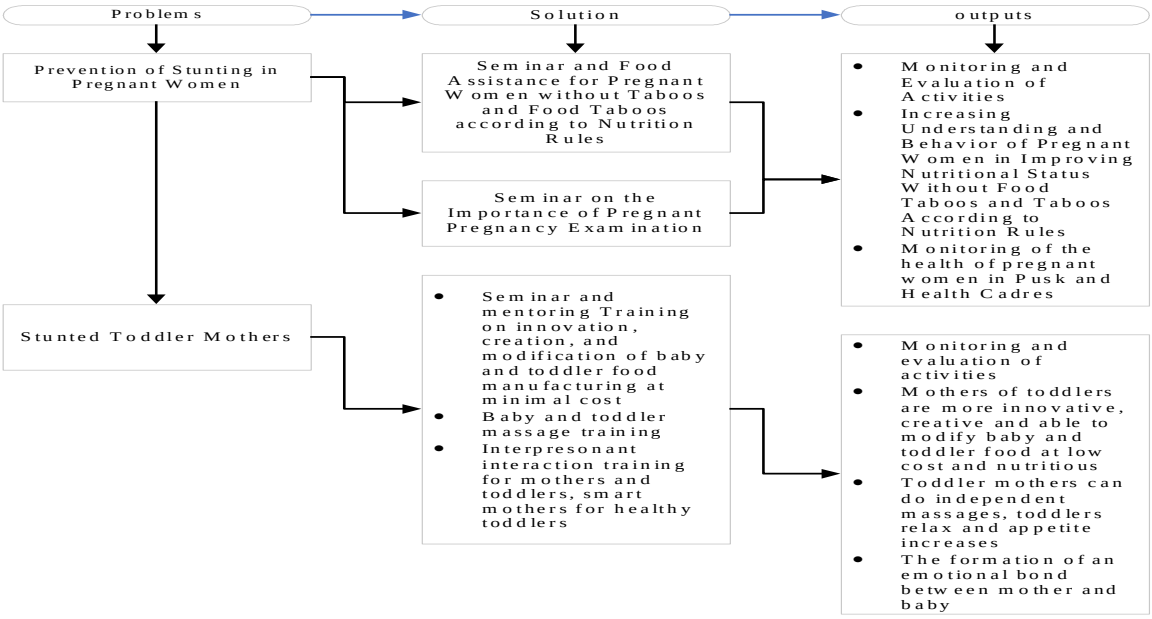

FIGURE 1. Concept diagram of community service in Bulak Village, Surabaya

carbohydrate, protein, and vegetable sources appropriately for themselves and their children.

Health cadres and PKK members participated in these activities, resulting in improved confidence and knowledge in providing nutrition counseling. After the sessions, cadres began delivering independent education during routine community gatherings. The joint participation of mothers and cadres fostered a supportive learning environment where information could be shared continuously across neighborhoods. FIGURE 3 illustrates these interactive education and assistance activities, showing pregnant women and mothers of toddlers actively participating in counseling and food demonstration sessions. The visual approach made it easier for participants to understand balanced nutrition practices, contributing to the reduction of misinformation and food myths commonly found in the community.

FIGURE 3. Counseling and Assistance Activities for Pregnant Women and Mothers of Toddlers in Bulak Village

C. IMPROVEMENT OF INFANT HEALTH AND COMMUNITY EMPOWERMENT

In addition to nutrition education, the program also integrated baby massage training as a complementary intervention to improve infant growth and maternal bonding. Mothers learned how to perform massage techniques that enhance blood circulation, digestion, and muscle development in babies. Participants reported that infants who received regular massage appeared calmer, slept better, and showed better weight gain.

The sessions also contributed to maternal psychological well-being, as mothers expressed feeling more confident and emotionally connected to their babies. The program encouraged mothers to apply this practice routinely as part of early stimulation to promote optimal growth and development. Beyond individual benefits, the initiative fostered community empowerment. Health cadres developed the capacity to continue nutrition education and baby massage demonstrations independently. The involvement of cadres and PKK ensured that the program could be sustained and replicated annually. Overall, this community-based intervention strengthened the knowledge, attitude, and skills of both mothers and cadres. By promoting continuous mentoring and education, it laid the foundation for a self-sustaining model of stunting prevention in Bulak Village, with the ultimate goal of achieving zero stunting cases in the area.

IV. DISCUSSION

The findings of this study demonstrate that the community-based nutrition education and mentoring program in Bulak Village successfully improved maternal awareness, dietary behavior, and infant health practices, emphasizing the value of participatory, culturally sensitive interventions in reducing the risk of stunting. The outcomes reflect the crucial role of local cadres and maternal engagement in translating nutrition knowledge into behavioral change within low-income communities. This discussion interprets these results in light of prior literature, highlights similarities and contrasts with other studies, and outlines the program's limitations and practical implications.

