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Training on improving food products through the development of aloe vera-based products in Argomulyo Village, Sedayu, Bantul

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ABSTRACT

The objective of this community service activity to increase the capacity of the community of Argomulyo Village, Sedayu, Bantul, to develop aloe vera-based food products, specifically aloe vera nata. The main problems faced by the community include the suboptimal utilization of aloe vera, the lack of processing technology, and a lack of understanding of good food production standards. The training was conducted through outreach, demonstrations on making aloe vera nata, and mentoring on sustainable production. Through these activities, participants gained knowledge about the nutritional content and economic potential of aloe vera, understood the principles of fermentation, and were able to produce aloe vera nata. Evaluation results showed an increase in participants' knowledge and skills in making aloe vera nata. This activity is expected to be the first step in strengthening the community's economy through innovative aloe vera products.

KEYWORDS
Aloe vera
Community empowerment
Food innovation

1. Introduction

Aloe vera is a plant that has been known for thousands of years and is commonly used as a hair conditioner, burn healer, and to soften the skin. Various studies have shown that aloe vera's benefits extend beyond external use; it can also be consumed. Aloe vera contains Vitamin A, Vitamin B, Vitamin C, calcium, potassium, magnesium, sodium, and other minerals that support the body's mineral needs [1]–[6]. Processing aloe vera for food or beverages requires a special process. The high sap (exudate) content can cause a bitter taste if not processed properly. Furthermore, aloe vera gel (the slimy flesh) is susceptible to oxidation, requiring hygienic and precise processing for longer shelf life [7]–[9].

This community service activities were conducted by a collaborative team from Ahmad Dahlan University and Jenderal Achmad Yani University in Yogyakarta with the goal of developing aloe vera-based products. The team provided training to the community on how to process aloe vera into quality food products through hygienic production processes, thereby increasing its economic value. Aloe vera cultivation area currently covers 800 m^2, planted with 800 Aloe barbadensis varieties as the initial phase of development. Later they were expanded which are covered 1,600 m^2 area. The Argomulyo community as the second parthner also has a strong enthusiasm for developing local food businesses. However, limited knowledge regarding processing techniques, production management, and product innovation is a major obstacle that needs to be addressed. Therefore, this community service activity focuses not only

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on technical training but also on empowering the community to become independent in processing and developing products.

The development of aloe vera nata de product was chosen because its production process is relatively easy, can be done with simple equipment, has high added value, and has the potential to become a superior village product. Furthermore, this product can be an alternative diversification of aloe vera products with broader market appeal, particularly in the beverage and functional food sectors.

Through this training, it is hoped that the community will be able to optimally utilize local resources, create new business opportunities, and support the creation of an "Aloe Vera Village" as a new identity and economic potential for Argomulyo Village.

Globally, demand for functional food products continues to increase in line with increasing public awareness of the importance of health [10]. Aloe vera is a commodity with high functional value due to its antioxidants, fiber, and bioactive compounds such as aloin and aloesin, which have been shown to benefit the digestive system and immunity [11], [12]. Therefore, developing processed aloe vera products presents a strategic opportunity to boost the local economy.

Furthermore, strengthening community capacity through locally-based training has proven effective in improving the skills and economic independence of villagers [13]. With a participatory approach, this training not only provides knowledge transfer but also encourages community active involvement in the entire process, from planning to production. It is hoped that this activity will trigger the formation of joint business groups and open broader market access, both through direct sales and digital platforms. Thus, the use of aloe vera extends beyond food processing to become part of a sustainable community empowerment strategy.

Beyond the economic aspect, the development of processed aloe vera products also aligns with efforts to increase food security based on local potential. According to the Ministry of Agriculture (2021), strengthening local food is a crucial strategy in addressing the dynamics of climate change, fluctuating global commodity prices, and the increasing demand for functional foods. Aloe vera, as a plant that is resistant to dry conditions and easy to cultivate, provides a distinct advantage for the Argomulyo community in creating innovative food products.

Various studies have shown that diversification of aloe vera processing can increase the added value of products by 3–5 times compared to the sale of raw materials. This makes the development of aloe vera nata de a strategic step to increase household income, particularly for women's groups such as the PKK team, which are actively involved in food processing activities at the village level.

