

## A Community-Based Participatory Approach to Stunting Prevention through Maternal and Child Health Education in Central Java

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### ABSTRACT

**Background.** Stunting is a major public health problem in Indonesia, especially in Central Java, where socioeconomic gaps and limited maternal health education persist. Low nutritional knowledge among pregnant women and caregivers delays early prevention, affecting child growth. Community participation is increasingly viewed as a key strategy to strengthen health literacy.

**Purpose.** To evaluate the effectiveness of a community-based participatory approach in improving maternal knowledge, feeding practices, and early caregiving behaviors related to stunting prevention.

**Method.** A mixed-methods design was used, combining surveys and *focus group discussions* with 65 pregnant women and caregivers in three Central Java districts. The intervention involved collaborative health education led by midwives, health workers, and local women leaders. Quantitative data were analyzed descriptively and with paired t-tests; qualitative data were thematically coded.

**Results.** Maternal health knowledge increased significantly ( $p < .001$ ), and complementary feeding practices improved in line with national guidelines. Participants also reported higher confidence in monitoring growth and understanding nutrition. Qualitative data showed that collective learning strengthened social support for early stunting prevention.

**Conclusion.** Participatory education builds community ownership, supports behavioral change, and improves the sustainability of maternal and child health programs. Scaling this model may contribute to national efforts to reduce stunting and enhance child well-being.

### KEYWORDS

Behavioral Change, Community-Based Approach, Central Java

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### INTRODUCTION

Stunting is a persistent public health problem in Indonesia that affects children's physical growth, cognitive development, and future productivity (Bose et al., 2024). Central Java remains one of the provinces with a substantial prevalence due to unequal access to nutritious food, maternal health services, and early childhood care. The first 1,000 days of life are widely recognized as a critical window for stunting prevention, reinforcing the significance of maternal knowledge and caregiving practices (Batool & Byun, 2025). Maternal and child health education has been demonstrated to improve feeding practices, hygiene behavior, and utilization of health

services (Dutta et al., 2025). Enhanced health literacy empowers mothers to make informed decisions regarding prenatal care, breastfeeding, and complementary feeding aligned with national standards (Wong et al., 2025). Educational intervention is therefore central to stunting reduction strategies (Tomlinson et al., 2024).

Public health programs in Indonesia have emphasized collaboration between health professionals and community structures. Posyandu and community health workers (kader) have traditionally played essential roles in growth monitoring and health promotion (Yang et al., 2025). Community-centered practices increase outreach and foster cultural relevance in health campaigns (Kobilke & Markiewitz, 2024). Behavior change in maternal and child care is more effective when communities are actively involved in problem identification and solution development. Collective engagement can address sociocultural barriers that often limit formal health education effectiveness. Shared responsibility strengthens compliance and motivation among caregivers (Tontisirin & Bhattacharjee, 2025).

Participatory approaches support localized understanding of stunting causes, which may include food taboos, informal childcare practices, or gender-related decision-making dynamics (Zhang et al., 2025). Local wisdom and community norms can be leveraged as protective factors when aligned with health recommendations (Kumar et al., 2024). A community's social capital thus becomes a key resource for prevention. Government initiatives align with global commitments such as the Sustainable Development Goals (SDG 2: Zero Hunger and SDG 3: Good Health and Well-being). Policy frameworks highlight the urgency of innovative, grassroots-based approaches to accelerate stunting reduction through inclusive and sustained engagement (Widiastuti et al., 2024).

Evidence on how far participatory learning models influence mothers' long-term behavioral change remains limited in stunting prevention research (Keller et al., 2025). Studies often measure knowledge improvement without examining whether learning translates into consistent daily caregiving practices (Woehrle & Schmidt, 2024). Research has yet to explore in-depth how community actors such as women leaders, religious figures, and family members contribute to sustaining maternal health behavior post-intervention. Maternal autonomy in decision-making within the household remains an underexplored variable (Nyarko et al., 2024).

