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The utilization of Tepache Probiotic Drink for health benefits and creating household-scale economic opportunities

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ABSTRACT

Probiotic drinks are needed to enrich the microbiome in the digestive organs. Increasing age causes a decrease in the ability of cells to metabolize food, resulting in various degenerative diseases. Tepache probiotic drinks, made from pineapple skin, contain magnesium minerals for bone health, vitamins A, B, and C. Through fermentation, it is enriched by lactic acid bacteria which play a role in helping food metabolism in the intestines and increasing the immune response. Counseling on making tepache probiotic drinks for PKK mothers RW 11 Pamulang Timur is expected to improve public health and stimulate the household economy. The method of implementing community service is carried out by means of socialization of the benefits of probiotic drinks, training in making tepache probiotic drinks, financial management and marketing training, and production assistance. Tepache drinks are made from pineapple skin fermented for 24 hours using brown sugar, water, cloves, and cinnamon. The success of fermentation is indicated by the presence of white grains on the surface of the liquid. The fermentation results are filtered and can be consumed directly. The results of the counseling produced a tepache drink product that has been routinely consumed by PKK mothers RW 11 Pamulang Timur, and has an impact on reducing knee pain, tension, blood sugar, uric acid, and cholesterol. The results of household-scale sales have not shown significant profits, but simple calculations if pursued will increase household income.

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1. INTRODUCTION

According to WHO data, individuals over the age of 50 often experience a decline in bodily functions and suffer from degenerative diseases, such as joint pain, obesity, and other degenerative conditions (Padayatty & Levine, 2016). The members of the PKK in RW 11, Pamulang Timur, South Tangerang, are aged between 38 and 65 years, with around 70 percent being women over the age of 50. Data from the posbindu RW 11, collected through monthly check-ups by healthcare workers from the Pamulang Timur Community Health Center and posbindu volunteers, shows that 72 percent suffer from hypertension, 68

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percent from gout, 54 percent from high cholesterol, and 32 percent from high blood sugar, with nearly 80 percent reporting joint pain. One of the causes is excessive body weight due to reduced digestive function, leading to lower nutrient absorption and fat accumulation in various parts of the body. This results in various complaints of pain, especially headaches and joint pain. The degenerative diseases they suffer from significantly disrupt daily activities and, if left untreated, could lead to death. Medications prescribed by doctors to alleviate pain or dizziness often have long-term side effects.

The transitional season between the rainy and dry periods increases the prevalence of viruses and other microbes in the environment, leading to about 85 percent of the women experiencing alternating flu and cough symptoms, similar to what occurred during the COVID-19 pandemic. Symptoms include dizziness, nausea, weakness, sometimes fever, and body aches. Therefore, a supplement that can address these health issues, is easily accessible, and is affordable is highly needed to boost stamina and reduce the impact of degenerative diseases.

The residents of RW 11, Pamulang Timur, are predominantly retirees, which affects household economics. Many women who previously had careers in government or the private sector now spend their time at home. They need activities that not only alleviate boredom but also generate income and have a positive impact on their health.

Thus, there are two main problems faced by the PKK mothers in RW 11, Kelurahan Pamulang Timur, South Tangerang: (1) Health issues – individuals over the age of 50 are highly vulnerable to degenerative diseases, requiring appropriate solutions to alleviate these problems; and (2) Economic issues – entering retirement impacts household income, necessitating activities that can help supplement household earnings.

Therefore, the main focus of this community service program is to provide training on making probiotic Tepache drinks from pineapple peels, which can improve health, as well as offering training on marketing strategies and basic financial reporting. Tepache is a probiotic drink made from pineapple peel, rich in magnesium and other minerals, as well as vitamins A, B, and C. It is fermented using brown sugar and water, with the addition of cinnamon and cloves for flavor. The fermentation process produces lactic acid bacteria, which are beneficial for health by aiding in digestion (Arief et al., 2014; Corona-González et al., 2013; Hujjatusnaini et al., 2022).

