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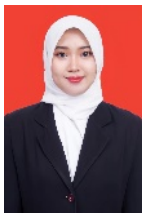

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UTILIZATION OF PROCESSING TEMPEH WASTE INTO HIGH PROTEIN FLOUR AS AN EFFORT TO PREVENT STUNTING IN KALIJAGA

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Abstract

Background. Stunting is a global health problem that affects children's growth and development, particularly in cognitive, motor, and emotional domains. In RW 04 Kalijaga Village, the problem of stunting is still a major concern because of the high prevalence of children with growth disorders compared to other areas. The main factors contributing to stunting in this region include a lack of parental education on proper parenting, a low understanding of balanced nutrition, and limited access to health services.

Aims. This study aims to identify and describe the factors that affect the incidence of stunting, as well as interventions to improve parents' understanding of how to support optimal child growth and development.

Methods. The method involves observing children's growth and development using emotional, auditory, fine motor, and gross motor parameters, as well as parenting education delivered through digital media and direct interaction.

Result. The outputs targeted in this study include increasing public understanding of child parenting, increasing awareness of the importance of monitoring children's growth and development from an early age, and the creation of educational media in the form of animated videos and comics that can be accessed by the wider community. In addition, this research contributes to mapping stunting incidence in RW 04 as a basis for public health policy-making. TKT (Technology Readiness Level) of this study is at levels 4-5, where interventions have been tested on a community scale with an education-based and digitalization-based approach.

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Implementation. The next step is to apply the results of this research at a broader scale to have a significant impact on efforts to combat stunting across regions.

Keywords: stunting; child growth and development; parenting; health education; digital intervention

INTRODUCTION

In the long term, including physical growth, cognitive development, and productivity in adulthood (WHO, 2021). This condition results from inadequate chronic nutritional intake, recurrent infections, and insufficient psychosocial stimulation during the first 1,000 days of life (Ministry of Health of the Republic of Indonesia, 2022). According to data from the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in Indonesia is 21.6%, indicating that nearly 1 in 5 children experience growth disorders (Ministry of Health of the Republic of Indonesia, 2022). In RW 04 Kalijaga Village, stunting cases are still a major concern because of the high number of children with growth disorders compared to other areas around it. Research indicates that the primary factors contributing to stunting in this region include limited parental understanding of appropriate parenting, inadequate balanced nutrition, and limited access to health services (Indrasari, 2023). Low parental knowledge about the importance of monitoring children's growth and development, including motor, hearing, and emotional aspects, can hinder the optimization of children's potential (Saputri, 2024). Effective education-based interventions not only focus on providing information, but also utilize digital media such as animated videos and educational comics to expand the reach of information to the public (HALIMAH, 2024)

Situation Analysis

Kalijaga Village is located in Harjamukti District, Cirebon City, with an area of approximately 4.65 km². This area has a growing population and is dominated by workers in the trade, services, and small and medium-sized enterprises (SMEs) sectors. RW 04, the location for the implementation of the Real Work Lecture (KKN), has a population of approximately 980 people distributed across RT 01, RT 02, and RT 03. People in RW 04 have a relatively high level of economic activity but still face challenges in health, digital literacy, and the use of innovation

