



TRAINING ON THE UTILIZATION OF VEGETABLE PROTEIN SOYBEAN TEMPE AND PROCESSED TEMPE "SPICY TEMPE NUGGETS AND TEMPE PUDDING" IN KENDARI CITY

Yuli Purbaningsih¹, Sitti Aida Adha Taridala², Idrus Salam³

¹Universitas Sembilanbelas November Kolaka, Indonesia

^{2,3}Universitas Halu Oleo, Indonesia

Email: yoeliyoelan7@gmail.com*

Abstract

Soybean is an annual herb with branching dikotil little, the root system of a taproot, and cambium stem. Soybeans can turn into semi-vines in low light. Soy tempeh, which is not liked as food by the community, processed soybean tempeh, one of which is tempeh nuggets and tempeh pudding, has a very potential market, quite a lot of consumers support the development of this production which is an alternative food for people who want to consume products from tempeh flour. After we carry out all production activities, we continue to market it as the market potential in Southeast Sulawesi in particular, quite a lot of consumers support the development of this production which is a snack food for people who want to consume products from processed tempe products.

Keywords: Training, Vegetable Protein, Soy Tempe

INTRODUCTION

Soybeans are known by various names: sojaboom, soja, soja Bohne, soybean, soybean, peanut Ramang, beans fur, nuts gimbol, cracked mejong, kacang fur, nuts japanese, dekenana, demekun, dele, kadele, sometimes japanese, lebu bawak, lawui, sarupapa tiak, dole, kadule, puwe mon, yellow beans (aceh) and gadelei. These various names indicate that soybeans have long been known in Indonesia.

Soybean is an annual herb with branching dikotil little, the root system of a taproot, and cambium stem. Soybeans can turn into semi-vines in low light. Soybeans, especially white soybeans from the subtropics, are also short-day crops with an average critical time of 13 hours. It will flower immediately if, at the time of flowering, the length of the day is less than 13 hours. This explains the low production in the tropics because the plants flower too early.



Soybean Plant

Soybean (sometimes with "peanut" in front of its name) is one of the legumes that are the basis of many foods from East Asia such as soy sauce, tofu, and tempeh. Based on archaeological remains, this plant has been cultivated since 3500 years ago in East Asia. White soybeans were introduced to the archipelago by immigrants from China since the boom in trade with China, while black soybeans have been known to the local people for a long time. Soybean is the world's main source of vegetable protein and vegetable oil. The world's main soybean producer is the United States, although soybeans were practically cultivated outside of Asia after 1910.

Cultivated soybeans consist of at least two species: *Glycine max* (called white soybeans, whose seeds can be yellow, slightly white, or green) and *Glycine soja* (black soybeans, black seeds). *G. max* is native to subtropical regions of Asia such as China and southern Japan, while *G. soja* is native to tropical Asia in Southeast Asia. This plant has spread to Japan, Korea, Southeast Asia, and Indonesia.

Several white soybean cultivars are cultivated in Indonesia, including 'Ringgit', 'Orba', 'Lokon', 'Darros', and 'Wilis'. "Edamame" is a kind of green large-seed soybean that has recently been known in Indonesia and comes from Japan.



Soybeans

Soybeans are cultivated in paddy fields and dry land (fields). Planting is usually done at the end of the rainy season, after the rice harvest. Earthwork is usually minimal. Seeds are inserted directly into the holes made. Usually 20-30cm apart. Basic fertilization of nitrogen and phosphate is necessary, but after the plant grows the addition of nitrogen does not provide any benefit. Land that has never been planted with soybeans is recommended to be given a "starter" of nitrogen-fixing bacteria *Bradyrhizobium japonicum* to help plant growth. Soil fertilization is carried out when the plants are young (early vegetative phase), as well as cleaning from weeds and the second stage of phosphate fertilization. Before flowering, potassium fertilization is recommended even though many farmers neglect to save costs

Soybean seeds are in two pieces, wrapped in seed coats, and do not contain endosperm tissue. The embryo is located between the seed pieces. The color of the seed coat is yellow, black, green, brown. Seed navel (hilum) is a network of former seeds attached to the fruit wall. The shape of soybean seeds is generally oval, but some are round or slightly flattened. Soybeans are pods. Each plant can produce 100-250 pods. Soybean pods are hairy and brownish-yellow or gray. During the fruit ripening process, the pods which were initially green will turn black. Soybean consumption in Indonesia reaches 2.2 million tons per year; Of that amount, around 1.6 million tons had to be imported. 75% of that amount was imported by five importers, namely PT Gerbang Cahaya Utama, PT Teluk Intan, PT Gunung Sewu, PT Cargill Indonesia, and PT Sekawan Makmur Bersama .