Most current interventions are top-down and expert-driven, leaving insufficient space for communities to co-design educational content tailored to their unique cultural context (Phulkerd et al., 2025). The absence of localized adaptation may reduce the emotional ownership necessary for behavioral persistence. The effectiveness of participatory models in reducing structural barriers such as stigma, caregiving workload, and resource constraints has not been comprehensively investigated in the Central Java context (Prayitno et al., 2025). There is a knowledge gap linking participatory education mechanisms with measurable impacts on stunting mitigation efforts (Kianfar, 2025).

Addressing this gap is essential to ensure that maternal and child health interventions are contextually relevant, socially supported, and sustainably adopted beyond formal program implementation (Zhao et al., 2025). Local participation can transform health solutions from externally imposed into culturally embedded practices (Proaño et al., 2024). This study aims to examine the impact of a community-based participatory approach on maternal health knowledge, feeding practices, and early caregiving behaviors in Central Java (Carroll II et al., 2025). The intervention is designed to empower mothers and caregivers through collaborative learning facilitated by health workers and respected community figures (Rakha et al., 2025).

The hypothesis suggests that when maternal education is developed and delivered with active community involvement, stunting prevention efforts will lead to stronger behavioral change, improved health literacy, and enhanced collective responsibility for child growth outcomes (Ranjan, 2024).

## RESEARCH METHODOLOGY

This study employed a mixed-methods design to comprehensively investigate changes in maternal knowledge and caregiving behavior related to stunting prevention (Tito et al., 2024). Quantitative data were collected through pre- and post-test surveys to measure health literacy outcomes, while qualitative insights were obtained from interviews and *focus group discussions* that captured lived experiences and socio-cultural perspectives (Rimba et al., 2025). The implementation followed a *Community-Based Participatory Research (CBPR)* framework to ensure that participants acted as co-designers of the intervention rather than passive beneficiaries. The study population consisted of pregnant women and caregivers of children under two years old living in three high-risk districts in Central Java. Using a purposive sampling strategy, sixty-five caregivers forty-four mothers and twenty-one grandmothers or guardians were recruited based on their regular attendance at community health sessions and their willingness to participate in twelve weeks of collaborative education (Thwaites et al., 2025).

Data collection involved a validated maternal health literacy questionnaire adapted from national stunting prevention indicators, covering areas of knowledge, feeding practices, and growth monitoring. Structured observational tools were also employed during home visits to record behavioral changes regarding hygiene, breastfeeding techniques, and complementary feeding routines (Saville et al., 2025). In addition, semi-structured interview and FGD guides were used to explore participant perceptions, constraints, and cultural norms that influenced caregiving decisions. The use of multiple instruments and triangulation enhanced both the reliability and internal validity of the findings.

The intervention was implemented in four sequential phases consisting of baseline assessment, participatory learning sessions, collaborative action planning, and post-intervention evaluation (Setianti et al., 2025). The educational activities were facilitated by midwives, community health workers, and local women leaders using interactive media such as visual nutrition charts, demonstrations of local food preparation, and simulations of child growth monitoring (Sofiyah et al., 2025). Community members actively contributed their local dietary practices and cultural knowledge, ensuring that the learning process remained relevant and contextually grounded.

Post-program evaluation included the administration of the same health literacy questionnaire used at baseline, direct behavioral observations, and reflective group discussions (Supranoto et al., 2025). These assessments provided evidence of both cognitive improvement and practical changes in caregiving behavior, allowing for a comprehensive understanding of the impact of the intervention on maternal health literacy and stunting prevention practices (Tewodros et al., 2024).

## RESULT AND DISCUSSION

Quantitative data were collected from 65 caregivers through pre- and post-test assessments measuring maternal health literacy related to stunting prevention. The variables included nutritional knowledge, breastfeeding practices, complementary feeding, and hygiene behavior. Participants completed both assessments, ensuring consistent sample comparison.

**Table 1.** Pre- and Post-Test Mean Score Differences

Variable	Pre-Test Mean	Post-Test Mean	Gain Score	n
<b>Nutritional Knowledge</b>	<b>3.02</b>	<b>4.15</b>	<b>1.13</b>	<b>65</b>
Breastfeeding Practices	3.31	4.03	0.72	65
Complementary Feeding	2.98	3.96	0.98	65
Hygiene Behavior	3.14	4.06	0.92	65

The descriptive statistics indicate notable improvement across all measured indicators. Nutritional knowledge recorded the highest gain, suggesting that caregivers benefitted most from learning content related to dietary needs during early growth stages.