Pineapple (Ananas comosus L Merr) is a shrub-like fruit plant. Initially, in Indonesia, pineapples were used as home garden plants and grown in dry land in several orchards, thriving across the archipelago. Pineapple fruit contains vitamins (A and C), calcium, phosphorus, magnesium, iron, sodium, potassium, dextrose, sucrose (cane sugar), and bromelain enzymes (Hujjatusnaini et al., 2022; Mavani et al., 2020). The chemical content of pineapple peel includes water, crude fiber, carbohydrates, protein, bromelain enzymes, reducing sugars, and antioxidant flavonoids and tannins. Damage caused by free radicals through oxidation reactions can lead to DNA damage in genetic material within cells. The accumulation of free radicals can cause cell damage, leading to cell aging and degenerative diseases such as cancer, vascular and heart diseases, immune system decline, and brain and nervous system dysfunction, such as Parkinson's disease, Lou Gehrig's disease, and dementia. DNA mutations that accumulate in cells can be neutralized by antioxidants, thereby halting the aging process when consuming foods containing sufficient antioxidants. Antioxidants inhibit the aging process and degeneration of cells and tissues. These antioxidants can come in the form of vitamins, minerals, and other compounds (Benny et al., 2023; Damogalad et al., 2013).

Vitamin C in pineapple peel acts as a form of vaccination against cancer, particularly cancers of the stomach, esophagus, pancreas, oral cavity, and potentially the cervix, rectum, and breast. Consuming five servings of fruits and vegetables per day containing 200-300 mg of vitamin C is sufficient to inhibit

cancer growth. Vitamin C increases the production of lymphocytes and functions like an antibiotic to fight viruses. Furthermore, it enhances immunity by raising antioxidant glutathione levels in the body, a crucial substance for proper immune system function (Merenstein et al., 2023; Padayatty & Levine, 2016).

Magnesium (Mg) compounds help maintain the mitochondria organelles, which are responsible for energy production (Song et al., 2020). Mitochondrial damage can lead to cellular aging. New studies have found that many diabetes patients tend to have low magnesium levels in their cells and blood. Low magnesium levels are often accompanied by low vitamin D levels, which are essential for bone metabolism. The calcium compounds in pineapple can reduce hip fractures and lower high blood pressure by an average of 5-7 mm/Hg (systolic) and 3-4 mm/Hg (diastolic), especially in older adults (Hardiyanah et al., 2023).

Figure 2. Pineapple fruit and pineapple skin (Aisyah, 2023)
Figure 3. Tepache probiotic drink made from fermented pineapple skin (Ki, 2024)

The method of making tepache probiotic drinks is very easy, it only takes 1 day of fermentation (Sagita, 2023). The materials and tools used are very cheap and easy to obtain. The community service program is carried out with stages of socialization, probiotic making training and marketing strategy training, as well as assistance in making probiotics and packaging production results. During the assistance, training was given on packaging beverage products, including how to store products, pack products, how to market them, and simple financial management. The purpose of this community service is to provide education about the benefits of tepache probiotic drinks for health, as well as to provide training on how to make these probiotic drinks so that in addition to improving public health, it can also help increase income for household-scale production.

2. METHODS

In the implementation of community service activities by the PKK mothers of RW 11, Pamulang Timur Village, this includes five methods of health checks and socialization, training, mentoring and evaluation of activities.

Health Check and Socialization

Before the socialization, a health examination was conducted for all participants, including blood pressure, blood sugar levels, uric acid, and cholesterol. This health examination serves as initial data on the health condition of all participants, which will be compared to health data after participants consume the probiotic tepache drink. Participants' health will be rechecked after two weeks of regularly consuming the probiotic tepache drink. This data is crucial as evidence of the health benefits of probiotic tepache.

During the socialization activity, information was provided about the benefits and contents of the probiotic tepache drink, marketing strategies, and product packaging. The probiotic tepache drink has significant benefits due to its content of lactic acid bacteria, and high levels of vitamins A, B, and C, along with magnesium, which help alleviate bone and joint pain, and address issues like blood sugar, uric acid, and cholesterol. With its extraordinary benefits, the probiotic tepache drink is expected to be in high demand among the public due to its sweet and slightly sour taste, reminiscent of yogurt. When consumed, it provides a sense of comfort and freshness, alleviating aches and pains. Its effects will also positively impact bone health, skin, nerves, and digestion, while lowering high blood pressure, uric acid, cholesterol, and blood sugar levels. Thus, the production of this drink has a promising and broad market potential. Therefore, socialization on business opportunities, marketing strategies, and methods for financial reporting and monitoring was conducted.

Practice Making Tepache

Training on the preparation of probiotic tepache drink was conducted for all participants in a classroom setting. The necessary ingredients include 1 pineapple, 500 ml of water, 200 grams of brown sugar, 2 cinnamon sticks, and 5 cloves. The required tools include a knife, cutting board, strainer, pot, digital scale or kitchen scale, sealed glass jar, and clean cloth.