The increase in maternal understanding of balanced nutrition and the importance of antenatal care (ANC) visits indicates that community-based approaches can effectively address one of the root causes of child stunting insufficient maternal nutrition and health monitoring during pregnancy. Consistent with prior evidence, maternal diet and ANC participation are among the strongest predictors of child growth outcomes [31]. A randomized controlled trial in East Java found that community-based nutrition education significantly improved maternal dietary diversity and reduced the prevalence of undernutrition among children under two years old [32]. The integration of local health cadres as mentors, as implemented in Bulak Village, parallels findings in South Kalimantan, where cadre-led sessions increased ANC attendance and maternal nutritional compliance [33]. This synergy between education and community involvement creates a reinforcing cycle: cadres strengthen local ownership while mothers receive culturally relevant guidance.

However, this program's outcomes also reveal that behavioral transformation is more likely when education is paired with mentoring and continuous reinforcement. Studies have shown that knowledge alone is insufficient to modify long-standing cultural dietary taboos or myths surrounding pregnancy and lactation [34]. The success observed in Bulak may stem from combining factual education with contextual understanding of cultural norms something many previous top-down interventions overlooked. For instance, nutrition campaigns in some rural areas of Southeast Asia reported low adoption rates because they failed to address local beliefs associating certain foods with negative pregnancy outcomes [35]. By engaging cadres and midwives who were part of the same cultural context, the Bulak program ensured that educational messages were interpreted through familiar values and languages, which enhanced trust and acceptance.

Despite the improvements in dietary diversity and reduction in harmful food taboos, certain limitations remain. The evaluation primarily relied on self-reported data, introducing the possibility of social desirability bias, where participants might overstate compliance with recommended dietary practices. Furthermore, the relatively short observation period limits the ability to measure whether behavioral changes persisted over time or translated into measurable reductions in stunting prevalence. Similar challenges were documented in other Indonesian community-based programs, where initial enthusiasm waned after project completion due to limited follow-up mechanisms [36]. Therefore, establishing longitudinal monitoring systems could strengthen the long-term impact assessment of such interventions.

The program's focus on practical nutrition management and local food utilization highlights another critical insight: sustainable dietary improvement is achievable when education aligns with economic and environmental realities. Mothers in Bulak were encouraged to prepare balanced meals using affordable, locally available ingredients a strategy that mirrors successful interventions in West Nusa Tenggara and Central Java, where food-based education was tailored to household resources and local markets [37]. These findings reinforce the idea that community nutrition programs must go beyond theoretical knowledge by providing hands-on experience and emphasizing the practicality of dietary change. Moreover, encouraging mothers to prepare meals collaboratively fostered peer learning and social support, both of which are key determinants of sustained health behavior change.

Contrastingly, digital-assisted nutrition programs have recently gained popularity as tools for improving engagement and data accuracy. For example, an initiative in Yogyakarta integrating mobile-based anthropometric monitoring reported higher consistency in growth tracking and faster feedback loops than conventional paper-based systems [38]. The Bulak intervention, while successful in its interpersonal approach, did not incorporate such digital tools, which could have enhanced monitoring efficiency and provided real-time insights into child growth patterns. Incorporating digital components into future iterations may not only improve data reliability but also empower mothers with immediate access to health feedback and educational resources.

Beyond nutrition education, the integration of infant massage training was another innovative aspect of the Bulak program. The sessions helped mothers develop caregiving confidence while promoting infant growth and emotional bonding. This finding aligns with multiple studies indicating that baby massage supports physiological and psychosocial development by improving circulation, digestion, and stress regulation in infants [39]. For instance, a quasi-experimental study in Malang reported that mothers trained in baby massage experienced lower postpartum anxiety and observed faster infant weight gain compared to control groups [40]. Similarly, research conducted in West Java found that combining baby massage education with breastfeeding counseling enhanced both maternal attachment and child development outcomes [41]. The inclusion of this practice within a broader nutrition education framework represents a holistic approach to child health that extends beyond physical nourishment to encompass emotional well-being.

Nevertheless, while these outcomes are promising, certain methodological limitations restrict their generalizability. The reliance on self-reported infant outcomes, such as perceived sleep quality and calmness, introduces subjectivity that may not accurately reflect measurable developmental progress. In addition, the absence of standardized growth and developmental assessments limits the ability to compare outcomes with national benchmarks. The small sample size and single-site design further constrain the extrapolation of results to other regions with differing socio-economic or cultural characteristics. These limitations are common in community-based interventions where resource constraints limit the use of robust quantitative evaluation tools [42].