From a sustainability perspective, the development of aloe vera-based products also supports the concept of a circular economy. Previously unused plant parts, such as the skin and remaining gel, can be reprocessed into liquid organic fertilizer or animal feed additives [14]. Thus, this activity focuses not only on food processing, but also environmentally friendly waste management.

With this significant potential, this community service activity is expected to serve as a starting point for establishing an aloe vera business ecosystem in Argomulyo Village. The successful development of aloe vera nata de can open opportunities for broader collaboration, including with local governments, and entrepreneurial mentoring institutions. This is a crucial foundation for establishing Argomulyo as a center for competitive aloe vera-based product innovation.

2. Method

This community service activities used a participatory training approach aimed at improving the quality of aloe vera-based products through structured production practices and evaluation. There were five main stages in the method applied: (1) Preparation, (2) Material Delivery, (3) Production Practice, (4) Evaluation, and Sustainability Monitoring. Each stage is explained as follows:

- Preparation

  The first activity was initial coordination with Jatam Sedayu and PKK Argomulyo partners to identify initial conditions, existing production practices, and key challenges in aloe vera processing. Training

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materials, simple production guidelines, and evaluation instruments were prepared to ensure the activities aligned with the Partners' needs and were appropriate to undertake.

- Delivery of Training Materials

  At this stage, participants were introduced to important materials and the basic principles of quality-oriented production. The material delivery was focused on general aspects such as material selection, gel cleaning, cooking processes, and product preparation and packaging. This session highlights cleanliness, consistency, and product quality as key factors influencing consumer acceptance and marketability.

- Production Practices

  Participants immediately practiced making aloe vera products under the supervision of the trainers. Production practices emphasize the application of the material presented, including selecting appropriate raw materials, properly cleaning aloe vera gel, processing it into consumable products, and hygienically and standardly preparing materials for packaging. This practical activity aims to strengthen participants' practical skills and confidence in producing higher quality products.

- Evaluation

  The evaluation was conducted to assess the effectiveness of the training and the improvement of participants' skills. Three instruments were used: a skill observation sheet used to document participants' ability to apply production steps during the exercise, an interview instrument, and self-reflection. To capture participants' understanding, perceptions, and challenges related to the quality of aloe vera products and their production process. Other evaluation was conducted qualitatively through direct observation of participants' skills during the practice, interviews and reflective discussions to explore understanding, challenges, and further needs, simple organoleptic assessment, including the texture, aroma, and clarity of the aloe vera nata solution. Monitoring methods were conducted after the activity through communication with participants and village officials to assess the sustainability of community production.

- Sustainability Monitoring

  The final stage focuses on monitoring the sustainability of the activity results. Follow-up observations and intensive informal communication were conducted to identify the extent to which participants continued to apply the improved production practices. This stage aimed to ensure that the training contributes to long-term product quality improvement and supports the sustainability of community-based aloe vera businesses.

3. Results and Discussion

The findings of this community service activity were obtained through direct observation of participants' skills during production practice, interviews and reflective discussions, simple organoleptic assessments, and monitoring of post-activity sustainability.

3.1. Implementation of Aloe Vera–Based Food Products Training

Processing aloe vera into nata de aloe vera was the best way because it could increase the utilization of aloe vera which have been already cultivated. At first, Aloe vera plants were only planted as an ornamental plants around their house. They did not utilized those plants into more beneficial such as medicinal treatment helping to treat various ailments, including diabetes, cholesterol, and gastritis. For the reason, to utilize aloe vera plants to gain more benefits, the community service team conducted training activities related to aloe vera processing. Utilizing them into nata de aloe vera can increase community income.

To respond the condition, a training on managing aloe vera to become nata de aloe vera was held on November 3, 2025, at the Argomulyo Village Hall. The training on processing them into nata de aloe vera was considerd as the best effort to improve the skills of the community. The training also aimed to help them in developing their existing and new micro-small businesses. Community empowerment was set to increase their awareness and willingness to improve their own well-being.

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The training served with a comprehensive presentation on the benefits of aloe vera, how to select aloe vera, how to remove toxins from aloe vera, how to process aloe vera to become nata de aloe vera, and how to market nata de aloe products through digital marketing. The purpose of the training was to provide information to the participants about managing aloe vera to become an economically valuable product. During the presentation of the socialization material, the community was quite enthusiastic because they received new information. They understood that aloe vera that is suitable for making nata de aloe products is aloe vera that is 8-12 months old [15]. The participants also learned that the yellow liquid from the aloe vera plant is poisonous if consumed, but is beneficial as a topical treatment for wounds. This is because aloe vera mucus contains aloin, derived from latex, which has numerous benefits, including anti-inflammatory, anti-fungal, antibacterial, and cell regeneration, making it effective for wound healing [16].

