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Enhancing mothers' understanding of sanitation and nutrition for stunting prevention through a participatory approach in Palembang

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ABSTRACT

Stunting in Indonesia is closely linked to inadequate sanitation and maternal health literacy. This community service program aimed to improve mothers' knowledge and sanitation practices for stunting prevention through a Participatory Action Research (PAR) approach in Palembang. The program involved 39 mothers of stunted children across four public health centers. Evaluation was conducted using pre–post KAP questionnaires, household observations, and environmental measurements. The results showed that 82% of participants improved their knowledge scores compared to baseline, with average scores increasing from low to good levels. Observable behavioral changes included proper handwashing, improved waste management, safer water storage, and better home ventilation. Coliform contamination in drinking water decreased from 58.2 to 5.13 CFU/100 mL, indicating a positive improvement trend, although not yet meeting WHO standards. The formation of the "Ibu Peduli Sanitasi" group strengthened sustainability through peer education and community monitoring. This program demonstrates that participatory community empowerment effectively enhances maternal capacity and promotes sustainable sanitation behavior in stunting prevention.

KEYWORDS
Stunting Prevention
Sanitation
Nutrition

1. Introduction

Stunting remains a major public health challenge in Indonesia, reflecting chronic malnutrition that affects children's physical growth, cognitive development, and long-term productivity [1]–[5]. National reports indicate that stunting is influenced not only by inadequate nutritional intake but also by poor environmental sanitation, recurrent infections, low maternal education, and limited health literacy [6]–[8]. While various government interventions have focused on food supplementation and maternal-child health services, persistent sanitation-related risks continue to undermine these efforts.

In the urban and peri-urban areas of Palembang, particularly within the service coverage of Gandus, Kertapati, Makrayu, and Merdeka Public Health Centers (Puskesmas), sanitation-related problems remain a priority concern. Based on preliminary coordination with Puskesmas staff and initial field observations, several key issues were identified: inadequate household ventilation, unsafe drinking water storage, poor waste management, and limited awareness of proper hygiene practices such as handwashing with soap. Many mothers of stunted children reported frequent cases of diarrhea and acute respiratory infections, indicating that environmental and behavioral factors were significantly contributing to growth faltering despite ongoing nutritional interventions [9], [10].

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Based on coordination meetings with the four Puskesmas, it was reported that several households with stunted children still lacked proper ventilation systems, used uncovered water storage, and practiced inconsistent handwashing. Health cadres also indicated that previous health education programs had not resulted in sustained behavioral change [11]. These field conditions confirmed that sanitation-related behavioral risks remained a priority issue requiring direct community-based intervention [12], [13].

Thus, the partner institutions (Puskesmas and community health cadres) identified poor household sanitation practices and limited maternal literacy in sanitation–nutrition integration as priority problems requiring immediate intervention. The challenge was not merely a lack of information, but the absence of sustained behavioral change and community ownership in addressing sanitation risks. Therefore, an intervention that combined education, environmental assessment, and participatory engagement was considered more appropriate than conventional one-way health counseling [14]–[17].

Previous studies in Indonesia have demonstrated associations between sanitation, maternal knowledge, and stunting prevalence [8], [18]–[20]. However, most of these studies were observational in nature, focusing on identifying determinants rather than implementing structured, community-based empowerment programs. Several community education programs have also been conducted, yet many relied primarily on lecture-based dissemination without integrating environmental monitoring or long-term peer-group strengthening mechanisms.

This community service program differs from previous initiatives in three main aspects. First, it integrates sanitation education with direct environmental measurements (water quality, ventilation, lighting, and temperature), enabling participants to observe tangible changes in their household conditions. Second, it applies a Participatory Action Research (PAR) framework, allowing mothers to actively identify problems, design solutions, and monitor improvements rather than serving as passive recipients of information. Third, the program emphasizes sustainability through the formation of the "Ibu Peduli Sanitasi" (Sanitation Care Mothers) group, functioning as peer educators and community monitors beyond the intervention period.

By positioning mothers as key agents of change and integrating sanitation, nutrition literacy, and environmental monitoring, this initiative addresses the identified priority problem of the partner communities: persistent sanitation-related risks contributing to stunting. The program aims not only to improve knowledge but also to foster sustained behavioral transformation and community resilience. Consequently, this initiative contributes to strengthening local health systems while supporting the achievement of Sustainable Development Goal (SDG) 3 (Good Health and Well-being) and SDG 5 (Gender Equality).

2. Method

2.1. Location and Participation

The program was implemented in four primary healthcare service areas (Puskesmas) in Palembang City: Gandus, Kertapati, Makrayu, and Merdeka. These locations were selected in coordination with local health authorities due to their sanitation challenges and the presence of stunting cases.