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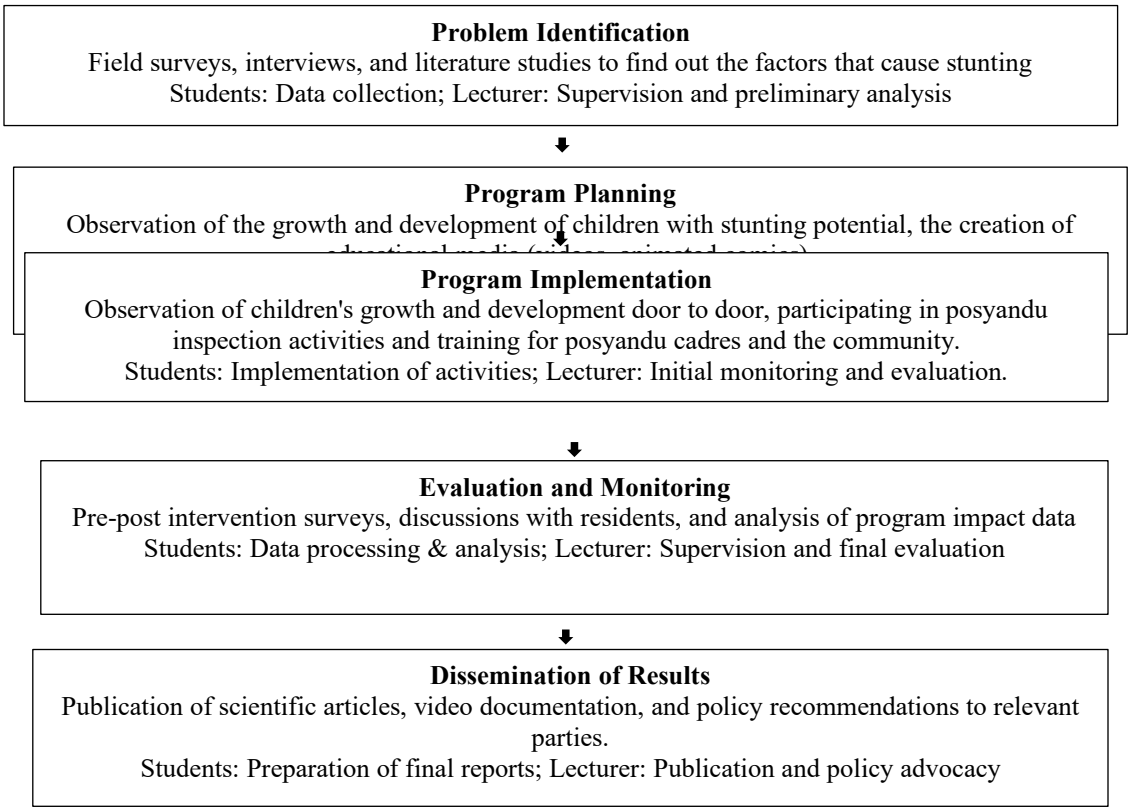
in MSMEs.

In terms of human resources, Kalijaga Village has significant potential, with a large proportion of the population in the productive age range. This can be an opportunity for community-based economic development, especially in the MSME and creative entrepreneurs sectors. In addition, public awareness of education and health is high, as evidenced by residents' active participation in religious activities, posyandu, and community empowerment programs. With the right approach, the people of Kalijaga can be more receptive to digital innovations across various aspects of life, particularly in improving health outcomes and the local economy.

In the health sector, Kalijaga Village has several health service facilities, such as Posyandu and Posbindu, spread across various RWs, including RW 04. This facility plays an important role in providing health services to pregnant women, infants, and older adults.

Team Task Activity Stage



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However, there are still challenges in increasing public awareness of the importance of preventive health and monitoring of child growth and development. Based on data from the Indonesian Nutrition Status Survey (SSGI) (Ministry of Health of the Republic of Indonesia, 2022)The stunting rate in Harjamukti District is among the highest in Cirebon City. Therefore, nutrition education and stunting prevention are two of the main focuses in the KKN program. Innovations that can be carried out include counseling on balanced nutrition for pregnant and lactating women, making healthy foods based on local ingredients such as moringa pudding and soy milk from high-protein flour obtained from tempeh waste, as well as the development of MSMEs, and the use of technology in monitoring child growth and development through digital data-based health applications.

Problems and Solutions

Although Kalijaga Village has considerable potential, several challenges remain, including a high rate of stunting that requires further nutrition interventions and limited innovation in the MSME sector, which keeps many small businesses behind in marketing and production. However, this challenge also presents a significant opportunity for students in the KKN program to make a meaningful impact on society through initiatives centered on digitalization and innovation.

METHODS

Study Design

This study employed a quasi-experimental one-group pretest–posttest design to evaluate the effectiveness of a community-based educational intervention in preventing stunting and in promoting tempeh waste utilization. This design was selected to assess changes in parental knowledge before and after exposure to the intervention program.