The steps for making tepache drink are as follows: First, the pineapple is peeled thickly and cleaned, then placed in the glass jar. The brown sugar is cut into small pieces and boiled along with the cinnamon and cloves. After boiling, let it cool. Once cooled, the brown sugar mixture is added to the jar containing the pineapple peel. Seal the jar tightly and wrap it with a clean cloth to protect it from direct sunlight. Let it sit at room temperature for 24 hours until fermentation occurs, indicated by the appearance of white foam or small bubbles. Strain the fermented solution into another container, ready to be served with added ice or stored in the refrigerator for up to 10 days. Consume daily for health benefits. This probiotic drink is ready to serve, with a sweet and sour taste due to its high vitamin C content (Hujjatusnaini et al., 2022; Sagita, 2023).

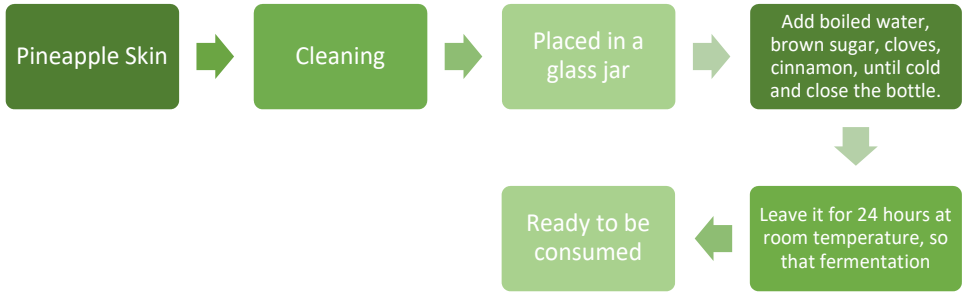

Figure 4. Stages of making tepache probiotic drink

Assistance

After the classical training on making probiotic tepache drinks, practical mentoring on making this probiotic drink product was carried out in groups. There were 6 groups of PKK mothers, namely PKK RT 1, RT 2 to RT 6. It is hoped that through the mentoring process, all participants of PKK RW 11 mothers can make this probiotic tepache drink in their respective homes with mentoring by students. The mentoring process in groups is more efficient so that it is hoped that participants will be more skilled and better understand tepache drink production, product packaging, marketing strategies, and financial reports.

Evaluation

An evaluation of the results of the tepache drink making training was carried out, namely an evaluation of the tepache product, an evaluation of the increase in health as a result of consuming tepache drinks, and an evaluation of the marketing process. The evaluations carried out included: (1) Evaluation of the tepache product, taste and color; (2) Evaluation of the health data collection of PKK RW 11 mothers which included blood pressure, blood sugar levels, cholesterol, and uric acid; (3) Evaluation of sales results which had an impact on increasing the household economy.

3. RESULTS AND DISCUSSION

The activity began with a socialization conducted in a classical manner and attended by around 45 PKK mothers from a total of 56 participants invited. Participants were PKK mothers from RW 11 from RT 1 to RT 6. The socialization activity delivered material on the advantages and benefits of probiotic drinks, the vitamin and mineral content of tepache probiotic drinks, the bacteria it contains and its benefits for health, tepache drink business opportunities, and simple financial management in home-scale businesses. The material was delivered in a classical manner followed by a question-and-answer session.

Figure 5. Delivery of material through socialization of tepache products and health checks for PKK mothers in RW 11 Pamulang Timur

On the next day, classical tepache making practice was carried out. Participants were given tools and materials for tepache production, which included pineapple, jars, brown sugar, cinnamon, and cloves. In this training, everyone practiced making tepache probiotic drinks so they could practice it themselves at home.

Figure 6. Practice making tepache from pineapple skin, brown sugar, cloves and cinnamon

During the mentoring, the mothers were very enthusiastic about producing tepache at home for their own consumption and for household sales. During the mentoring, the mothers were skilled at practicing the production of tepache themselves routinely every 3 days for their own consumption. After routinely consuming tepache, the mothers felt the benefits of the drink which were directly, the body felt more comfortable, fresh, headaches gradually disappeared, body aches, eliminating aches, pain in the joints and knees. The results of the health check before and after consuming the tepache drink are attached in Table 1.

