

Health and Nutrition Counseling for Children in Daycare Centers in Plantation Areas of Berau District

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ABSTRACT

This community service program in the operational area of PT Sentosa Kalimantan Jaya, Tanjung Batu Village, Pulau Derawan Subdistrict, Berau Regency, was driven by the persistent risk of nutritional and health problems among children in daycare centers due to limited knowledge, attitudes, and practices of caregivers and parents regarding balanced nutrition. The program aimed to enhance community capacity through nutrition and health education based on Participatory Action Research (PAR), engaging caregivers, parents, and local health volunteers in all stages. The implementation method included needs assessment, collaborative planning, interactive material delivery, hands-on practice, and evaluation using pre-post tests and reflective discussions. The results indicated a significant improvement in nutrition knowledge scores, awareness of healthy food choices, and better child feeding practices. These changes were reinforced by active participation and social support developed throughout the program, fostering a sense of ownership over the intervention. This success suggests that participatory approaches adapted to local contexts can produce relevant and sustainable outcomes, with potential for replication in other plantation-based communities with similar characteristics.

Keywords: Health and Nutrition Education, Children in Daycare Centers, Plantation Operational Area

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INTRODUCTION

The nutrition and health issues of children in daycare centers in the PT Sentosa Kalimantan Jaya Plantation working area are crucial because the early phase of life is a critical period of brain growth and development. Interventions at this age will determine the quality of a child's future health and intelligence. Field observations and interviews with caregivers revealed that most of the daily meals at daycare centers consisted mainly of simple carbohydrates (rice and instant noodles) with very little variety in terms of animal-based side dishes, vegetables, or fruit. This diet does not meet the nutritional needs for children's golden period, which is the critical period of brain growth and development that occurs during the first 1000 days of life and the following years. Inadequate intake of protein,

iron, vitamin A, and omega-3 during this phase risks hindering cognitive development, lowering immunity, and in the long term, contributing to stunting. The urgency Based on data from the 2024 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in Berau rose to 23.4 percent, an increase of 2.4 percent compared to the previous year. (Izza Berau Post, 2025)

Health and nutrition counseling at the crèche site provides direct access to caregivers and parents so that knowledge and skills can be transferred effectively. The results of a systematic review by (Prasetyo et al., 2023) showed that nutrition education for mothers can significantly improve children's nutritional status. (Pienaaah et al., 2025) confirms that child nutrition counseling that considers gender dynamics in the family can significantly increase children's dietary diversity. The data reinforces the urgency of implementing this service because it targets vulnerable groups and is often missed in formal health interventions (Nurhikmah, 2024). This intervention also has the potential to address the nutritional problems faced by children in plantation areas who are often far from access to optimal health services, thus becoming an important part of the strategy to prevent stunting and malnutrition.

Community-based nutrition education has proven to be an effective strategy in various regions with diverse socio-economic backgrounds. The DASHAT (*Dapur Sehat Atasi Stunting*) program in Karawang, for example, combines nutrition education and supplementary feeding to increase energy, protein, fat and calcium intake and significantly reduce the prevalence of stunting, wasting and underweight (Sukmawati et al., 2023). Another study by (Maidelwita et al., 2024) showed that nutrition counseling for parents and teachers in early childhood education institutions can reduce the incidence of stunting through increased knowledge and skills in healthy food processing. The Care Group approach, which utilizes local cadres, shows the effect of information multiplication and cost efficiency, making it relevant in plantation areas where health workers are limited. By involving the community as agents of change, the nutrition education program is able to increase the sustainability of the intervention while expanding its reach.

This effort is closely associated with comparable national and international initiatives currently in progress. In early 2025, the Indonesian government introduced a free healthy meal program for schoolchildren and pregnant women, which is intended to reach millions of beneficiaries and reduce chronic nutrition issues (Karmini & ALANGKARA, 2025). The establishment of the National Nutrition Agency in 2024-2025 is a strategic moment to integrate local and national initiatives into one policy framework (Fund, 2025). In addition, the government's collaboration with the World Bank through the INEY program succeeded in reducing the prevalence of stunting from 30.8% to 21.5% in five years, reaching more than 20 million children and training thousands of community cadres. Nutrition counseling in daycare centers has great potential to support the sustainability and strengthening of the achievements of these programs, especially in areas where the INEY program has been implemented. 2 of these programs, especially in areas that are difficult to reach by large-scale interventions.

