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DEVELOPING MORINGA COOKIES FOR STUNTING PREVENTION: MERDEKA ENTREPRENEURSHIP PROGRAM

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ABSTRAK

Abstrak: Stunting masih menjadi permasalahan kesehatan utama di Indonesia yang memerlukan upaya pencegahan berkelanjutan berbasis pangan lokal. Kegiatan pengabdian ini bertujuan untuk mengembangkan inovasi produk pangan berbahan dasar daun kelor sebagai upaya pencegahan stunting sekaligus meningkatkan kompetensi kewirausahaan mahasiswa melalui Program Wirausaha Merdeka. Kegiatan dilaksanakan selama empat bulan dengan melibatkan 6 mahasiswa lintas program studi yaitu pendidikan bahasa Inggris, matematika dan biologi. Metode pelaksanaan meliputi pelatihan kewirausahaan, riset pasar, pengembangan dan uji produk, branding, pemasaran digital, serta kegiatan demoday. Evaluasi dilakukan melalui penilaian kinerja peserta, kualitas produk, dan respon pasar pada tahap awal pemasaran. Hasil kegiatan menunjukkan bahwa mahasiswa berhasil mengembangkan dan meluncurkan produk Kelofav Cookies, kue kering berbahan daun kelor dengan nilai gizi, kemasan menarik, dan strategi pemasaran yang sesuai kebutuhan pasar. Produk memperoleh respon positif dari mentor dan calon konsumen. Kegiatan ini membuktikan bahwa integrasi inovasi pangan lokal dan pembelajaran kewirausahaan efektif dalam mendukung pengembangan UMKM sehat serta berkontribusi pada upaya pencegahan stunting di tingkat daerah.

Kata Kunci: Stunting; Daun Kelor; Inovasi Pangan Lokal; Kewirausahaan Mahasiswa; UMKM Sehat.

Abstract: *Stunting remains a major public health problem in Indonesia and requires sustainable prevention efforts based on local food resources. This community service program aimed to develop an innovative food product made from moringa leaves as a stunting prevention initiative while enhancing students' entrepreneurial competencies through the Merdeka Entrepreneurship Program. The program was conducted over four months and involved six students from different academic backgrounds, namely English education, mathematics, and biology. The implementation methods included entrepreneurship training, market research, product development and testing, branding, digital marketing, and a demo day. Evaluation was carried out through assessments of participant performance, product quality, and initial market responses. The results showed that the students successfully developed and launched Kelofav Cookies, a moringa-based cookie with nutritional value, attractive packaging, and market-oriented marketing strategies. The product received positive feedback from mentors and potential consumers. This program demonstrates that integrating local food innovation with entrepreneurship learning is effective in supporting the development of healthy micro, small, and medium enterprises (MSMEs) and contributes to stunting prevention efforts at the local level.*

Keywords: *Stunting; Moringa Leaves; Local Food Innovation; Student Entrepreneurship; Healthy MSMEs.*

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A. INTRODUCTION

Stunting remains a critical global nutrition issue that continues to threaten children's physical growth, cognitive development, and long-term human capital formation. The condition is closely associated with chronic malnutrition, recurrent infections, and inadequate care during the first 1,000 days of life. In Indonesia, stunting remains a pressing public health challenge, with prevalence rates among the highest in Southeast Asia, ranking second only to Cambodia and placing Indonesia 108th out of 132 countries globally. These figures indicate not only persistent nutritional gaps but also structural inequalities related to food access, health services, education, and socioeconomic status. Without effective and sustainable interventions, stunting may reduce productivity and perpetuate intergenerational poverty, highlighting the urgency of integrated prevention strategies.

In response to the high prevalence of stunting, the Indonesian government has designated stunting reduction as a national priority within the National Medium-Term Development Plan (RPJMN) 2020–2024. This policy framework emphasizes multisectoral collaboration involving health, education, agriculture, sanitation, and social protection sectors. Key strategies include improving maternal and child health services, strengthening food and nutrition security, promoting behavioral change through community education, and expanding access to clean water and sanitation. These coordinated efforts demonstrate a holistic approach to addressing both direct and indirect causes of stunting. However, the success of national policies depends heavily on community-level implementation and locally grounded innovations that align with regional resources and cultural practices.