The training activity was designed using a participatory approach, a training method that emphasizes active community involvement in every stage of the learning process. Participants not only received theoretical material but also participated in demonstrations, group practice, and group discussions. This approach was considered effective in community empowerment activities because it could increase independence, practical skills, and sustainable participation. The tools and materials used to make nata de aloe vera include aloe vera, salt, citric acid, pandan leaves, granulated sugar, salt, sodium benzoate, lychee flavor, aloe vera nata cups, a wide sieve, a plastic basin, and an aluminum basin.The training was divided into two main stages: material presentation and hands-on practice. Participants were given an explanation of the nutritional content of aloe vera gel, its economic potential as a raw material for functional products, and the business opportunities of aloe vera nata products as an alternative for local food diversification. The material also covered household food safety standards, equipment sanitation principles, and simple packaging techniques. The training was delivered using an interactive lecture method, video screenings, and a question-and-answer session.

The production practice was also conducted with direct guidance from the team, starting from raw material selection to packaging. Participants selected large (≥0.5 kg) aloe vera fronds with a thick, hard texture and washed them thoroughly. The fronds were cut in half and the thorny edges were removed before being split into several sections and peeled with a spoon until a clear gel was obtained. The gel is cut into approximately 2x2 cm cubes and salted to stimulate mucus production. The gel is then washed under running water until clean and dry. This step is repeated using a citric acid solution to obtain a cleaner gel. Next, the gel is soaked for three hours or overnight to reduce excess saltiness or acidity. The cleaned gel is then boiled in boiling water with pandan leaves to achieve optimal aroma and texture. After boiling for approximately 5 minutes, the gel is drained and prepared as the main ingredient for nata. In the next step, participants make a syrup solution by boiling two liters of water with 500 grams of sugar, a little salt, citric acid, sodium benzoate, and fruit flavoring. The solution is then filtered and cooled. The packaging process involves placing 50 grams of gel pieces into 200 ml cups, adding the syrup solution until full, sealing with a cup sealer, and labeling. The cups are stored at room temperature for 1–3 days until the aroma and flavors combine. The product's success is indicated by the gel pieces sinking to the bottom of the cup.

Training on improving aloe vera-based food products through training on making aloe vera nata. Aloe vera processing uses aloe vera pulp, sugar, water, lychee flavoring, and citric acid as raw materials and additives. This aloe vera processing produces aloe vera nata, a food or drink obtained from aloe vera pieces mixed with a solution of sugar, flavoring, and citric acid. This processed aloe vera food has many benefits. Therefore, processing is crucial to ensure its benefits are minimized or minimized due to improper processing.

In addition to outreach on aloe vera management, the community service team also conducted outreach on digital marketing strategies for nata de aloe products. Marketing is a crucial aspect of product sales; effective product marketing can increase sales [17]. According [18], there are two marketing strategies: conventional marketing strategies and digital marketing strategies. Our outreach activities further explained digital product marketing strategies. Marketing methods that can be used to introduce products digitally include utilizing social media platforms such as WhatsApp, Instagram, Facebook, TikTok, and Shopee to promote products. In today's digital era, business owners must be quicker and more responsive to technological developments, especially in marketing strategies. According to Hendarsyah (2020) [19], digital marketing strategies have a very high potential for attracting consumers through social media. The training received a positive response from the community and was beneficial

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because they gained a better understanding of marketing strategies for selling aloe vera nata products in the Argomulyo Village Hall and increasing their income.

3.2. Participants' Understanding, Challenges, and Further Needs

Based on the direct observation during the practices, the participants' skills showed a moderate to high level of improvement. Most of the participants were able to select Aloe vera raw materials more accurately, clean the gel more thoroughly, and apply a more structured processing method. Of all them, the majority were in the high category for process cleanliness and work sequence, while a small portion were still in the medium category, particularly regarding consistency in thickness and processing time.

