

Utilizing Tofu Residue as an Additional Food Ingredient in Soy Nata Products

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ABSTRACT

The utilization of whey tofu is rarely known by the public. Chemical composition analysis of whey tofu shows that whey tofu media is suitable for the growth of lactic acid bacteria because it still contains a certain amount of nitrogen that can be utilized for the survival of bacteria. This community service aims to provide valuable information to the community regarding the benefits of whey tofu for microorganisms that support digestive health. This community service method involves providing education to the community of the Aisyiyah Branch Leadership in the Pamarican District. The results of the education provide mothers with an understanding of the importance of utilizing whey tofu, which can maintain digestive health.

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INTRODUCTION

The necessity of food is fundamental in human life. In Indonesia, one of the highly popular and promising food sources is tofu. Tofu, derived from soybeans, along with tempeh, constitutes a significant source of high-quality protein crucial for maintaining bodily nutritional balance. Tofu consumption in Indonesia is notably high, with an average per capita consumption reaching 0.158 kg per week in 2021 (Hulu, 2023)). The community perceives tofu as a highly nutritious food source.

However, recent attention has been drawn to research on the nutritional potential contained within tofu wastewater, known as Tofu Whey. This liquid waste originates from the tofu manufacturing process and is often discarded without further processing (Maulani et al., 2021)). If disposed of into the environment without treatment, this waste can lead to serious environmental pollution. Yet, recent studies reveal that Tofu Whey possesses significant potential as a raw material for the growth of beneficial bacteria crucial for human digestion (Y. Xu et al., 2019), particularly the *Lactobacillus acidophilus* bacteria.

Tofu Whey is rich in essential nutrients such as sugar compounds, minerals, and proteins. Research indicates that with the addition of nitrogen and carbon sources, Tofu Whey can serve as an excellent growth medium for lactic acid bacteria. Each kilogram of soybeans produces tofu wastewater ranging from 1.5 to 2 liters (Mardika & Rahajoeningroem, 2021), indicating a substantial potential for Tofu Whey production.

With soybean demand for the tofu industry reaching 450 thousand tons annually across Indonesia, the potential production of Tofu Whey could reach millions of tons per year. However, presently, soybean prices have experienced significant increases, raising concerns about the availability of raw materials for the tofu industry. This surge in soybean prices also impacts communities economically and in terms of health.

Given the substantial potential of Tofu Whey, community engagement initiatives have been undertaken, targeting unproductive partners, particularly members of the PCA Pamarican Community. This community was chosen due to its high potential for creativity, enabling them to leverage newfound knowledge to enhance their own health and well-being.

The aim of this community engagement is to impart understanding to community members regarding the potential of Tofu Whey as a food ingredient that can help address stunting (Singh & Krishnaswamy, 2022), particularly in maintaining digestive bacterial balance.

METHODS

The implementation of counseling was conducted face-to-face by holding interactive discussion sessions and practical demonstrations on the utilization of Whey Tofu as a raw material in food processing, such as nata de soya. The interactive discussion phase provided participants the opportunity to share knowledge, experiences, and directly ask the resource persons about various aspects related to Whey Tofu and its processing methods. This discussion allowed for the exchange of information between resource persons and participants, deepening the understanding of the potential and benefits of Whey Tofu.

Additionally, practical demonstrations were conducted through the presentation of video demonstrations showing detailed steps in processing Whey Tofu into various diverse and appealing food products. Through these video demonstrations, participants could visually understand the Whey Tofu processing process and directly see the end results of various food products that could be made using this ingredient. The video demos also facilitated participants in following the Whey Tofu processing steps more effectively.

As a means of ensuring the achievement of the counseling activities, assessments were conducted using pretest and posttest questionnaires. Pretest questionnaires were given before the counseling began to measure participants' initial knowledge about Whey Tofu and its utilization. Meanwhile, posttest questionnaires were given after the counseling sessions to evaluate the extent to which participants' understanding and knowledge had improved after participating in the counseling activities. Thus, the use of pretest and posttest questionnaires became an effective tool in assessing the effectiveness and impact of the counseling on participants' understanding and knowledge. Evaluations with these questionnaires provided a clear picture of the extent of participants' understanding improvement after participating in the counseling activities.