Study Setting and Period

The study was conducted in RW 04, Kalijaga Subdistrict, Harjamukti District, Cirebon City, West Java, Indonesia. Data collection was conducted during the community service program (Lecture Kerja Nyata) in 2024.

Participants and Sampling

The study population comprised parents of children aged 0–59 months residing in RW

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04. Participants were recruited using total sampling, whereby all eligible parents who met the inclusion criteria were invited to participate.

Inclusion Criteria:

- Parents or primary caregivers of children aged 0–59 months
- Permanent residents of the study area
- Willing to participate in all intervention activities
- Provided informed consent

Exclusion Criteria:

- Parents who were unavailable during the intervention period
- Incomplete questionnaire responses

A total of 21 participants were included in the final analysis.

Intervention Program

The intervention consisted of an integrated educational and practical program focusing on:

1. Stunting prevention and child nutrition
2. Processing tempeh waste into high-protein flour
3. Demonstration of innovative food products (silky soymori)
4. Digital-based educational media (animated videos and comics)

The intervention was delivered through interactive lectures, hands-on demonstrations, group discussions, and digital media dissemination over a four-week period.

Research Variables

The study variables included:

1. Independent Variable: Community-based educational intervention on stunting prevention and tempeh waste utilization.
2. Dependent Variable: Parental knowledge regarding: Stunting and child growth monitoring, Infant and young child feeding practices, Nutritional value of tempeh waste products, utilization of local food innovations

Data Collection Instruments

Questionnaire

A structured questionnaire comprising 12 closed-ended items was used to assess parental

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knowledge. The questionnaire covered four domains:

- Stunting awareness
- Infant feeding practices
- Nutritional literacy
- Utilization of tempeh waste

Responses were scored on a dichotomous scale (correct = 1; incorrect = 0), with higher scores indicating greater knowledge.

Prior to use, the questionnaire was reviewed by public health and nutrition experts to ensure content validity.

Observation Checklist

An observation checklist was used to document participant engagement, implementation fidelity, and practical skills during product demonstrations.

Documentation

Photographs, videos, and field notes were collected as supporting qualitative evidence.

Study Procedures

The study was conducted in six sequential phases:

1. Preparation PhaseStakeholder coordination, instrument development, media production, and facilitator training.
2. Baseline Assessment (Pretest)Administration of the knowledge questionnaire prior to intervention.
3. Educational InterventionDelivery of health education sessions and food processing demonstrations.
4. Post-Intervention Assessment (Posttest)Re-administration of the questionnaire immediately after the intervention.
5. Monitoring and Evaluation: Follow-up discussions and field observations.
6. DisseminationReporting, publication, and policy recommendation development.

Data Analysis

Quantitative data were analyzed using IBM SPSS Statistics (version XX)**.** Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to summarize

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participant characteristics and knowledge scores. Inferential statistics were conducted using a paired-samples t-test to assess differences between pretest and posttest scores. When normality assumptions were not met, the Wilcoxon signed-rank test was applied. Statistical significance was set at $p < 0.05$.

Ethical Considerations

The study adhered to the ethical principles of the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Universitas Muhammadiyah Ahmad Dahlan Cirebon (Approval No: XXX/EC/2024). All participants provided written informed consent prior to data collection. Participant confidentiality and data anonymity were strictly maintained.

DISCUSSION

The program to utilize tempeh waste as a raw material for innovative products that support sensitive nutrition interventions to reduce stunting is implemented in three main stages. The first stage began with measuring parental knowledge of stunting and tempeh waste use via the distribution of pre-test questionnaires. Furthermore, the second stage involves providing education on stunting prevention through innovative tempeh-waste products, such as high-protein flour and silky soymori. The last stage is program evaluation through the provision of post-test questionnaires and direct observation at the service location to assess changes in parents' knowledge and behavior. Discussions with partners were also held to assess the extent to which this intervention increased public understanding of stunting and the use of tempeh waste.