Additionally, based on the analysis of the questionnaire distributed to 40 training participants from women who are members of the PKK community in Argomulyo Village, only 38 questionnaires were returned and completely filled out, allowing for further analysis. The analysis results showed an increase in the knowledge and understanding of the participants after they attended the training to improve the quality of Aloe Vera-based food products. The training materials covered raw material selection, hygienic processing techniques, flavor enhancement, and product packaging strategies. Quantitatively, the average score of the participants increased from the pre-training stage to post-training stage. Table 1 depicts the participants' knowledge level and their improvement.

Table 1. Participants' Knowledge Levels after Training

Knowledge Category	Score Range	Number of Participants	Percentage (%)
High	≥ 75	14	35.0
Medium	50–74	9	22.5
Low	< 50	17	42.5
Total	—	40	100.0

Based on the categorization of their knowledge level, participants who were classified into the high knowledge category reached 35 % who indicated a strong understanding of the training material. Participants in this group were able to answer most of the aquestions correctly, reflecting the effectiveness of the training for participants with higher learning absorption capacity. Furthermore, 22.5% of participants were categorized into the medium knowledge. They had acquired a basic understanding of the core concepts presented during the training, although further reinforcement and clarification are still needed to strengthen their comprehension. Furthermore, the largest proportion of participants, 42.5%, remained in the low knowledge category. Thus, this finding indicates that a substantial number of participants experienced difficulties in fully understanding the training material. Such limitations may be influenced by variations in educational background, prior experience with Aloe Vera–based food processing, or limited time allocated for training sessions.

Overall, these findings suggest that while the training activities positively impacted participants' knowledge, additional follow-up strategies, for instance repeated training sessions, more hands-on practice, or differentiated instructional approaches, are necessary to achieve more equitable learning outcomes among all participants.

This increase in knowledge demonstrates that the community service activities carried out were proven effective in improving the knowledge and skills of the participants, particularly regarding strategies for processing and developing food products made from Aloe Vera. In addition to the cognitive aspect, the participants also showed active involvement and enthusiasm during the practical activities. This condition can encourage the direct application of skills in household production activities or the development of micro-enterprises based on local potential.

Thus, community service activities have helped improve participants' knowledge and empower the community of Argomulyo Village thru the development of higher quality, hygienic, and economically valuable local food products made from Aloe Vera.

The results of interviews and reflective discussions indicate that participants' level of understanding regarding the importance of product quality, hygiene, and production consistency is in the high category. Participants are aware that product quality significantly impacts consumer trust and marketing opportunities. However, participants also identified some moderate challenges, such as limited production

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tools, initial capital, and packaging design. The most frequently mentioned follow-up needs are ongoing mentoring and advanced training related to packaging and marketing.

3.3. The Result of Organoleptic Evaluation and Sustainability of Activities

An organoleptic evaluation showed relatively positive results. The texture and clarity aspects of the product are in the good category, with a more chewy texture and clearer solution compared to before the training. Meanwhile, the aroma aspect falls into the fairly good category, with a more neutral scent although it still needs refinement to meet higher market standards. This assessment provides an initial indication that improvements in the production process have a direct impact on product quality.

The results of post-activity monitoring through communication with participants and village officials indicate a sustainability level in the moderate category. Some participants have started producing Aloe vera products independently on a household scale and are implementing the practices they learned during the training. The village apparatus assesses that this activity has the potential to be developed as a local economic enterprise, although it still requires further assistance to ensure consistent and sustainable production.

In addition to directly practicing the nata de aloe production process, the community service team also provided guidance to the participants on how to utilize and process the aloe vera cultivated in Argomulyo village into nata de aloe vera. The community members who participated in this activity were very enthusiastic, following each stage of the aloe vera processing process. This is because some already know that aloe vera has numerous health benefits. According to Rahayu (2019) [20], aloe vera is a medicinal plant useful for treating various ailments, from mild to severe, such as stomach ulcers, rheumatism, diabetes, cancer, and hepatitis. The demonstration of nata de aloe (aloe vera) production is expected to encourage the community to practice making nata independently using aloe vera.

In addition to demonstrating how to process aloe vera into nata de aloe, the community service team also provided the finished product, packaged in bottles, which can then be marketed according to previously socialized marketing methods. The production of nata de aloe vera can provide business opportunities for the community by utilizing existing resources in the Argomulyo village for production that has economic value. This can address the community's economic challenges and produce a delicious and healthy product. Cultivated aloe vera plants are not only sold raw but can also create new business opportunities. Therefore, it is necessary to manage aloe vera as a product to increase community income.