The significance of this work resides in its emphasis on the critical period, during which interventions exert a substantial and lasting influence on children's health, cognitive development, and future productivity. Educating caregivers and parents in daycare centers can improve their ability to select and prepare foods that meet children's needs, reduce the risk of stunting, and improve early eating habits. This is in line with the findings of (Prasetyo et al., 2023) and (Pienaaah et al., 2025) who showed a direct relationship between nutrition knowledge and children's diet quality. In addition, the program complements the DASHAT strategy and supports the implementation of the free nutritious meal and National Nutrition Agency policies. An integrated approach combining education, community empowerment and national policy support will result in greater and more sustainable impact.

The contribution of this service to further development holds significant potential, particularly as a model that can be replicated in other plantation regions or remote areas across Indonesia. The approach that integrates nutrition education, supplementary feeding, and the engagement of local health cadres may serve as a model for the development of standardized training modules and job aides for field officers. (Shofia & Dirgayunita, 2024). Data from the implementation of this program will also enrich the local evidence base for policy planning and strategies to accelerate stunting reduction at the national level. With integration into the National Nutrition Agency strategy and the support of international programs such as INEY, the results of this service are expected to make a real contribution to strengthening the nutritional resilience of Indonesian children in the future, while strengthening commitment to achieving sustainable development targets.

METHOD

The Participatory Action Research (PAR) approach is used in this service to ensure that every step of the activity is based on the real needs and context of the community. PAR places caregivers, parents, and local health cadres at the daycare center as co researchers who play an active role in the process of problem identification, strategy formulation, activity implementation, and evaluation of results. Through the stages of the reflection-action-evaluation cycle, any input from participants is directly integrated into the next action plan, so that interventions are adaptive to field conditions (Chadd et al., 2025). This approach strengthens the sense of ownership among participants, increases the relevance of educational materials, and maximizes the active involvement of all stakeholders (Baum et al., 2006). In its implementation, the PAR method adopts the principles of equal participation, multidisciplinary collaboration, and integration of local knowledge with technical expertise, which have been proven effective in improving the success of nutrition interventions in various community contexts (Baum et al., 2006). The direct involvement of participants at each stage also serves as a means of strengthening capacity, so that this service does not only provide outputs in the form of increased knowledge, but also a means of strengthening capacity. 3 not only provides output in the form of increased knowledge, but also builds skills and sustainable social networks.

The implementation of PAR in this service is carried out through a series of activities designed to explore community perspectives and aspirations, while producing concrete actions that directly address the challenges of child nutrition and health in the daycare area. Activities begin with community entry that respects local social and cultural structures, followed by focus group discussions (FGDs) to map problems, needs, and potential local resources (Chadd et al., 2025). Photovoice techniques are used to encourage participants to document real conditions related to child nutrition and health, while service mapping helps identify service networks that can support program sustainability (Chadd et al., 2025). Educational materials were developed with local cadres using language and examples relevant to daily life, taking into account the results of problem identification. During counseling, facilitators encourage two-way interactive learning so that participants can exchange experiences, strengthen social support, and motivate behavior change (Baum et al., 2006). Afterwards, a participatory evaluation is conducted using mutually agreed qualitative and quantitative measurement tools to ensure the program's achievements are measurable and actionable.

The use of PAR in this service contributes significantly to the program's sustainability and effectiveness. Unlike the top-down strategy, PAR permits any emerging innovations to come from community activities, thereby boosting the possibilities of the intervention being sustainable after the program finishes. (Tremblay-Wragg et al., 2025). Previous research has shown that active community participation in the planning and implementation process leads to increased adoption of healthy behaviors, including increased consumption of nutritious food and improved parenting (Chadd et al., 2025). In the context of this service, such an approach helps integrate extension materials with the daily practices of caregivers and parents, making the nutrition messages easier to understand and internalize. Furthermore, the use of creative methods such as photovoice and service mapping strengthens the documentation of results and provides visual evidence that can be used for advocacy at the local and regional levels. Thus, PAR is not only an implementation method, but also a sustainable empowerment process that enables communities to become agents of change in efforts to improve child nutrition and health.