Soybean production in Indonesia							
Year	2004	2005	2006	2007	2008	2009	2010
Total Production in Indonesia (tonnes)	723 483	808 353	747 611	592 634	776 491	603 531	-



Soybeans

In Indonesia, soybeans are the main source of vegetable protein nutrition, although Indonesia has to import most of its soybean needs. This happens because of Indonesia's high demand for white

soybeans. While soybeans are not native to tropical plants so yields are always lower than in Japan and China. Breeding and domestication have not succeeded in completely changing the photosensitive properties of white soybeans. On the other hand, non-photosensitive black soybeans have received less attention inbreeding, although from an adaptation point of view it is more suitable for Indonesia.

Soybean is a versatile plant. Because the roots have free nitrogen-fixing nodules, soybean is a plant with high protein content, so the plant is used as green manure and animal feed.

Business prospect

Soybean seeds, which are commonly known to the public only as tempeh, can also be processed into processed tempeh which can replace tempeh as a substitute for animal protein. Tempe is a processed product from soybeans that is processed by a fermentation process. To be able to be processed into various foods and industrial needs such as tempeh nuggets, tempeh sausages, tempeh croquettes, tempeh gimbals, tempeh juice, tempeh pudding, etc., their role becomes strategic in national development, among others, can increase agro-industry growth, increase job opportunities. and business opportunities in each of its agribusiness chains, thus soybean seeds are a food commodity that has the potential to be developed in food commodity processing programs with the use of vegetable protein to increase food security.

Tempe is a food that is only consumed by the lower middle class and most of the transmigrating people of Java, Bali in the Southeast Sulawesi area consume it monotonously (not varied) so there is a need for innovations about Tempe processing, this will change consumption patterns that lead to variations in Tempe consumption patterns caused by the availability of various processed products, various types of food for side dishes, snacks, drinks, and various snacks that have a distinctive taste, aroma and attractive appearance and do not reduce the rules and nutritional value of Tempe itself. Thus, there is a mutually beneficial business prospect due to the increase in the economic value of Tempe into a high-level commodity and can encourage farmers to utilize, develop and increase their production to meet increasing market needs due to changing consumption patterns and better commodity prices. These changes are caused by the availability of various processed products from Tempe.

Soybean tempeh

Tempe is a food made from fermented soybean seeds or some other ingredients using several types of Rhizopus molds, such as Rhizopus oligosporus, Rh. oryzae, Rh. stolonifer (bread mold), or Rh. arrhizus . This fermented preparation is commonly known as "tempe yeast". Tempe is whitish due to mold hyphae that attach soybean seeds



Soybean tempeh

Unlike other traditional soy foods which usually originate from China or Japan, tempeh originates from Indonesia . It is not clear when the tempeh-making began. However, this traditional food has been known for centuries, especially in the eating culture of the Javanese people, especially in Yogyakarta and Surakarta . In chapters 3 and 12 of the Serat Centhini manuscript with Javanese settings in the 16th century (Serat Centhini itself was written in the early 19th century) the word "tempe" has been found, for example by mentioning the name of the dish jae santen tempe (a type of tempeh dish with coconut milk). and kadhele tempe srundengan . This and other available historical records indicate that perhaps tempe was originally produced from black soybeans , originated from traditional Javanese

rural communities, possibly developed in the Mataram area, Central Java , and developed before the 16th century. Indonesia is the largest tempe producer in the world and the largest soybean market in Asia . As much as 50% of Indonesian soybean consumption is in the form of tempeh, 40% tofu, and 10% in the form of other products (such as tauco, soy sauce, and others). The average consumption of tempeh per person per year in Indonesia is currently estimated to be around 6.45 kg.