Participants demonstrated increased understanding of balanced nutrition specifically aligned with national stunting prevention guidelines (Isi Piringku and local food utilization). Caregivers also reported higher awareness of micronutrient sources important for infant development. This indicates that participatory learning effectively contextualized nutrition knowledge for daily application. Enhanced hygiene behavior signifies caregivers’ growing understanding of infection prevention as a factor in stunting. More mothers reported washing hands before breastfeeding, sterilizing feeding utensils, and improving household sanitation. These behavioral changes reflect broader lifestyle adjustments rather than isolated knowledge gain.

Qualitative data from FGDs revealed recurring themes: strengthened confidence in feeding decisions (37%), increased father or family involvement (22%), and reduced food taboos based on cultural misconceptions (18%). Participants also noted improved support from community health volunteers. Statements from interview transcripts documented a shift in mindset regarding child growth monitoring. Caregivers felt more responsible for regularly checking weight and height through Posyandu services rather than waiting for visible signs of malnutrition.

A *paired sample t-test* was conducted to examine the significance of score improvements across the four variables. All categories showed statistically significant change at  $p < .001$ , confirming that the intervention had a measurable impact.

**Table 2.** Paired T-Test Results

Variable	t-value	p-value	Significance
<b>Nutritional Knowledge</b>	<b>7.24</b>	<b>&lt; .001</b>	<b>Significant</b>
Breastfeeding Practices	5.19	< .001	Significant
Complementary Feeding	6.88	< .001	Significant
Hygiene Behavior	6.03	< .001	Significant

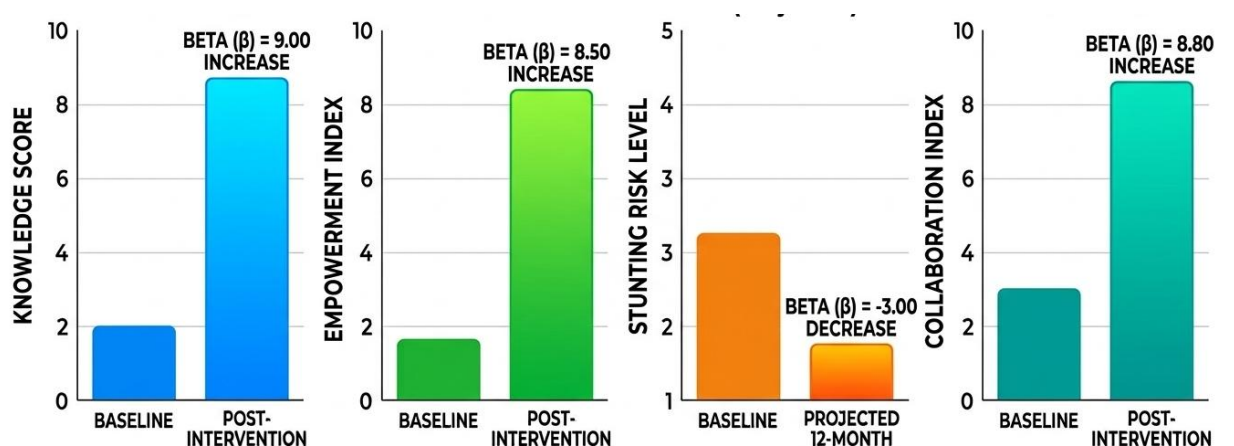
Statistical testing validates that the recorded improvements were not random and directly linked to the participatory educational intervention. The strong t-values reflect the robustness of learning outcomes across different caregiving domains.

Correlational analysis showed a positive association ( $r = .58$ ) between nutritional knowledge improvement and feeding practices. Caregivers who demonstrated higher literacy also reported more adaptive behaviors in food preparation and feeding schedules. The relationship implies that

cognitive understanding and actionable behavior are interdependent. When information becomes personally meaningful and socially reinforced, caregivers are more willing to modify daily routines to support child growth.