The subjects participating in this activity consisted of childcare providers and parents, using FGD guidelines and teaching aids/posters entitled "My Plate" based on nutritional needs. The educational activities were carried out during the last two weeks of the PPM (Community Empowerment Practicum) at the IAI Ngawi campus. The results of the FGD and observations were analyzed thematically using coding techniques, then the data was presented and conclusions were drawn.

Participants and Study Setting

The program involved 30 participants, comprising daycare childcare providers and parents of children attending the center. The inclusion criteria were: 1) being a primary caregiver or parent of a child at the targeted daycare, and 2) willingness to participate in the entire series of activities and the evaluation process. The educational and intervention activities were conducted intensively over a period of two weeks during the Community Empowerment Practicum (PPM).

Data Collection and Analysis

A mixed-methods approach was used for data collection and evaluation.

Quantitative Data: Knowledge improvement was measured using pre-test and post-test questionnaires. The questionnaire consisted of 20 multiple-choice items covering key topics such as food groups, balanced nutrition, meal frequency, and hygiene practices. Each correct answer was scored 1 point, with a total maximum score of 20. The scores were analyzed using a paired sample t-test to determine the significance of knowledge change before and after the intervention, with a significance level set at $p < 0.05$. **Qualitative Data:** Data from FGDs and field observations were analyzed using thematic analysis. The coding process was conducted manually, which involved familiarization with data, generating initial codes, searching for themes, reviewing themes, defining themes, and producing the report.

Ethical Considerations

Prior to implementation, ethical clearance was obtained from the relevant institutional review board. Furthermore, informed consent was secured from all participants after the purpose, procedures, and their rights to withdraw at any time were thoroughly explained.

RESULTS AND DISCUSSION

Overview of the Implementation of Extension Activities in the Field

The implementation of extension activities in the field begins with a structured and planned preparation stage, involving intensive coordination between the implementation team, daycare managers, community leaders, and local health workers to ensure the suitability of the program to the local context (Chevalier & Buckles, 2019). The initial community entry activities were conducted through introductory meetings and brief discussions to understanding the socio-cultural conditions, facilities, and eating habits of children in the neighborhood. This process is followed by focus group discussions (FGDs) involving caregivers, parents and health cadres to identify nutrition, hygiene and health problems faced by children. The results of the FGDs were used as the basis for developing modules of extension materials that are relevant to local characteristics, including the use of food ingredients that are easily obtained around the plantation area (Abma et al., 2023). This material development activity adopted Participatory Action Research (PAR) principles that place participants as active partners in the learning process. The extension method designed combines exposure to nutrition theory with interactive discussions and practical simulations, ensuring the material is not only conceptually understood but also directly applicable (Davidson et al., 2025). The principle of equal participation was consistently applied so that all participants felt they had an important role in the intervention process (Ledwith & Springett, 2022).

The field counseling was conducted in the form of interactive workshops divided into several thematic sessions, such as "The Importance of Food Variety", "Hygiene in Food Processing", and "Nutritious Menus with Local Ingredients". Each session began with a brief presentation of the material by the facilitator, followed by a small group discussion where participants could relate the topic to personal experiences. Creative methods such as photovoice were used to

document kitchen conditions, tableware, and children's daily menus, thus triggering discussions based on field realities (van der Vlegel-Brouwer, 2023). In addition, service mapping techniques helped map participants' access to health facilities, markets, and food sources, which informed the planning of sustainable nutrition improvement strategies (Vaughn & Jacquez, 2020). Participants were also invited to practice making healthy food with affordable ingredients, such as processing cassava into nutritious food or adding green vegetables to the complementary food menu. This activity improves participants' technical skills while building confidence to implement behavior change at home. The two-way interaction during the workshop strengthens relationships among participants, encourages information exchange, and expands social support for the sustainability of better nutrition practices (Hunt et al., 2021).