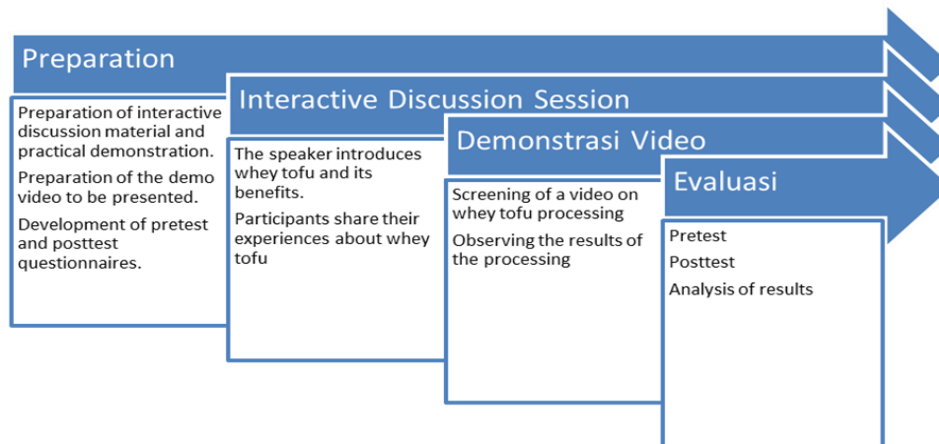


FIGURE 1. Community activity chart

RESULTS AND DISCUSSION

Description of Activity Implementation

The community service activities of the D3 Pharmacy Study Program in 2023 aimed to address stunting issues through counseling on the utilization of Whey Tofu as an alternative solution. Conducted under the title "Problem Solving Prevention of Stunting in the Utilization of Microbiota Products," (Surono et al., 2021) this activity was based on field data showing high levels of stunting in several partner domiciles (Mulyaningsih et al., 2021), as recorded in the Aisiyah cadre reports. The Ciamis Regent's report on Stunting Reduction Locus in Ciamis Regency in 2022 also indicated that 20 sub-districts were the main focus for recovery from stunting issues.

Considering these worrying conditions, counseling activities on the utilization of Whey Tofu were expected to be an effective solution in reducing the stunting rate by enhancing productive utilization (Yunita Satya Pratiwi, 2023). The sequence of activities in the Community Partnership and Service Program (PKLK) included several stages, starting from the preparation stage, the implementation stage, to the post-implementation stage.

Preparation Stage

In this stage, several preparations were carried out, including preparing the counseling module and materials, selecting and training resource persons, determining the target partners, and coordinating with partner institutions. The preparation phase was crucial in ensuring the smooth implementation of counseling activities, as it laid the foundation for all subsequent stages.

Implementation Stage

The implementation stage consisted of several sub-stages, including the introduction of the counseling program, conducting counseling activities, and evaluating the effectiveness of the counseling. During the introduction phase, the counseling program was introduced to the target partners, providing them with an overview of the objectives, activities, and expected outcomes of the program (Safitra et al., 2021). Following the introduction, counseling activities were conducted through interactive discussions and practical demonstrations, as described in the previous section.

Improving Understanding of Microbiota and Utilization of Microbiota Products

On April 10, 2023, a socialization program was conducted with the theme "Problem Solving in Stunting Prevention through Microbiota Product Utilization," with the sub-theme "Tofu Waste as an Additional Food Ingredient for Nata De Soya Products." This activity was held at the Aisyiyah Pamarican Branch and attended by 20 mothers who are Aisyiyah Pamarican cadres. The purpose of this counseling was to provide understanding about the importance of microorganisms for human life, particularly in the context of health and nutrition. One of the main focuses was education on the relationship between gut microbiota (probiotics) and pregnancy, as well as the importance of safe probiotic consumption for pregnant women. Additionally, participants were provided with information on how to make nata de soya from tofu whey as one effort to reduce stunting rates in the area. This activity was based on data indicating high stunting rates in several domiciles of partner members, as recorded in the Ciamis Regent's report on Stunting Reduction Loci in Ciamis Regency in 2022. By providing information about the relationship between gut microbiota and health, as well as the utilization of microbiota products such as nata de soya, it is expected to increase participants' awareness and knowledge in addressing stunting issues and improving family nutrition and health. During the counseling session, the material was presented interactively using presentations, discussions, and demonstrations of nata de soya production. Participants were given the opportunity to ask questions and discuss the material presented, creating a collaborative and interactive learning environment. At the end of the activity, an evaluation was conducted to measure participants' understanding and satisfaction with the program. Overall, this program was considered successful in improving understanding of microbiota and the utilization of microbiota products, as well as providing encouragement for participants to take action in improving family health and nutrition (Taufiqurokhan, 2023).

The Importance of Microbiota Balance during Pregnancy

This activity aims to provide participants with an understanding of the importance of maintaining gut microbiota balance during pregnancy and its impact on the health of the fetus and pregnant women. During the counseling session, it was explained that maintaining gut microbiota balance during pregnancy is crucial because gut microbiota plays a significant role in body metabolism that can affect fetal growth in the womb (Qi et al., 2021). Gut microbiota also plays a role in maintaining digestive health and the immune system, both of which are essential during pregnancy (Liu et al., 2022). Pregnancy is known to be vulnerable to inflammation due to changes in the composition of bacteria in the gut in the first trimester (Edwards et al., 2017). Increased pathogenic bacteria such as Proteobacteria and Actinobacteria, and decreased healthy bacteria such as Lactobacillus and Bifidobacterium, can cause inflammation that could potentially harm the health of pregnant women and fetuses (Varela-Trinidad et al., 2022). Through this counseling, participants were informed about the importance of maintaining gut microbiota balance during pregnancy through consumption of healthy foods containing probiotics and prebiotics (Barrientos et al., 2024) as well as through a healthy lifestyle. Participants were also given an understanding of the importance of consulting with healthcare professionals if experiencing health problems related to gut microbiota during pregnancy. With the understanding provided in this program, it is hoped that participants can take preventive measures to maintain gut microbiota health during pregnancy, thus reducing the risk of inflammation and other health problems that may affect the health of pregnant women and fetuses (Nyangahu & Jaspán, 2019).