Tempe is rich in dietary fiber, calcium, B vitamins and iron. Various kinds of content in tempeh have medicinal value, such as antibiotics to cure infections and antioxidants to prevent degenerative diseases. In general, tempeh is white due to the growth of mycelium of molds that glue soybean seeds together to form a dense texture. The degradation of soybean components in fermentation makes tempeh have a distinctive taste and aroma. In contrast to tofu , tempeh tastes a bit sour.

Nutritional Content of Soy Tempe

No	Nutrient content	Heavy
1	Calories	149 (cal)
2	Protein	18.3 (g)
3	Fat	4.0 (g)
4	Phosphor	154 (mg)
5	Carbohydrate	12.7 (g)
6	Iron	10.0 (mg)
7	Calcium	129 (mg)
8	Vit. A	(50) SI
9	Vit. B	0.17 (mg)
10	Vit. C	0 (mg)
11	Water	64.0 (g)

Source: Directorate of Nutrition Ministry of Health RI, 1981

Soya bean

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Nutrient Content of Soybean Seeds

No	Nutrient content	Heavy
1	Calories	331 (cal)
2	Protein	34.9 (g)
3	Fat	18.1 (g)
4	Carbohydrate	34.8 (g)
5	Calcium	227 (mg)
6	Phosphor	585 (mg)
7	Iron	8.0 (mg)
8	Vitamin A	110 (SI)
9	B vitamins	1.07 (mg)
10	Vitamin C	0
11	Water	7.5 (g)

Source: Directorate of Nutrition Ministry of Health RI, 1981

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immediately if, at the time of flowering, the length of the day is less than 13 hours. This explains the low production in the tropics because the plants flower too early.



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Soy Tempe Fermentation

Fermentation of tempe from the fermentation of soybean seeds or several other materials using several types of Rhizopus molds, such as Rhizopus oligosporus, Rh. oryzae, Rh. stolonifer (bread mold), or Rh. arrhizus. This fermented preparation is commonly known as "tempe yeast". The mold that grows on soybeans hydrolyzes complex compounds into simple compounds that are easily digested by humans.

After peeling, the soybeans are soaked. The purpose of the soaking stage is to hydrate soybean seeds and allow natural lactic acid fermentation to occur to obtain the acidity needed for fungal growth. Lactic acid fermentation occurs characterized by the appearance of a sour odor and foam in the soaking water due to the growth of Lactobacillus bacteria. Lactic acid fermentation and acidification are also beneficial in increasing nutritional value and eliminating toxic bacteria.

Processed Tempe

Tempe is a food made from fermented soybean seeds or some other ingredients using several types of Rhizopus molds, such as Rhizopus oligosporus, Rh. oryzae, Rh. stolonifer (bread mold), or Rh. arrhizus. This fermented preparation is commonly known as "tempe yeast".

Tempe Tempe is a source of protein in the manufacture of Processed Tempe and raw materials for the manufacture of Tempe Nugget, Tempe Pudding. Soy protein, which is the raw material for tempeh, is hydrophilic so that it can absorb and retain water, can help form emulsions and can form membranes or films, form gels, has high adhesion, and is a thickener

METHOD AND PROCEDURES

This service activity uses the method of direction, demonstration, and practice. The directions given were presented in the form of a powerpoint presentation and demonstrated how to make tempeh. After that, it was followed by a discussion session to motivate in improving and developing community service activities. Time and Place This service activity is carried out by group self-help funds in April 2021, namely Sido Mulyo Kendari Small Business Group, Address. Lepo Lepo Village, Baruga District, Kendari City. This service is carried out at the expense of self-help groups

RESULTS

Community service activities regarding Training on the Utilization of Soy Tempe and Processed Tempe Vegetable Protein "Spicy Tempe Nuggets and Tempe Pudding" in Kendari City, this activity was carried out well under the expected goals. The stages of service activities carried out are as follows:

1. Tempeh Making

Tempeh is wrapped in plastic and tempeh leaves are wrapped in banana leaves which are sold in traditional Indonesian markets. However, the technique of making tempeh in Indonesia found by Chandra Dwi Dhanarto (1994) generally consists of *boiling, peeling, soaking and acidifying, washing, inoculation with yeast, packaging, and fermentation*.