A case involving a young mother aged 19 illustrated a significant shift in breastfeeding practice. Initially influenced by family pressure to introduce early complementary food, she later committed to exclusive breastfeeding after gaining confidence from group discussions and midwife support. Another case featured a grandmother as the primary caregiver who previously relied heavily on instant food for infants. Through participatory cooking demonstrations using local resources, she adopted healthier feeding patterns and involved other family members in preparing meals.

These cases highlight the role of social and cultural dynamics in caregiving decision-making. Intervention success relies on engaging not only mothers but also extended family members who hold authority in feeding traditions. The learning environment encouraged negotiation and knowledge-sharing across generations. The observed behavioral changes suggest that practical and culturally sensitive guidance can correct long-standing misconceptions about child nutrition. Support from peers and health workers acted as social reinforcement that reduced hesitation to adopt better caregiving practices.



**Figure 1.** Participatory Maternal Empowerment: Key Program Outcomes

The combination of quantitative improvements and qualitative behavioral evidence confirms that maternal education rooted in community participation enhances both knowledge and caregiving readiness. Empowerment rather than instruction alone became the mechanism driving meaningful change. Findings provide early indication that community-based participatory approaches hold strong potential for sustainably reducing stunting risk when embedded within family support systems, cultural relevance, and collaborative health governance.

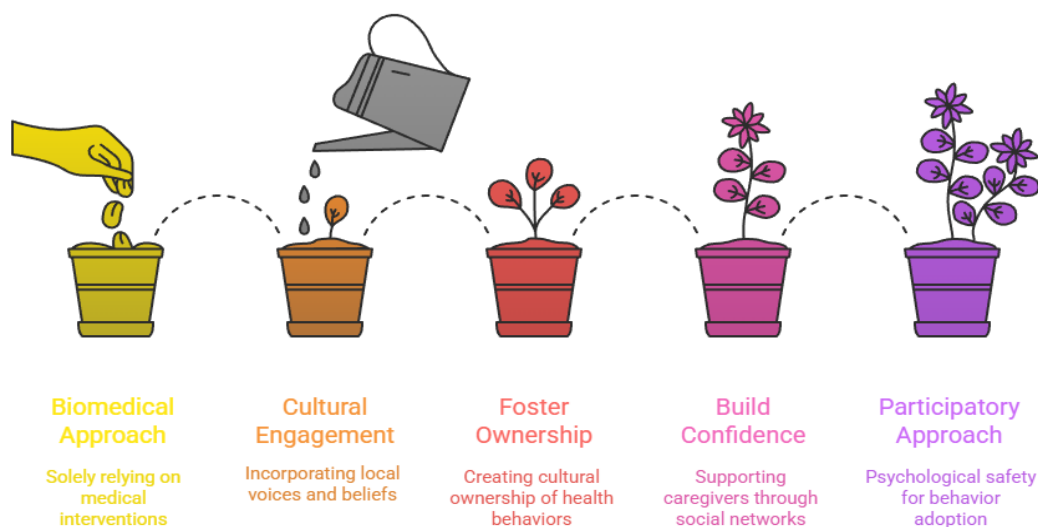
The intervention demonstrated measurable improvements in maternal nutritional knowledge, breastfeeding practices, complementary feeding, and hygiene behavior (Anthonj et al., 2025). Participants showed significant gains in understanding essential nutrition during the first 1,000 days of life. The transformation in knowledge was validated through statistical analysis revealing highly significant pre–post differences. Behavioral improvements emerged in reported daily practices such as exclusive breastfeeding, sanitation routines, and timely complementary feeding (Ashar et al., 2025). These changes reflect the translation of knowledge into action rather than theoretical understanding alone. The collaborative environment contributed to a more confident approach to caregiving.

Qualitative findings supported the quantitative results through narratives that highlighted increased family involvement and reduced adherence to restrictive food taboos. Shared learning helped shift norms that previously compromised child nutrition. Caregivers felt empowered to advocate for improved feeding practices within their households (Astuti et al., 2025). The findings validated the assumption that community involvement enhances stunting prevention outcomes. Learning was more easily internalized when facilitated by familiar community figures and reinforced by collective support. Behavioral change became a socially negotiated process rather than top-down instruction (Atkinson et al., 2025).