The Role of Probiotics and Prebiotics in Stunting Prevention

This activity aims to provide participants with an understanding of the importance of probiotics and prebiotics in maintaining health, particularly in the context of stunting prevention. During the counseling session, the roles of probiotics and prebiotics in maintaining health (Ji et al., 2023), especially in preventing complications caused by gut microbiota disorders such as gestational diabetes, preeclampsia, and others (Teixeira et al., 2023), were explained in detail. Participants were provided with information on how healthy gut microbiota can support the digestion process, nutrient absorption, and regulation of the immune system. Useful probiotic examples (Gyawali et al., 2019), such as *Lactobacillus* and *Bifidobacterium* commonly found in yogurt, were also explained in this counseling. Participants were given an understanding of how regular probiotic consumption can help maintain gut microbiota balance and prevent related health disorders. Additionally, the counseling addressed stunting issues and explained the role of prebiotics in its prevention. For example, *Azotobacter xylinum* was chosen as a model to address stunting issues because of its ability to enhance the growth of beneficial bacteria in the large intestine. Participants were informed about how prebiotics work as food for good bacteria in the gut, thus increasing the number and activity of these bacteria to support digestive health and nutrient absorption. Through this counseling, it is hoped that participants can understand the importance of the roles of probiotics and prebiotics in maintaining health, especially in stunting prevention. Participants are also expected to take concrete steps to increase their consumption of probiotics and prebiotics in their diet to support optimal health and growth, especially during pregnancy and children's growth (Heuven et al., 2021). Nata De Soya Making Demo as an Example of Whey Tofu Utilization

This activity aims to demonstrate to participants how whey tofu can be utilized to produce highly nutritious food products (Benedetti et al., 2016) such as nata de soya. In this demo, participants were shown the fermentation process using *Azotobacter xylinum* bacteria on whey tofu. This bacteria performs metabolic activities on whey tofu, producing millions of cellulose threads that later form nata de soya. This process was explained in detail to participants, from soaking to the extraction of whey tofu as nutrition for *Azotobacter xylinum* bacteria. The purpose of this demo is to provide participants, especially pregnant women and families, with an understanding of the potential of whey tofu as a high-nutrient source that can be economically and nutritionally valuable. By utilizing whey tofu to make nata de soya, it is hoped that participants can understand that tofu industry waste can be transformed into beneficial food products. Through the socialization phase and video playback, it is expected that the community's understanding of the importance of gut microbiota balance and the utilization of microbiota products such as nata de soya will increase. Thus, it is hoped that healthier eating habits (X. Xu et al., 2023) and lifestyles will occur, contributing to stunting prevention in the community. Participants are also expected to apply the knowledge gained in this demo in their daily lives, thus improving the overall quality of family nutrition and health.

TABLE 1. Participant Characteristics

Variabel	n
Female	20
Married	20
Age:	
20 – 30 years old	16
31 – 40 years old	4
Occupation:	
Housewives	11
Farmers	
Business Owner	2
Teacher	4
	3
Pregnant	17
Not pregnant	3



FIGURE 2. Demonstration video for making Nata De Soya from Whey Tofu

Post-Implementation Stage

The post-implementation stage involved evaluating the effectiveness of the counseling activities and documenting the results. This stage aimed to assess the extent to which the counseling had achieved its objectives and identify any areas for improvement in future activities. The evaluation process included administering pretest and posttest questionnaires to measure participants' knowledge levels before and after the counseling sessions

Results of Pretest and Posttest Questionnaires

The pretest and posttest questionnaires were administered to measure participants' knowledge levels before and after participating in the counseling activities. The questionnaires consisted of multiple-choice questions covering various aspects of Whey Tofu and its utilization in food processing. The results of the questionnaires were then analyzed to determine the effectiveness of the counseling in improving participants' understanding of the topic.

The analysis of the pretest and posttest questionnaire results revealed a significant improvement in participants' knowledge levels after participating in the counseling activities. The average score on the posttest questionnaire was substantially higher than the average score on the pretest questionnaire, indicating that the counseling had successfully enhanced participants' understanding of Whey Tofu and its utilization

.CONCLUSION

In conclusion, the community service activities on the utilization of Whey Tofu as an alternative solution to address stunting issues were highly successful. Through interactive discussions and practical demonstrations, participants gained a deeper understanding of Whey Tofu and its potential in food processing. The pretest and posttest questionnaires provided quantitative evidence of the effectiveness of the counseling in improving participants' knowledge levels.

Moving forward, it is essential to continue promoting the utilization of Whey Tofu and other microbiota products as part of efforts to address stunting and improve community health and well-being. By harnessing the nutritional potential of Whey Tofu and other similar waste products, it is possible to not only reduce environmental pollution but also enhance food security and nutrition for vulnerable populations. Further research and collaboration are needed to explore innovative ways of utilizing waste products like Whey Tofu to maximize their benefits for human health and the environment.

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