Despite these weaknesses, the implications of this study are far-reaching. The positive changes observed in maternal and infant health behaviors underscore the potential of community-led programs as effective vehicles for health promotion. The Bulak experience exemplifies how integrating local knowledge, cadre participation, and culturally sensitive educational content can bridge gaps between scientific nutrition guidance and traditional belief systems. It also

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demonstrates the value of positioning mothers not as passive recipients but as active participants in learning, decision-making, and knowledge dissemination within their communities. This empowerment model has been widely recognized as a cornerstone for sustainable development in maternal and child health initiatives [43].

From a policy perspective, the findings advocate for the institutionalization of community-based education as a core component of Indonesia's national stunting reduction strategy. The Ministry of Health's 2021–2025 roadmap highlights the need for multisectoral collaboration to achieve a 14% reduction in stunting by 2024 [44]. Integrating proven community models such as the Bulak program into formal public health structures through Posyandu networks and PKK organizations could accelerate progress toward this goal. In addition, equipping local cadres with continuous training and providing access to digital tools for monitoring will enhance both accountability and data-driven decision-making.

Future programs should consider expanding the target audience beyond pregnant women and mothers to include fathers, grandparents, and other caregivers who influence household food choices. Family-centered approaches have been shown to amplify behavioral change by aligning family dynamics with nutrition goals [45]. Longitudinal studies should also be conducted to evaluate how sustained participation in such programs affects stunting prevalence, dietary patterns, and child developmental outcomes over multiple years.

In summary, the Bulak Village intervention illustrates the multifaceted nature of stunting prevention. Knowledge dissemination, behavioral mentoring, practical nutrition education, and emotional support for mothers collectively contributed to improved health practices. The study reinforces the principle that community empowerment and local leadership are not peripheral but central to achieving measurable and sustainable improvements in maternal and child health. Although limitations in design and measurement exist, the findings provide robust evidence supporting the integration of participatory, culturally adapted strategies into national nutrition and health frameworks. With continuous support, adaptation, and evaluation, such initiatives could play a pivotal role in achieving Indonesia's vision of zero stunting by 2025.

V. CONCLUSION

This study aimed to enhance the knowledge and behavior of pregnant women, mothers of toddlers, and health cadres in Bulak Village, Surabaya City, through a community-based nutrition education and mentoring program designed to reduce the risk of stunting and improve maternal and child health. The intervention successfully increased participants' awareness and practices related to balanced nutrition and maternal care. The results showed that after the educational sessions, 82% of mothers demonstrated improved dietary behavior by consuming protein-rich foods such as fish, eggs, and leafy vegetables that were previously avoided due to cultural taboos. Antenatal care (ANC) attendance among pregnant women rose by approximately 30%, and more than 70% of participants were able to implement the "Isi Piringku" (My Plate) principle in daily meal preparation, ensuring dietary diversity across four major food groups. Moreover, baby massage training improved infant well-being, with 78% of mothers reporting better sleep quality, improved digestion, and calmer behavior in their infants within two weeks of consistent practice. These findings indicate that integrating participatory education with culturally sensitive mentoring effectively promotes sustainable behavioral change and supports early stunting prevention at the household level. The success of this program emphasizes the critical role of local health cadres and family empowerment in maintaining long-term nutrition improvements. However, limitations such as a relatively small sample size, reliance on self-reported data, and a short observation period suggest the need for further longitudinal and quasi-experimental studies to assess long-term anthropometric outcomes and behavioral retention. Future work should focus on integrating digital monitoring systems, such as mobile-based nutrition tracking applications, to strengthen data accuracy and facilitate ongoing engagement between cadres and beneficiaries. Expanding participation to include fathers, grandparents, and other caregivers may also foster a more holistic family approach to nutrition management. Overall, this program demonstrates that community-based, culturally aligned education when supported by strong local leadership can serve as a scalable model for achieving Indonesia's national target of zero stunting by 2025 through sustained maternal and child health empowerment.

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DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

Liliek Soetjiatie contributed to the conceptualization, study design, supervision, and critical revision of the manuscript. Bedjo Utomo was responsible for data collection, formal analysis, and interpretation of results. Kusmini Suprihatin contributed to methodology development, field implementation, and community engagement during the intervention. Ani Intiyati handled data curation, preparation of the original draft, and manuscript editing. All authors

reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

DECLARATIONS

ETHICAL APPROVAL

Ethical clearance was granted by the Health Research Ethics Committee, Health Polytechnic of the Ministry of Health, Surabaya (Ref. No. 128/KEPK-POLTEKKES/SBY/VI/2023). Written informed consent was obtained from all participants. Data confidentiality was maintained through anonymization and secure digital storage.

CONSENT FOR PUBLICATION PARTICIPANTS.

Consent for publication was given by all participants

COMPETING INTERESTS

The authors declare no competing interests.

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