Table 1. Health data of PKK mothers in RW 11 East Pamulang

Initial	Before Consuming Tepache				After Consuming Tepache				Description (regular/ non-regular consumption of tepache)
	Tension	Blood sugar level	Gout Level	Cholesterol Level	Tension	Blood sugar level	Gout Level	Cholesterol Level	
ZY	110/80	145	7.6	210	110/80	135	6.0	180	Routinely
ES	145/110	180	6.5	125	135/110	180	6.5	125	Not Routinely
YU	120/90	220	7	145	120/90	220	7	145	Routinely
SU	155/90	160	4.5	180	110/90	140	4.5	120	Routinely
LI	143/100	210	5.7	160	120/100	160	57	120	Routinely
AM	134/90	200	6.2	190	134/90	150	5.8	160	Routinely
NU	156/110	180	9.3	180	120/110	130	6.3	180	Routinely
TA	130/90	220	12.1	130	130/90	220	12.1	130	Not Routinely
RI	140/120	180	9.2	110	140/120	180	7.2	150	Not Routinely
TA	144/100	130	8.6	130	124/100	130	6.0	130	Routinely
NE	134/110	160	5.8	180	124/110	120	5.8	150	Routinely
BU	140/100	167	10.2	176	130/100	127	7.2	126	Routinely
SY	120/80	156	7.2	220	120/80	156	7.2	220	Not Routinely
YK	140/100	210	6.6	190	120/100	130	6.0	160	Routinely
TI	120/90	180	8.8	215	120/90	180	8.8	215	Not Routinely
HR	134/110	167	7.5	210	120/80	160	6.5	180	Routinely
NA	140/100	145	6.0	221	140/100	145	6.0	221	Not Routinely
MU	132/100	120	5.9	190	120/90	120	5.9	140	Routinely
SH	128/100	187	4.7	187	120/90	147	4.7	167	Routinely
ES	130/100	140	6.0	180	120/80	140	6.0	140	Routinely
ES	134/90	130	5.7	210	124/90	130	5.7	160	Routinely
DH	130/90	125	5.9	196	130/90	125	5.9	196	Not Routinely
RH	135/110	210	4.9	210	125/90	160	4.9	170	Routinely
DA	150/100	178	5.8	140	150/100	168	5.8	140	Not Routinely
ZR	134/90	165	5.7	120	124/90	165	5.7	120	Routinely
DY	158/100	134	5.6	180	158/100	134	6.6	180	Not Routinely
YU	128/100	180	4.8	126	120/90	180	4.8	126	Routinely
KU	136/88	156	6.0	210	136/88	156	6.0	170	Not Routinely
US	136/88	176	8.3	180	126/88	130	6.0	140	Routinely
EK	128/100	134	5.8	167	128/90	134	5.8	167	Routinely
CO	135100	176	8.0	210	125/90	160	5.0	160	Routinely
LH	142/110	180	5.8	170	122/110	180	5.8	150	Routinely
LI	130/90	125	6.3	160	125/90	125	6.3	160	Routinely
IM	130/90	225	6.2	140	120/90	150	6.2	140	Routinely
YM	143/110	187	4.9	145	123/90	147	4.9	145	Routinely
PU	140/100	156	5.0	185	120/90	156	5.0	165	Routinely
RU	136/80	170	5.9	180	120/80	170	5.9	180	Routinely
BA	150/100	160	4.8	145	120/90	160	4.8	145	Routinely
NE	140/100	157	5.6	180	140/90	157	5.6	210	Not Routinely
ER	120/90	148	6.8	215	120/90	148	6.0	170	Routinely
RK	134/110	160	7.2	170	134/110	160	7.2	170	Not Routinely
YA	130/90	185	8.2	180	130/90	185	8.2	180	Not Routinely
ES	158/100	125	5.5	145	120/100	125	5.5	145	Routinely
DE	160/100	180	5.7	134	120/90	180	5.7	134	Not Routinely
PA	130/90	167	8.0	180	132/90	167	6.0	160	Routinely

From the health examination results of the mothers in the PKK RW 11 of Pamulang Timur Village before and after consuming the probiotic tepache drink (Table 1), it is evident that those who regularly consumed tepache experienced better health improvements. The condition of high blood pressure decreased to normal levels, while high blood sugar, uric acid, and cholesterol levels also decreased. However, among the mothers who did not regularly consume this tepache drink, their health examination results did not improve and, in fact, worsened. This indicates that the probiotic tepache drink, which contains magnesium, vitamins A, B, and C, is capable of enhancing body metabolism and improving health.

Magnesium is an essential mineral that plays several critical roles in the human body. It helps manage blood glucose levels and insulin sensitivity. In blood pressure regulation, magnesium can help lower blood pressure by relaxing blood vessels and balancing electrolytes, thereby reducing high blood sugar levels (Prasad et al., 2022; Yang et al., 2021).