A total of 39 mothers participated in the program, selected through purposive sampling based on the primary criterion of having a stunted child. This sampling approach ensured that participants were directly relevant to the priority problems identified by partner institutions. All participants provided informed consent prior to program implementation.

The total number of 39 participants was determined based on coordination with the four Puskesmas, focusing on mothers of identified stunted children who were willing to participate throughout the program cycle. The distribution of participants was proportionally adjusted according to the number of stunting cases reported in each Puskesmas area to ensure balanced representation of the target communities.

2.2. Study Design

This community service program employed a Participatory Action Research (PAR) framework combined with a pre–post evaluation design to assess program impact. The purpose of the evaluation was not to test a research hypothesis but to measure changes in participants' knowledge, attitudes, practices,

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and household environmental conditions following the intervention. The analytical focus was therefore program-impact oriented rather than inferential hypothesis testing.

2.3. Instrument Development and Validation

Several instruments were developed to support program monitoring and evaluation:

- Knowledge–Attitude–Practice (KAP) Questionnaire

  The KAP questionnaire was developed based on national sanitation guidelines, PHBS indicators, and WHO recommendations on household hygiene and child nutrition. The instrument consisted of structured items using a 4-point Likert scale (1 = poor/incorrect understanding, 4 = good/correct understanding). Content validity was assessed through expert review by two public health professionals and one environmental health specialist. Minor revisions were made to improve clarity and contextual relevance. The questionnaire was pilot-tested on a small group of mothers outside the intervention area to ensure comprehension and consistency.

- Observation Checklist

  The household sanitation observation sheet was adapted from standard environmental health assessment tools used by local Puskesmas. It included indicators such as floor cleanliness, ventilation adequacy, drinking water storage practices, waste disposal systems, and toilet conditions.

- Environmental Measurement Tools

  Environmental parameters included: Water pH (measured using a portable digital pH meter), Indoor temperature (digital thermometer), Light intensity (lux meter), Coliform levels in drinking water (laboratory-based microbiological analysis).

These measurements were conducted before and after the intervention to assess environmental improvements.

2.4. Program Implementation

The community empowerment program was conducted in several stages:

- Preliminary survey and identification of sanitation-related problems in collaboration with Puskesmas staff.
- Participatory discussions to design context-specific solutions.
- Health education sessions and practical demonstrations on handwashing, safe water storage, waste management, ventilation improvement, and preparation of balanced meals.
- Household mentoring and environmental monitoring.
- Formation of the "Ibu Peduli Sanitasi" group to promote sustainability through peer education.
- End-line evaluation using the same instruments applied at baseline

2.5. Data Analysis

Quantitative data from KAP questionnaires and environmental measurements were analyzed descriptively to evaluate changes before and after the intervention. Mean scores, percentages, and comparative differences were calculated to determine the magnitude of improvement.

The analysis was conducted as a program evaluation to assess the effectiveness of the community service intervention rather than to test a formal research hypothesis. Therefore, findings are interpreted in terms of practical impact and behavioral change rather than statistical causality.

Qualitative data obtained from interviews and observations were analyzed using thematic analysis to identify recurring patterns in participants' experiences, perceived benefits, and behavioral transformations.

The analysis was designed to assess program effectiveness and practical improvements at the community level rather than to test statistical hypotheses.

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3. Results and Discussion

3.1. Community-Identified Problems and Practical Interventions

Field observations and interviews confirmed that the primary challenges faced by participating households were not limited to economic constraints but were strongly associated with inadequate sanitation practices, poor household ventilation, unsafe drinking water storage, and limited awareness of hygiene-related disease transmission. Frequent cases of diarrhea and respiratory infections among children indicated that environmental exposure and recurrent infections were likely contributing to growth disruption.

From a practical perspective, these findings highlight that improving nutrition alone is insufficient when sanitation-related risks persist. Therefore, the program's integrated approach—combining sanitation education, environmental monitoring, and household mentoring—directly addressed the priority problems identified by both the Puskesmas and the participating mothers.

Rather than focusing solely on theoretical knowledge transfer, the intervention emphasized immediate, actionable changes such as proper handwashing with soap, covering drinking water containers, improving ventilation by adding openings or routinely opening windows, and separating household waste. These small but consistent behavioral adjustments represent meaningful improvements in daily household health practices.

3.2. Changes in Knowledge, Attitudes, and Practices (KAP)

The evaluation results showed a clear upward trend in maternal knowledge, attitudes, and practices following the intervention. The majority of participants demonstrated improved understanding of sanitation, safe water handling, and balanced nutrition. Importantly, the increase in knowledge was accompanied by observable behavioral changes at the household level.