The extension program is continuously evaluated using direct observation, short interviews, and pre-post exams to assess increases in participants' nutritional knowledge (Wadsworth, 2021). The initial evaluation results revealed a considerable increase in participants' comprehension of food types, proper feeding frequency, and the need of sanitation in food processing (Zuber-Skerritt, 2018). In addition to quantitative measurements, qualitative evaluations revealed that participants felt the methods used were relevant to their conditions, making them easier to apply in their daily lives. Local cadres involved in the extension process reported increased capacity to facilitate similar activities independently in the future (Abma et al., 2023). The effectiveness of this activity is supported by the active involvement of all parties from the planning to evaluation stages, in accordance with PAR principles that encourage equal participation and strengthening community capacity to manage change in a sustainable manner (Chevalier & Buckles, 2019). This implementation not only resulted in increased knowledge, but also built a network of support that can be an important social capital for the sustainability of nutrition programs in plantation areas.

This increased knowledge led to measurable behavioral changes. Participants started expanding children's diets by include locally sourced protein and veggies. One caregiver noted: "Before, we thought full was enough. Now we understand about 'full and nutritious'. We've started adding eggs and tempeh to the noodles, and the children have gotten used to seeing greens on their plates." This shift from a carbohydrate-centric diet towards more balanced meals underscores the intervention's practical impact (Binsa, 2025).

Participation of Caregivers, Parents, and Local Cadres in the Process

The participation of caregivers, parents, and local cadres in the extension activities was dynamic from the early stages to the end of implementation, reflecting the effectiveness of the Participatory Action Research (PAR) approach that places the community as active subjects, not just recipients of information (Chevalier & Buckles, 2019). In the planning phase, caregivers and parents were involved in identifying nutrition issues through focus group discussions, sharing experiences on constraints and child feeding practices at the daycare center. Local cadres acted as liaisons between the implementation team and the community, helping to explain the program's objectives and inviting the active participation of other participants. This process not only strengthens ownership of the program,

but also builds trust among all parties involved. Previous research has shown that community involvement in the early stages of planning can increase the relevance of the materials and the sustainability of the program (Abma et al., 2023). During the activities, attendance gradually increased due to the interactive and culturally appropriate learning methods (Davidson et al., 2025). The adoption of the principle of equal participation ensures that all participants have equal opportunities to express their opinions and contribute to formulating solutions (Ledwith, 2022).

Engagement during the implementation of activities was seen in the form of active participation in thematic workshops, two-way discussion sessions, and the practice of preparing nutritious menus using affordable local ingredients. Caregivers often shared strategies for dealing with children who had difficulty eating, while parents shared ideas for modifying menus to suit their children's tastes without compromising nutritional content. Local cadres served as field facilitators, helping to guide practical sessions and ensuring participants understood the material presented. Techniques such as photovoice allow participants to reflect on their eating habits and household conditions, leading to more in depth discussions (van der Vlegel-Brouwer, 2023). Observations show that these methods not only strengthen knowledge transfer, but also encourage the exchange of practical experiences that are immediately applicable (Oddo et al., 2022). Nutrition communication studies at the community level confirm that active participation in the learning process strengthens internal motivation and improves adaptability to health messages (Hunt et al., 2021). The increasingly confident role of local cadres in facilitating discussions is an indicator of successful skills and knowledge transfer (Vaughn, 2020).

The evaluation phase also included full engagement from caregivers, parents, and local cadres, who offered direct input on the success of the materials, methods, and activity execution. This feedback was utilized to improve subsequent sessions, creating a continuous feedback cycle following PAR principles. (Wadsworth, 2021). Caregivers and parents showed increased understanding as measured by pre-test and post-test, while local cadres were able to design follow-up plans in the form of independent counseling activities at the community level (Zuber-Skerritt, 2018). This shows that participation does not stop at the implementation of activities, but continues to become a local initiative that strengthens the sustainability of the program. Research in the community empowerment literature confirms that active involvement in all stages of the program contributes to strengthening local capacity and increases the chances of long-term behavior change (Ledwith & Springett, 2022). Thus, 6 The participation model developed during this activity can be used as a reference for the implementation of similar programs in other plantation areas and remote areas.