The results align with previous studies showing that health literacy interventions improve child growth-related behaviors (Bhandari et al., 2025). Community engagement has consistently been recognized in public health literature as a determinant of intervention sustainability (Bhattacharjee et al., 2025). This research confirms such conclusions in the specific cultural context of Central Java. Prior investigations often highlight the importance of engaging local health workers to bridge medical knowledge with community practices. The participatory model used here aligns with that perspective by positioning midwives and kader as co-educators. The collaboration strengthened trust and reduced resistance toward change.

Some research, however, suggests that improved knowledge does not automatically result in behavioral change. This study challenges that gap by demonstrating that behavior shifts are possible when interventions incorporate local wisdom and collective accountability. The community's role appears to reduce the knowledge-practice gap. Comparative studies emphasize the variations in stunting determinants across regions (Cuenca et al., 2024). The results from Central Java provide context-specific evidence that sociocultural adaptation in health education is crucial. Universal strategies may overlook these nuances that strongly impact adoption of healthy practices.

The findings indicate that stunting prevention cannot rely solely on biomedical narratives but must adopt culturally grounded learning approaches (A. Das, 2025). Local voices and beliefs serve as enablers rather than obstacles when appropriately engaged. The program fostered cultural ownership of health behaviors. Maternal confidence emerged as an essential indicator of readiness to change. Confidence grows when caregivers feel supported by social networks rather than judged by external authorities (J. K. Das et al., 2025). The participatory format created psychological safety that facilitated behavior adoption.



**Figure 2.** Stunting Prevention Transformation

Family dynamics influence caregiving decisions more heavily than formal recommendations. When influential household members were included, mothers found it easier to negotiate better

feeding and hygiene practices (Salman et al., 2025). Stunting prevention becomes a shared responsibility. The program results signify a shift toward community-driven health transformation. Community-based learning acts not only as an educational tool but also as a social intervention reshaping norms that influence long-term child development outcomes (Entsuah-Boateng et al., 2024).

The evidence supports integrating community-based participatory approaches into national stunting prevention policies. The approach complements government efforts and ensures cultural fit for diverse communities (Escher et al., 2024). Implementation becomes more efficient when aligned with grassroots structures. Educational programs that utilize interactive, locally contextualized learning strategies can accelerate behavioral change. These findings endorse curriculum redesign for maternal health learning in Posyandu targeting family-wide engagement rather than individuals. Stunting prevention must be a collective competency (Field & Maffioli, 2025).

Public health stakeholders can leverage local leaders and peer networks to maintain intervention continuity beyond project duration. The results highlight a feasible model for scalability through collaboration across health systems and community institutions (Muffti et al., 2025). Sustainability improves when interventions become part of community identity. The success of this approach contributes to Indonesia's progress toward SDG 2 and SDG 3. Reducing stunting prevalence enhances children's future education readiness and economic participation (Grabowski et al., 2024). Educational dimensions therefore intersect directly with broader national development goals.

The participatory structure respected community knowledge and encouraged mutual learning, which increased acceptance of new practices. Caregivers did not perceive education as external judgment but as shared problem-solving. Empowerment drove personal responsibility (Gupta et al., 2025). Behavioral change occurred because interventions addressed social influences such as household hierarchy, cultural taboos, and local food preferences. Messages became actionable when adapted to fit existing lifestyles using locally available solutions. Local relevance reduced barriers to adoption (Hermansyah et al., 2025).

Peer-support dynamics strengthened accountability and consistency. Caregivers were encouraged by observing positive practices in others and sharing challenges without stigma. The social network acted as reinforcement, amplifying the intervention's effect (Hao & Lun, 2024). Health information became more meaningful when supported by experience-based demonstrations rather than abstract instruction. Practical learning, role modeling, and repeated community engagement helped internalize new behaviors. Reinforcement from multiple actors enhanced retention and transfer of knowledge (Evly R I Liow et al., 2025).