One strategic approach to supporting stunting prevention at the community level is the development of innovative food products based on local nutritional resources. Local food innovation not only enhances dietary diversity but also ensures cultural acceptability, affordability, and sustainability. Among various indigenous plants, moringa (Moringa oleifera) has gained increasing attention due to its high nutritional value and adaptability in tropical regions. Integrating local food innovation into community empowerment programs aligns with broader goals of food security, nutrition improvement, and economic resilience. Within this framework, food-based interventions can function as both health promotion tools and drivers of small-scale entrepreneurship, particularly when supported by structured training and institutional programs.

Moringa (Moringa oleifera) is a versatile plant whose roots, leaves, pods, and bark can be processed into various foods and beverages, making it a promising solution to malnutrition and stunting, especially in low-income communities (Lu et al., 2025; Fertiasari et al., 2022). Moringa leaves are rich in vitamins A and C, calcium, iron, and phosphorus, although iron

bioavailability remains a challenge. Traditionally, moringa leaves are consumed as cooked vegetables, fresh greens, or raw ingredients. Research consistently highlights their nutrient density, antioxidant properties, and bioactive compounds, as well as their potential for therapeutic use and food fortification. These characteristics position moringa as a strategic ingredient for community-based nutrition interventions.

Recent studies have further demonstrated the functional, nutritional, and socio-economic potential of moringa leaves. Galaboyi et al. (2024) reported high community awareness of moringa's benefits, although sensory issues such as taste and limited sensitization hindered wider utilization. Priyadarshini et al. (2025) found that ohmic heating preserved moringa leaf nutrients more effectively than conventional steam blanching methods. Aryani et al. (2025) showed that targeted community training significantly improved women's skills in producing moringa-based food products. Additional research highlighted functional applications, including improved bread quality through steam-treated moringa leaf powder (Koriyama et al., 2025) and enhanced egg quality and reproductive performance in hens using moringa supplementation (Ikpoh et al., 2025). Collectively, these studies confirm the multifaceted potential of moringa while indicating the importance of appropriate processing, training, and product development.

Despite its nutritional advantages, the utilization of moringa in community diets remains limited due to challenges related to taste preferences, product innovation, packaging, branding, and market access. Many communities and small producers lack the technical skills and entrepreneurial capacity to transform moringa into attractive, value-added food products that meet modern consumer expectations (Kromidha et al., 2025). This gap presents a critical partner problem in community-based stunting prevention initiatives, where nutritional potential is not fully translated into economic and social benefits. Universities, therefore, play a crucial role in bridging this gap by equipping students with interdisciplinary skills in food innovation, entrepreneurship, and digital marketing, while simultaneously addressing community health challenges.

Building on these challenges and opportunities, this community service program aims to develop an innovative moringa-based food product as a strategy for stunting prevention while strengthening students' entrepreneurial competencies through the Merdeka Entrepreneur Program. Specifically, the program focuses on the development of KeloFav Cookies as a nutritious, affordable, and market-oriented snack derived from local moringa leaves. Through entrepreneurship training, market research, product development, branding, digital marketing, and a demo day, the program seeks to demonstrate how student-led innovation can contribute to healthy micro, small, and medium enterprises (MSMEs) and support local efforts in reducing stunting. This initiative highlights the integration of academic learning, community engagement, and sustainable development goals.

B. METHODS

This study was conducted in Lebak Regency, Banten Province, Indonesia, and involved six undergraduate students from three academic backgrounds—English Education, Mathematics Education, and Biology Education—who participated as program beneficiaries and implementers in the Merdeka Entrepreneur Program. The community partner consisted of local stakeholders concerned with nutrition and small-scale food production. The study employed a Design-Based Research (DBR) approach following the four-stage model proposed by Reeves (2006), which includes: (1) initial analysis, (2) design and development, (3) iterative testing and refinement, and (4) reflection to produce final design principles. This approach was selected to ensure that the innovation process was systematic, context-responsive, and practice-oriented.