Changes in Knowledge, Attitude, and Behavior related to Nutrition and Health

Changes in knowledge after the counseling intervention showed a marked increase in understanding of both practical and theoretical aspects of nutrition. Pre-post test results reflected significant increases in the ability to recognize food groups, ideal meal frequency, and the importance of nutritional variability for child development, in line with findings that participatory nutrition education interventions can strengthen nutrition knowledge but do not always directly

change behavior (Davidson et al., 2025). A participatory study in Bangladesh provided similar evidence, showing a 30% increase in nutrition knowledge scores in the training group (Davidson et al., 2025). However, the global literature warns that improved knowledge does not always translate into real changes in practice (Davidson et al., 2025). Educational interventions that are delivered in a stepwise, contextualized manner and empower participants through dialogue and reflection have been shown to be effective in strengthening knowledge retention and relevance (Kendel Jovanović et al., 2023), reinforcing the logic that the application of nutrition education outcomes needs to take into account the cultural context and availability of resources (Contento, 2019).

Following the extension, participants' attitudes toward nutrition and health changed, with participants becoming more conscious of the importance of healthy food choices, presentation hygiene, and reducing their use of sugar or fast snacks. According to the literature, positive attitudes emerge when people actively participate in the teaching process, feel ownership of the solution, and receive social support. (Mancone et al., 2024). For example, an educational intervention in Nepal improved nutrition attitudes and knowledge in school adolescents (Wagle & Bhandar, 2019). A lifestyle education program in Croatia was also successful in strengthening the desire to adopt a healthy lifestyle and balanced nutrition (Jovanović et al., 2023). A study in Ethiopia showed that health belief model-based behavior change communication improved nutrition knowledge and dietary practices among pregnant adolescents (Tesfaye et al., 2025), confirming the importance of a multilayered approach in shaping attitudes that support change (Contento, 2019).

Participants' nutritional behavior changed towards healthier patterns after the intervention. Implementation of knowledge was seen in the practice of adding diverse vegetables and protein sources to children's menus, as well as an increase in the frequency of structured meals. A study in Bogor, Indonesia, recorded significant improvements in the nutrition knowledge and practice scores of adolescent girls after a multi-session nutrition education program. Systematic reviews have shown that community based interventions, such as peer-led or care groups, are effective in increasing fruit and vegetable consumption and reducing unhealthy food intake. However, it has also been found that positive behaviors only last in the short term if there is no sustained follow-up (Wu et al., 2024). Therefore, participatory interventions that embrace the community as agents of change, as well as building networks and sustainable support systems, are key for behavior transformation to be sustainable and have long-term impact (Contento, 2019).



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Figure 1. Implementation of counseling

Analysis of Successes and Challenges of PAR Implementation

The Participatory Action Research (PAR) approach has proven to be a method capable of bridging the gap between academic knowledge and local realities, as it promotes a co creation process based on reflection-action-evaluation cycles that involve all stakeholders equally. Its main success lies in increasing community ownership of the program, as seen in a public health initiative in The Hague that involved residents and professionals in co-designing eight projects relevant to everyday needs. Another study in Vietnam showed that the application of PAR in vulnerable areas successfully mobilized cross-sectoral support, built networks of trust, and triggered local innovation despite limited resources. In addition, the implementation of PAR in early childhood health services in the UK was successful in creating collaborative evaluation mechanisms that were more sensitive to family needs, thereby increasing acceptance of the intervention (Chadd et al., 2025). Nevertheless, significant challenges remain, such as an imbalance in the distribution of power between researchers and communities, time constraints for a full cycle of PAR, and the risk of declining participation if immediate benefits are not realized. This underscores the importance of PAR designs that are flexible, transparent, and include sustainable participant retention strategies.

The strength of PAR also lies in its ability to dismantle structural factors that are at the root of health and nutrition problems, and open up spaces for critical dialogue that are not possible through top-down approaches. Through co- inquiry mechanisms, PAR enables communities to identify systemic barriers, such as limited access to nutritious food sources or policy mismatches with field conditions. Research in the context of organizational capacity building in Canada found that PAR can strengthen the legitimacy of programs in the eyes of the community as it encourages inclusive representation and prevents the dominance of a single narrative (Elysa, 2025). However, challenges arise when engagement is tokenistic participation, resulting in a reduction of PAR's transformative power. To avoid this pitfall, a strategy of regular critical reflection and multiple accountability mechanisms are needed to ensure that all parties, especially marginalized groups, have an equal voice. The literature confirms that the success of PAR relies heavily on a balance between methodological flexibility and an ethical commitment to power redistribution.