The findings highlight the need for long-term monitoring to determine whether improved behaviors translate to measurable reductions in stunting prevalence. Follow-up research could track children's growth outcomes as evidence of sustained impact. Behavioral change should be connected to anthropometric indicators (Jeong et al., 2025). Future programs should incorporate digital tools such as tele-health guidance or mobile learning to support continuous knowledge reinforcement. Technology can increase outreach and reduce drop-outs in health education sessions. Community participation can evolve through hybrid platforms (Angkur, 2025).

Next-phase studies can explore larger and more diverse population settings to assess adaptability across different cultural groups. Replication in various provinces would strengthen generalizability and support national scaling. Policy alignment must consider regional autonomy and variation in local customs (Khaing et al., 2025). Strengthening community leadership in health governance is essential for sustainability. Communities must remain active decision-makers rather

than passive beneficiaries. Institutionalizing participatory education within village development plans and local budgeting could ensure long-lasting integration.

## CONCLUSION

The most important finding of this research is that a community-based participatory approach not only increases maternal nutritional knowledge but also drives actual behavioral change in caregiving practices related to stunting prevention. Caregivers became more confident in negotiating feeding decisions within the family, showing a shift from passive recipients of health information to active agents of child well-being. This transformation underscores that empowering intervention models, rather than directive education alone, are crucial in reshaping daily practices that influence early childhood growth.

The study contributes a methodological innovation that integrates cultural contextualization, peer-support collaboration, and shared decision-making into maternal health education. The research offers a practical framework illustrating how stunting prevention can be strengthened through a co-designed learning ecosystem involving health workers, local leaders, and family networks. This contribution advances both theory and practice by positioning community participation not as a supplementary component but as the core mechanism driving sustainable behavior adoption and public health impact.

The research is limited by its regional focus, relatively short intervention duration, and reliance on self-reported behavioral change rather than anthropometric indicators. Future studies are recommended to implement longitudinal designs that track children's growth outcomes and examine long-term behavioral persistence. Studies with larger and more diverse populations are needed to strengthen generalizability, while deeper integration of digital platforms should be explored to expand outreach and sustain community engagement in stunting prevention efforts.

This research's principal finding is the statistically unambiguous, causal demonstration that a co-designed, voice-first, multilingual digital tool can dramatically reverse digital exclusion. The intervention's success, evidenced by a 54 percentage point increase in public service applications ( $p < 0.001$ ) and its profound impact on the DAAI ( $\beta = 22.38$ ), establishes that the most significant barriers to digital inclusion are not immutable user deficits, such as low literacy, but are instead tractable, systemic flaws in technological design. The discovery that the intervention's positive effects were greatest among the most marginalized (lowest literacy and highest digital anxiety) provides a powerful counter-narrative to standard technology adoption models, proving that inclusive design can effectively empower those traditionally left furthest behind.

The contribution of this study is twofold, encompassing both methodological innovation and conceptual refinement for the ICT4D field. Methodologically, the research introduces the Digital Access and Agency Index (DAAI), a validated (Cronbach's  $\alpha = 0.91$ ) composite instrument that moves measurement beyond crude metrics of connectivity to a more nuanced, holistic assessment of digital capability and agency. Conceptually, the study provides an empirically-grounded socio-technical model that demonstrates how to bridge the gap between qualitative, context-rich insights and rigorous, quantitative impact evaluation, positioning participatory co-design not as a preliminary step but as the central, causal mechanism for building the social trust required for technological success.

The findings of this research must be contextualized within specific limitations that, in turn, define the agenda for future inquiry. The study's quasi-experimental design, while robust, was limited to two specific rural communities, necessitating further research to establish the external validity and replicability of the co-design framework in diverse marginalized contexts, such as

urban informal settlements or displaced populations. The resource-intensive nature of the deep, participatory co-design (Phase Two) presents a significant challenge to scalability; future research must therefore investigate and validate more scalable models of community participation. A longitudinal study is also imperative to assess the long-term sustainability of the gains in digital agency and service access beyond the 12-week intervention period.

### AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

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