About 60 percent of the body's magnesium is found in bones, which helps regulate calcium levels, crucial for bone formation and maintenance. Consuming tepache can gradually alleviate pain in the legs, joints, and knees. Magnesium is also vital for muscle contraction and relaxation, so consuming tepache can help relieve muscle soreness. Magnesium is involved in the production of ATP (adenosine triphosphate) through oxidative phosphorylation, playing a role in energy production. It is also involved in the synthesis of DNA, RNA, and proteins for cell replication and helps convert amino acids into proteins (Geiger & Wanner, 2012).

Vitamin A is essential for maintaining good vision, forming the component rhodopsin, enabling vision in low-light conditions, and supporting corneal health. Vitamin A is crucial for the immune system, as it helps maintain the integrity of the skin and mucous membranes as barriers to infection and aids in producing white blood cells. Vitamin A plays a role in the differentiation of cells in the heart, lungs, kidneys, and other organs, thus helping regulate uric acid levels in the blood. Tepache plays a role in managing blood uric acid levels due to the function of healthy kidneys (Mason et al., 2015; Tanumihardjo, 2011).

One type of B vitamin is Vitamin B1 (Thiamine), which converts carbohydrates into energy. Thiamine plays a crucial role in glucose metabolism. Meanwhile, Vitamin B2 (Riboflavin) helps break down fats, proteins, and carbohydrates for energy. Vitamin B7 (Biotin) is involved in the metabolism of fats, carbohydrates, and proteins (Yoshii et al., 2019). Therefore, tepache helps lower cholesterol and blood sugar levels. Vitamin C is vital for collagen synthesis, a protein essential for the health of skin, blood vessels, bones, and connective tissues. Tepache helps strengthen joints and bones in older individuals (Carr & Maggini, 2017; Padayatty & Levine, 2016).

Figure 7. The servings of tepache probiotic drink

In addition to benefiting the health of the mothers in PKK RW 11 of Pamulang Timur, the production of this drink is utilized to increase family income as a home-based creative economy. Some other mothers are attempting to produce it for nearby consumers at a price of Rp. 3,000 per 250 ml bottle. Although this production has not yet shown maximum profit, it has only been running for one month and has not been produced regularly.

Table 2 shows a picture of the calculation of production and sales of tepache for the production of 100 glasses. However, this production has not been running intensively, it needs a marketing strategy both online and conventionally, considering that this drink only lasts one day at room temperature and 10 days in the refrigerator, therefore it needs to be done.

Table 2. Tepache sales calculation

Investment	Production materials	Total expenses	Sales results	Unit price	Gross	Net
Glass jar 28.000	Brown sugar	14,000	100 servings	2,500	250,000	176.000
	Cloves	5,000				
	Cinnamon	5,000				In a month 176,000 x 10 = 1,760,000
	Stickers and bottles	50,000				
	Pineapple peel waste	0				
Total		**74,000**				

4. CONCLUSION AND RECOMMENDATIONS

This community service program aims to provide skills, knowledge, and income improvement from the production of probiotic tepache drinks to the participants of the PKK mothers in RW 11 of Pamulang Timur, Tangerang Selatan. The probiotic tepache drink is made from inexpensive and easily obtainable ingredients: pineapple skins, brown sugar, cinnamon, and cloves. This probiotic drink is expected to enhance the health of the participants as well as increase their income. After receiving training and materials on how to make probiotic tepache drinks, and after consuming it several times, the mothers experienced health improvements, such as reduced high blood pressure, cholesterol levels, blood sugar, and uric acid. This is attributed to the content of tepache, which includes magnesium, vitamins A, B, and C, impacting blood pressure, blood sugar, cholesterol, and uric acid levels. The drink's excellent health benefits present potential as a highly marketable product.

The limitations of this activity are that it has not been implemented on a massive scale by the residents of RW 11, Pamulang Timur, Tangerang Selatan. Therefore, support from the local government, at least at the RT or RW level, is needed for the development of tepache production, facilitated by training on how to make this probiotic drink for all residents. There needs to be a contribution from the government or local corporate social responsibility (CSR) initiatives in the form of financial assistance for the purchase of raw materials, such as brown sugar. Additionally, regular health check-ups for mothers should not be limited to those over 50 years of age, as degenerative diseases, high blood pressure, uric acid, and blood sugar issues are also experienced by individuals under 50. So far, health posts (posbindu) have been intended for residents over 50 years old.

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