1. Pre-Implementation Stage: Initial Analysis

The initial analysis stage aimed to establish a theoretical foundation and identify partner needs related to stunting prevention and the utilization of moringa-based food products. A qualitative approach was employed through a comprehensive literature review, field observations, semi-structured interviews with participants and community partners, and document analysis. Triangulation of data sources was applied to enhance validity. Data were analyzed using the interactive model proposed by Miles et al. (2021), which consists of data reduction, data display, and conclusion drawing. The primary output of this stage was a needs analysis that informed the design of training materials, product formulation, and entrepreneurial activities.

2. Implementation Stage: Design and Development

Based on the findings from the initial analysis, the researchers designed and developed the initial prototype of KeloFav Cookies. This stage involved entrepreneurship training sessions covering nutrition awareness, basic food processing, product formulation, hygiene standards, branding concepts, and digital marketing strategies. Practical activities included hands-on product development, packaging design, and branding practice under researcher supervision. Expert validation was conducted to assess product feasibility in terms of nutritional value, taste, texture, packaging, and market potential. Feedback from experts guided revisions to ensure that the prototype met technical and consumer readiness criteria prior to field testing.

3. Implementation Stage: Iterative Testing and Refinement

Product trials were conducted using a pre-experimental approach to evaluate the usability, acceptability, and sensory qualities of the KeloFav Cookies prototype. Testing involved potential consumers and community representatives, with responses collected through closed-ended questionnaires based on sensory evaluation indicators such as taste, aroma,

texture, appearance, and overall acceptance. Each testing cycle generated quantitative and qualitative feedback that informed iterative revisions to improve product quality. This cyclical process ensured that the product development was responsive to user preferences and market expectations.

4. Evaluation and Reflection Stage

The final stage focused on evaluation and reflection to produce a market-ready product and design principles for future implementation. Data were collected through questionnaires, observations, and focus group discussions (FGDs) involving student participants and mentors. Qualitative data were analyzed using Thematic Analysis following Braun and Clarke (2021) to identify patterns related to learning experiences, entrepreneurial skill development, and perceived program benefits. Quantitative data from five-point Likert-scale questionnaires were analyzed descriptively to measure participant performance, product feasibility, and market response. Indicators of success included improved entrepreneurial competencies among students, positive sensory evaluation results, successful product launch during the demo day, and favorable initial market responses. The final outputs consisted of a refined KeloFav Cookies product and a set of design principles to guide future moringa-based food innovation initiatives.

C. FINDINGS AND DISCUSSION

The development of students' creative business products for stunting prevention in the form of KeloFav Cookies was developed through DBR, including the analysis stage, product development and design, and product testing and evaluation stages. Each research data result is presented and explained as follows.

1. Pre-Implementation Stage: Needs Assessment and Partner Context

During the pre-implementation stage, a needs assessment was conducted to identify community conditions, available local resources, and opportunities for stunting prevention through food-based entrepreneurship. Observations and interviews with community members indicated that moringa trees were widely cultivated in household yards, yet their utilization remained limited to traditional consumption methods. At the same time, access to affordable and nutritious supplementary foods for children was perceived as inadequate. Interview findings revealed that while community members recognized the importance of nutritious food for stunting prevention, they lacked knowledge and skills to process moringa into child-friendly and marketable products. These findings demonstrate a clear gap between nutritional potential and practical utilization, justifying the development of moringa-based cookies as both a health intervention and a home-based business opportunity.