From a community perspective, the practical significance of these improvements lies in risk reduction. For example:

- Proper handwashing reduces the transmission of diarrheal pathogens.
- Improved ventilation decreases indoor humidity and lowers the risk of respiratory infections.
- Safe water storage and reboiling drinking water reduce microbial contamination

These changes, although simple, directly influence children's exposure to infection, one of the underlying drivers of stunting. Thus, the program's impact extends beyond knowledge acquisition to tangible environmental and behavioral modifications that can protect child growth and health over time.

3.3. Improvements in Water Quality and Household Environment

Water quality analysis in participating households revealed a substantial reduction in coliform contamination, from 58.2 CFU/100 mL before the intervention to 5.13 CFU/100 mL after program implementation. Although this level has not yet reached the WHO standard of 0 CFU/100 mL for safe drinking water, the downward trend indicates a significant and encouraging improvement.

From a practical standpoint, the reduction in coliform concentration reflects better household water management practices, including the use of covered storage containers, routine cleaning of utensils, and reboiling drinking water. These practices directly decrease children's exposure to pathogenic microorganisms and reduce the likelihood of recurrent gastrointestinal infections.

Similarly, improvements in environmental parameters—such as more stable water pH, reduced indoor temperature due to improved ventilation, and increased natural lighting—contribute to creating healthier living spaces. While these environmental changes may not immediately eliminate all health risks, they represent an important transition toward safer household conditions.

Therefore, even though WHO standards have not yet been fully achieved, the positive trajectory demonstrates that community-based sanitation empowerment can produce measurable environmental improvements within a relatively short intervention period. Continued practice reinforcement is expected to further reduce contamination levels over time.

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3.4. Community Empowerment and Sustainability Mechanism

A key outcome of this program was the formation of the "Ibu Peduli Sanitasi" (Sanitation Care Mothers) group. This peer-based group serves as a sustainability mechanism to ensure that behavioral changes persist beyond the formal intervention period. The sustainability strategy operates through three mechanisms.

- Peer Education and Monitoring

  Group members regularly share information with other mothers in their neighborhood and monitor sanitation practices within their community.

- Collaboration with Puskesmas and Health Cadres

  The group maintains coordination with local health workers, enabling integration with ongoing maternal and child health programs.

- Community Ownership through PAR

  Because mothers were actively involved in identifying problems and designing solutions, they developed a sense of responsibility and ownership. This participatory engagement strengthens long-term commitment and reduces dependency on external facilitators.

The PAR approach ensured that participants were not passive recipients of information but active agents of change. This empowerment process enhances resilience and promotes sustained behavioral transformation at the household level.

3.5. Overall Practical Impact

Overall, the integration of participatory education, environmental monitoring, and peer-group strengthening resulted in:

- Improved maternal literacy in sanitation and nutrition,
- Observable behavioral transformation,
- Measurable environmental improvements,
- Strengthened community leadership among mothers

The practical significance of these outcomes lies in reducing children's exposure to infection, fostering healthier home environments, and building a self-sustaining community support system. These changes, although incremental, contribute meaningfully to long-term stunting prevention efforts and align with broader public health goals.

4. Conclusion

The participatory sanitation and nutrition education program successfully improved mothers' knowledge, attitudes, and practices related to stunting prevention in Palembang. These improvements were accompanied by measurable environmental changes, including a substantial reduction in coliform contamination in drinking water (from 58.2 to 5.13 CFU/100 mL) and improved household ventilation and lighting conditions. Although water quality has not yet fully met WHO standards, the positive downward trend demonstrates meaningful progress in reducing infection risks among children. For partner institutions, particularly the participating Puskesmas, the program provided practical benefits by strengthening maternal health literacy, supporting ongoing PHBS campaigns, and generating a community-based support system that complements formal health services. The integration of education, mentoring, and environmental monitoring enabled health workers to address sanitation-related stunting risks more comprehensively at the household level. The establishment of the "Ibu Peduli Sanitasi" group represents a key sustainability outcome of this initiative. Through peer education, local monitoring, and continued collaboration with health cadres, the program fosters long-term behavioral change beyond the intervention period. The Participatory Action Research (PAR) approach enhanced community ownership, increasing the likelihood that improved sanitation practices will be maintained and further developed over time. Given its participatory design, low-cost behavioral focus, and measurable environmental impact, this model has strong potential for replication in other urban and peri-urban areas facing similar sanitation-

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related stunting challenges. With contextual adaptation and continued collaboration with local health authorities, the approach can contribute to broader stunting prevention strategies and support the achievement of Sustainable Development Goal (SDG) 3 (Good Health and Well-being) and SDG 5 (Gender Equality).

Photo Attachment

Fig. 1. Photo Documentation of Community Service Activities

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Declarations

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