Comparative analysis of various studies shows that the success of PAR depends heavily on the quality of social relationships built, the intensity of communication, and the consistency of involvement of local actors throughout the program cycle. A review of PAR projects in Australia found that building social capital from the start, such as trust and solidarity, was a key factor in ensuring sustainability of outcomes. Meanwhile, common challenges include cultural resistance, logistical limitations, and administrative pressures that inhibit process flexibility. In the context of community-based nutrition interventions, such barriers often result in delays in achieving targets or major adjustments to action plans

(Tamphu et al., 2024). Recent manuals on PAR emphasize that long-term success requires a combination of technical strategies, such as capacity building and the use of local media, as well as social strategies, such as strengthening the role of community leaders and local facilitators. Therefore, applying PAR to nutrition and health work requires careful planning that not only focuses on the content of the intervention, but also on the collaborative ecosystem that sustains the process from start to finish.

Comparison with Similar National and Global Programs

Recent national programs in Indonesia, such as the Free Nutritious Meal for school children and pregnant women, feature a very large scale of implementation compared to Participatory Action Research (PAR)-based service programs implemented at the community level. The program targets 82.9 million recipients through more than 30,000 local kitchens, with the aim of reducing malnutrition, improving the quality of daily nutrition, and creating jobs for local communities (AP News, 2025; Financial Times, 2025). This approach has advantages in terms of population reach and significant budget support of over US\$28 billion for the period 2025-2029, but also faces severe challenges in terms of logistics, food supply chain resilience and the risk of cost overruns (Reuters, 2024). In contrast, PAR at the local scale does not have massive reach, but it excels in contextual relevance because it is able to design interventions based on the identification of needs by the communities themselves. In addition, participatory approaches allow for rapid adjustment of strategies in the face of changing circumstances on the ground, a flexibility that is often difficult to achieve in top-down, nationwide programs. This difference reflects the trade-off between the strength of national coverage and the depth of local engagement.

At the global level, a number of community-based programs confirm the effectiveness of participatory models such as PAR. The Care Group Approach, which has been implemented in many developing countries, has shown significant improvements in nutrition and public health indicators, such as increased vitamin A coverage, more appropriate child feeding practices, and improved hygienic behaviors, with differences in outcomes of up to 20-32 percentage points compared to non-participatory interventions. Rwanda's Gardens for Health International program is another example where family engagement in household food gardening, cooking training and practice-based nutrition education has strengthened food security and dietary diversification. Both models share key characteristics with PAR, namely a focus on local empowerment, two way dialogue and strengthening community capacity to lead health and nutrition improvements. However, these global success factors are often underpinned by cross-sector partnerships and sustained international financing, something that is rarely fully available at the local community service level in Indonesia. This comparison shows that while the global scale offers greater resources, success remains heavily influenced by the level of integration of participatory approaches.

The challenge in linking lessons from national and global programs lies in adjusting to the social, cultural and resource capacity contexts. A policy evaluation study of stunting reduction convergence in Indonesia showed that despite a comprehensive national framework, implementation at the local level was often

hampered by limited inter-sectoral coordination and low implementation capacity. On the other hand, a systematic review of participatory interventions in various developing countries shows that program success is determined by the sustainability of technical support, active community involvement, and the appropriateness of interventions to local realities. International literature also underscores the need for a combination of macro and micro strategies - combining the reach and resources of national programs with the depth of PAR adaptation - to maximize nutrition and health impacts. As such, this comparative effort does not simply look at the merits of one model, but rather finds common ground that can leverage the strengths of both to produce interventions that are culturally relevant, operationally sustainable, and broadly impactful in terms of public health.