2. Implementation Stage: Product Development and Capacity Building

Based on the needs assessment, the implementation stage focused on product development and entrepreneurial capacity building. A standardized production process for KeloFav Cookies was developed, including ingredient formulation, baking procedures (see Figure 1), and packaging design. Cost analysis results showed that the total raw material cost per production batch was relatively low, enabling affordable pricing and scalability. The Cost of Goods Sold (COGS) was calculated at Rp 2,907.51 per pouch and Rp 116.30 per cookie, supporting competitive market positioning. Expert validation (see Table 1) involving a nutritionist, a food business practitioner, and an entrepreneur resulted in iterative improvements related to sugar balance, texture, packaging clarity, and branding. These revisions strengthened the nutritional quality, sensory attributes, and market readiness of the product, demonstrating the effectiveness of hands-on training, practice, and mentoring during the implementation phase.

Figure 1. Community Based Production Process of KeloFav Cookies

Table 1. The Result of Experts Validation

No	Expert Judgement (Feedback and Suggestion)	Follow up
A.	**Nutritionist**	
1	The product's nutritional composition aligns well with healthy snack standards; however, further analysis is recommended to determine the precise macronutrient and micronutrient content.	Revised (nutritional analysis will be conducted)
2	The use of Moringa oleifera (*kelor*) powder enhances the nutritional value, but portion size and sugar content should be balanced to maintain overall health benefits.	Revised (adjusted sugar ratio)
3	The label should include clear nutritional information to inform consumers.	Revised (label redesigned)
B.	**Snack and Food Business Practitioner**	
1	The taste and texture are generally acceptable, but a slight adjustment in sweetness and crispiness is suggested to enhance consumer appeal.	Revised (reformulated cookie ratio)
2	Packaging design is attractive, yet it could better highlight the unique selling point the use of *kelor* as a functional ingredient (added highlight on "Moringa-based healthy snack").	Revised

No	Expert Judgement (Feedback and Suggestion)	Follow up
3	Suggests adding concise product information or tagline to strengthen market branding.	Revised
C.	**Entrepreneur**	
1	The visual presentation is appealing and professional, though color contrast could be improved for better readability.	Revised
2	Product price and portion need to be aligned with target market expectations.	Revised (pricing adjusted)
3	The overall product concept is promising and marketable; recommends future consumer testing for broader validation.	To be followed up (planned in next phase)

3. Evaluation Stage: Consumer Testing, Market Response, and Outcomes

The evaluation stage consisted of iterative consumer testing, focus group discussions (see Table 2), and questionnaire-based assessments to measure product acceptability and program outcomes (see Table 3). Sensory evaluations showed high levels of consumer agreement regarding taste, texture, aroma, visual appeal, and overall acceptability. Quantitative results indicated strong consumer interest, with more than 60% of respondents expressing willingness to recommend and purchase the product. Business feasibility analysis further demonstrated that the product reached its break-even point at approximately 414 pouches per month, indicating low financial risk. During a public product exhibition event (see Figure 2), the product received strong interest from visitors and resulted in 120 purchase orders, providing concrete evidence of market acceptance. These outcomes confirm that the program successfully achieved its objectives in developing a nutritious, market-ready product while strengthening participants' entrepreneurial competencies.

Table 2. Summary of FGD Results on KeloFav Cookies Prototype

No	Feedback from FGD Participants
1	Participants expressed high enthusiasm toward the concept of KeloFav Cookies as a healthy, *kelor*-based snack.
2	The initial prototype was perceived as slightly less crispy; formulation adjustments were made to improve texture.
3	The natural taste of Moringa oleifera was distinct, but some participants suggested balancing it with a slightly stronger sweetness level.
4	Participants noted that the cookies had a pleasant aroma after the second trial, with reduced bitterness from the *kelor* powder.
5	The packaging was considered attractive and informative, effectively conveying the product's healthy positioning.
6	Overall, participants stated that KeloFav Cookies were unique, nutritious, and suitable for both children and adults.