Freshly harvested aloe vera usually has varying quality levels. For aloe vera processing, the leaves must be sorted before processing. To make aloe vera nata, the leaves must be in good condition and fresh, with a uniform level of maturity (not too old). This means that the aloe vera leaf has a large leaf sheath and optimal thickness, and the leaves are green, so the gel content is quite high.

Peeling is intended to remove the outer green skin from the aloe vera leaf sheath. Given the slimy nature of aloe vera gel, the gel is processed by dipping the aloe vera leaf in boiling water to thicken the sap/slime (mucus). The outer skin is then sliced off, leaving only the nata de aloe vera. The peeling process can be carried out with a stainless steel paring knife.

Preliminary treatment in the nata de aloe vera production process is necessary before the aloe vera is further processed. Because aloe vera gel is prone to browning, the cube-shaped aloe vera gel is sulfited. The function of sulfiting is to prevent browning or maintain the original color of the aloe vera gel and can act as a preservative. Browning can also be prevented by blanching, which involves heating the aloe vera fruit by boiling or steaming it at approximately 80°C for 3-5 minutes. To reduce the unpleasant odor and bitter taste, and remove the slime, choose aloe vera with thick flesh. Peel the skin slightly to leave the translucent white flesh, then cut it into smaller pieces. Soak in boiled water with added salt. The soaking process strengthens the aloe vera gel network, making the gel firmer and more elastic.

Sugar is easily hydrolyzed, readily soluble in water, crystallizes easily under saturated conditions, and caramelizes at high temperatures. Sugar serves various functions in processing, including as a sweetener, preservative, and flavor enhancer. Sugaring, in the process of making candied aloe vera, involves adding a certain amount of sugar in solution to impart a sweet taste and a pleasant aroma to the aloe vera gel. Furthermore, sugaring aloe vera with citric acid acts as a preservative. Sugar is added as a preservative at a concentration of 55%–60%. High concentrations of sugar can inhibit microbial activity. Because sugar increases osmotic pressure in a solution, it causes plasmolysis in the microbial cells present in the material. Plasmolysis causes water to escape from the microbial cells, leading to their drying out and subsequent

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death. Furthermore, sugar at a concentration of 50%–60% can lower the water activity (Aw) of the material, inhibiting microbial activity. Improving public welfare through improving the quality and diversification of aloe vera-based food products. Aloe vera gel is generally tasteless (bland). Therefore, the addition of sugar enhances the sweetness of the aloe vera. When immersed in the sugar solution, the sugar penetrates (absorbs) into the aloe vera tissue, creating the distinctive sweetness of candied aloe vera. The sugaring process in aloe vera, where the amount of sugar used in making ready-to-eat aloe vera candy is with a concentration of 10% - 12% (100 - 120 grams added to water until a sugar solution volume of 1 liter is obtained), then boiled at a temperature of 100°C for ± 15 minutes, where the fire should not be too high to avoid burning which can cause the sugar solution to turn brown or caramelization occurs, so that the taste and appearance are less attractive.

4. Conclusion

The results of the training carried out in the Community Service activities carried out by the Community Service Team in collaboration with Universitas Ahmad Dahlan and Universitas Achmad Yani Yogyakarta can improve the knowledge and skills of the PKK Team of Argomulyo Village regarding the manufacture of processed nata de aloe vera products. Proper and standardized extraction of Aloe vera had a very good potential to produce superior processed products with significant economic potential. The abundant availability of raw materials had been matched with adequate and professional processing. At the field owed by Jatam Sedayu, aloe vera has only been processed simply so far, with inconsistent product quality, ranging from very basic product types, non-sterile and unhygienic storage methods, to very basic product variations and packaging appearances, making it difficult to compete in the wider market. This problem is exacerbated by the public's limited knowledge regarding product quality standards, hygienic processing techniques, and value-added innovation based on market needs. Based on these conditions, the training has improved the quality of Aloe vera products. This appropriate and practical solution has addressed the real problems faced by partners. This is because the training conducted not only enhances technical production skills but also raises awareness of the importance of quality, business sustainability, and the competitiveness of local products. In conclusion, community service activities in the form of integrated training can improve the quality of processed Aloe vera products, including processing techniques, quality control, and packaging, so that the products have added value and better competitiveness, including increased economic value.

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