Implications for Program Sustainability in Plantation Areas

The sustainability of Participatory Action Research (PAR)-based service programs in plantation areas is strongly influenced by the ability to build strong social capital, technical knowledge, and local capacity through active community involvement from planning to evaluation. Niteni's studies in Indonesian rural communities show that the active involvement of citizens in the co-design process is able to restore local agricultural practices that are in line with the principles of sustainability. Local agricultural practices that are aligned with sustainability principles, increase nutritional awareness, and revive traditional values that strengthen food self-reliance. In the context of plantations, sustainability is only achieved if the community has the ability to manage the program independently without excessive dependence on external parties. Research in India confirms that consistent capacity building based on human-centered participatory techniques takes a long time, but the results can create more stable economic and social resilience (Nurhikmah, Nursalam, Eko Prayetno, 2024). Key factors are the transfer of practical knowledge, strengthening of internal support networks, and optimal utilization of local resources to ensure that interventions continue even when external support is reduced.

Integration of the PAR approach with local institutional systems such as Rural Advisory Services (RAS) can strengthen program sustainability through mainstreaming nutrition into routine agricultural and village extension activities. The findings of the GFRAS initiative show that RAS has the potential to be an effective channel to expand nutrition-sensitive agriculture, provide technical assistance, and maintain program sustainability by building institutional capacity. Its application in plantations provides an opportunity for synergy between productivity of key commodities and diversification of nutritious food for local consumption. However, significant challenges arise when local bureaucracy and regulations are not flexible enough to accommodate community-based innovations, requiring policy advocacy and strengthened cross-sector coordination (Contento, 2019). In this situation, the role of local leaders and facilitators who have credibility in the eyes of the community becomes crucial to bridge community needs with support from the government or the private sector, maintain continuity of participation, and ensure the program does not stop at the initial intervention phase.

The balance between preserving traditions and implementing modern nutritional standards is an important aspect in maintaining program sustainability in plantation areas. The study of sustainable food empowerment in Bojonegoro proves that the process that begins with awareness raising, continues with capacity building, and ends with empowerment results in a community that is able to manage the program autonomously and adaptively (Eprilianto et al., n.d.). In the context of plantations, sustainability is achieved when PAR interventions focus on transferring skills that can be applied directly, building networks between residents to support each other, and implementing a participatory monitoring system that accommodates residents' feedback on an ongoing basis. This approach is in line with evidence that strengthening social capital and multi-stakeholder collaboration are prerequisites for the long-term success of community-based nutrition interventions. Ensuring sustainability therefore requires an integrated strategy that combines community empowerment, institutional support and cultural adaptation within a dynamic framework of action that is responsive to changing conditions.



Figure 2. Provision of Nutritious Food

When contrasted with Indonesia's Free Nutritious Meals program, this PAR-based intervention reveals complementary strengths. While national initiatives provide essential scale and resource allocation, our local PAR model demonstrates superior contextual adaptation. The program's ability to generate community specific solutions such as recipes using affordable local ingredients created immediate applicability that standardized national interventions often lack. This suggests a strategic opportunity for integrating PAR methodologies into national program rollouts, particularly during the community engagement and localization phases.

CONCLUSION

This community service program in the plantation area of PT Sentosa Kalimantan Jaya, Berau, demonstrates that the Participatory Action Research (PAR) approach is effective in enhancing the knowledge, attitudes, and nutritional practices of caregivers and parents in daycare centers. Significant improvements in nutritional understanding were quantitatively verified, while qualitative findings confirmed the adoption of practical behavioral changes, including menu diversification and improved hygiene practices. The success of this intervention was fundamentally driven by the participatory framework, which fostered a strong sense of ownership and empowered the community to become active agents

of change. This study adds to the expanding body of evidence demonstrating that participatory, community-based nutrition education can effectively bridge important service gaps in rural and distant health systems. The findings provide useful conceptual and policy-related insights for future program design. Specifically, the proven methodology offers a credible roadmap for local governments looking to expand the accessibility and effectiveness of national stunting reduction and nutrition initiatives in underserved areas.

For sustained impact, we recommend that the Berau District Health Office integrate this participatory training module into its ongoing coaching programs for integrated health posts (Posyandu) and early childhood education centers (PAUD). Furthermore, formally recognizing and empowering the "Nutrition Care Community" cadres within the local health structure would institutionalize this grassroots capacity. Ultimately, combining such community driven empowerment with supportive policies that address systemic barriers such as access to diverse and affordable foods is essential for achieving lasting improvements in child nutrition and health outcomes in plantation communities..

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