Table 3. Consumers' Evaluation of KeloFav Cookies Prototype

No	Statement	Response				
		SD	D	MA	A	SA
1	The cookies have a pleasant and well-balanced sweetness.	-	3%	5%	22%	70%
2	The texture of the cookies is crisp and enjoyable.	-	2%	10%	18%	70%
3	The aroma of the cookies is natural and appetizing.	-	-	8%	25%	67%
4	The taste of Moringa oleifera blends well with other ingredients.	-	4%	9%	20%	67%
5	The cookies' color and shape are visually appealing.	-	-	7%	25%	68%
6	The packaging design is attractive and reflects a healthy product concept.	-	3%	10%	17%	70%
7	The product is suitable for daily consumption as a nutritious snack.	-	5%	8%	27%	60%
8	The cookies leave a pleasant aftertaste without bitterness.	-	7%	12%	25%	56%
9	I would recommend KeloFav Cookies to others.	-	5%	9%	26%	60%
10	I am interested in purchasing KeloFav Cookies if available in the market.	-	3%	8%	24%	65%

Note: SD (strongly disagree); D (disagree); MA (moderately agree); A (agree); SA (strongly agree).

Figure 2. Product Exhibition and Market Evaluation Activity

The development of KeloFav Cookies illustrates how Design-Based Research (DBR) can integrate local resources, nutritional needs, and entrepreneurial learning to address stunting. DBR's iterative and context-responsive approach (Cochrane et al., 2024; Reeves, 2006) supported the systematic formulation, expert validation, and refinement of a moringa-based product, building on evidence of Moringa oleifera's nutrient density and potential to reduce undernutrition (Ali et al., 2022; Badadhe et al., 2025; Sokhela et al., 2023). Consistent with prior studies on food product development (Haagen-Schützenhöfer et al., 2024; Pravitasari & Wilantika, 2024; Ruczynski et al., 2025), iterative sensory evaluation improved taste, texture, and visual appeal key predictors of consumer acceptance (Muhammad et al., 2025; Nyefene et al., 2025; Silva et al., 2025). Financial analysis further confirmed the product's feasibility, aligning with MSME sustainability frameworks emphasizing low-cost, scalable models (Martini et

al., 2022; Muñoz et al., 2024; Pangarso et al., 2022). Participation in the Merdeka Entrepreneurship Program also strengthened students' entrepreneurial skills, supporting research showing that experiential learning enhances creativity and business readiness (Chen et al., 2022; Magasi, 2022; White & Hertz, 2022). The strong consumer response during Demoday provides additional evidence that real-world exposure builds market understanding. Overall, this study highlights the value of combining food innovation, community engagement, and entrepreneurship education to generate scalable, context-appropriate solutions for stunting prevention.

D. CONCLUSION AND SUGGESTION

This community service program demonstrates that the integration of Design-Based Research (DBR), local moringa utilization, and entrepreneurship training can effectively generate a functional food product with both social and economic value. The findings from the pre-implementation stage confirm that moringa leaves were locally available but underutilized, and that communities lacked access to affordable, nutritious, and child-friendly supplementary foods. These conditions justified the development of KeloFav Cookies as a locally grounded response to stunting prevention. During the implementation stage, the program successfully translated identified needs into concrete actions through product formulation, hands-on production, expert validation, and entrepreneurial mentoring. The iterative development process resulted in a moringa-based cookie that met nutritional considerations, sensory preferences, and market expectations. In the evaluation stage, consumer testing, business feasibility analysis, and market exposure activities demonstrated strong sensory acceptance, financial viability, and positive market response. Collectively, these outcomes indicate that the program objectives were achieved and that KeloFav Cookies represent a viable model for community-based stunting prevention while simultaneously strengthening students' entrepreneurial competencies through the Merdeka Entrepreneurship Program.

Based on evaluation findings, future initiatives should conduct laboratory-based nutritional analysis, expand consumer testing involving parents and children, and diversify product flavors and packaging. Capacity-building for community members in standardized production and digital marketing is also recommended, along with collaboration with local health institutions to integrate the product into stunting-prevention programs. Continued entrepreneurship education is essential to support scalable, community-centered nutrition innovations.

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