Table 1. Pre-post Measurement Results Regarding Stunting Knowledge and Tempeh Waste Utilization

Yes	Questions	Pre-Test (n)	Pre-Test (%)	Post Test (n)	Post Test (%)
1	Do you know what stunting is?	20	95,2381	21	100
2	Does the mother give exclusive breast milk for 6 months?	21	100	21	100
3	Do mothers give formula before the child is 6 months old?	1	4,761905	21	100
4		21	100	21	100

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5	Does the mother give complementary foods to breast milk after the baby is 6 months old?	21	100	21	100
6		21	100	21	100
7	Do mothers often take their children to the posyandu for weighing?	21	100	21	100
8	Is the child's immunization complete?	16	76,19048	21	100
9	Do you know that tempeh waste can be used as a source of nutrition?	8	38,09524	21	100
10	Do you know about the nutritional content of tempeh waste?	5	23,80952	21	100
11	Have you ever used tempeh waste as a source of nutrition?	6	28,57143	21	100
12	Do you believe that tempeh waste can help address stunting?	7	33,33333	21	100

Overview of Parents' Knowledge about Stunting in RW 04 Kalijaga

Stunting counseling activities at RW 04 Kalijaga focus on increasing parents' knowledge about stunting and the use of innovative products, namely high-protein flour from tempeh waste and silky soymori. Based on the results of the questionnaire in Table 1, the questionnaire was administered to 12 participants in the post-questionnaire, indicating the effectiveness of the intervention given.

Figure 1 . Stunting counseling and demonstration of making silky soymori and the use of high-protein flour from tempeh waste

It shows a significant increase in respondents' knowledge of stunting and the benefits of the introduced products. The average knowledge score of the respondents increased from 7.67. During the counseling session, a demonstration was conducted to produce silky soymori and to highlight

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the use of high-protein flour derived from tempeh waste as an alternative source of nutrition to prevent stunting. The questionnaire indicated that the majority of respondents understood the product's nutritional benefits and were willing to use it in daily life. This result is evident in the change in knowledge category, with all respondents reaching the "Good" category after the intervention.

The involvement of MSMEs in this activity is limited to supplying tempeh waste, which the KKN team processes into high-protein products. This collaboration not only supports efforts to combat stunting but also provides economic benefits for local MSMEs as suppliers of raw materials. Counseling on stunting and the demonstration of innovative products increased the knowledge of the people of RW 04 Kalijaga. This program demonstrates that educational approaches and local product innovation can be effective strategies for supporting toddler health and preventing stunting.

Figure 2. Kodela Flour Products

Figure 3. SoyMori Silky Products

Based on questionnaire data, the average level of parental knowledge about stunting and the use of tempeh waste before the intervention was carried out was around 80%, with certain questions showing a lower percentage, for example, only 4.76% on the question about giving

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formula milk before the child was 6 months old. Following the educational intervention, knowledge increased significantly, reaching 100% across all questions.

This shows that the transfer of knowledge about stunting and the use of tempeh waste as an innovative product can be well received by the community. This increase not only reflects the success of the educational program but is also expected to influence parents' use of tempeh-based waste products to prevent stunting in their children.

Education is an effective strategy for increasing public knowledge of stunting, as supported by prior research. According to (Tarmizi, 2024) Increasing public knowledge through health education and counseling has been shown to be effective in promoting healthy behavior changes, including improvements in nutrition and stunting prevention. Evidence from previous research supports the effectiveness of education in increasing public knowledge of stunting. For example, research by (Indrasari, 2023) It shows that nutrition education is effective in increasing knowledge of stunting prevention in mothers who have children at risk of stunting. This study found a significant increase in maternal knowledge following nutrition education ($p = 0.05$).

CONCLUSIONS AND SUGGESTIONS

Counseling on stunting and the demonstration of innovative products increased the knowledge of the people of RW 04 Kalijaga. The KKN program in RW 04 Kalijaga shows that digitally based educational approaches and innovations in local food products can increase public knowledge and effectively support stunting prevention. Through proper education and collaboration with MSMEs, it is hoped that this program can be replicated in other regions to have a wider impact in reducing stunting rates in Indonesia.

This conclusion emphasizes the importance of further research that can focus on the effectiveness of various methods of education and food product innovation in reducing stunting rates. In addition, the development of community-based intervention models is needed to ensure the sustainability of educational programs.

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