In the early stages of making tempeh, soybeans are boiled. This boiling stage functions as a hydration process so that the soybean seeds absorb as much water as possible. Boiling is also intended to soften soybean seeds so that later they can absorb acid during the soaking stage. The soybean seed coat is peeled at the stripping stage so that the fungal mycelium can penetrate the soybean seed during the fermentation process. Peeling can be done by hand, trampled with feet, or with a seed coat peeler. After peeling, the soybeans are soaked. The purpose of the soaking stage is to hydrate soybean seeds and allow natural lactic acid fermentation to occur to obtain the acidity needed for fungal growth. Lactic acid fermentation occurs characterized by the appearance of a sour odor and foam in the soaking water due to the growth of *Lactobacillus* bacteria. <http://id.wikipedia.org/wiki/Subtropis> If the growth of lactic acid bacteria is not optimal (for example in subtropical countries, acid needs to be added to the bath water. Lactic acid fermentation and acidification are also beneficial in increasing nutritional value and eliminating toxic bacteria.

The final washing process is carried out to remove impurities that may be formed by lactic acid bacteria and so that the soybean seeds are not too acidic. Bacteria and dirt can inhibit the growth of fungi.

Inoculation is done by adding inoculum, namely tempeh or *laru yeast*. The inoculum can be in the form of molds that grow and dry on hibiscus leaves or teak leaves (called *usar*; used traditionally), tempe mold spores in flour medium (wheat, rice, or tapioca; many are sold in the market), or pure *cultures of R. oligosporus* (commonly used by tempe makers outside Indonesia). Inoculation can be done in two ways, namely (1) spreading inoculum on the surface of soybeans that have been cooled and dried, then mixed evenly before packaging; or (2) the inoculum can be mixed directly at the time of immersion, left for some time, and then dried.

After being inoculated, the soybean seeds are wrapped or placed in a container for fermentation. Various wrapping materials or containers can be used (eg banana leaves, hibiscus leaves, teak leaves, plastic, glass, wood, and steel), as long as they allow air to enter because tempeh requires oxygen to grow. Wrapping materials from leaves or plastic are usually given holes through pricks. The wrapped soybean seeds are left to undergo a fermentation process. In this process the mold grows on the surface and penetrates the soybean seeds, uniting them into tempeh. Fermentation can be carried out at a temperature of 20 °C–37 °C for 18–36 hours. Shorter fermentation time is usually for tempeh, which uses a lot of inoculum and higher temperatures, while the traditional process using leached from the leaves usually takes up to 36 hours of fermentation. Tempe is whitish due to mold hyphae that attach soybean seeds.

a. Tools and Materials for Making Soy Tempe

List of tools and materials used in the process of making soybean tempeh:

No	Tool's name	Amount	Material Name	Weight/Amount
1.	Steaming Pot/Cooker	1 piece	Soya bean	3 kg
2.	Tampah/Niru	1 piece	Laru Tempe/Yeast Tempe	50 gr/ 3 tablespoons

3.	Drain/drain	1 piece	Wrapping (Leaves/ plastic)	Enough
4.	Stove/Furnace	1 piece	Water	Enough
5.	Awl/wire tool	1 piece	BBM	Enough
6.	Irik/ fermentation rack	1 piece		
7.	Basin	4 pieces		
8.	Scales	1 piece		

b. Working Procedure for Making Soy Tempe

No	Process
1.	Cleaning soybean grains, in 2 ways, namely choosing good/undamaged seeds (hollow, black, moldy) and materials that do not include soybeans and by placing soybeans in a bucket filled with clean water to remove damaged soybeans and existing rocks.
2.	Washing with the treatment of cleaning soybeans with water at the same time the washing process is carried out
3.	Soaking is done after the soybeans are clean, the soybean granules are soaked in clean water for 12 hours to facilitate the peeling of the soybean skin.
4.	Washing, after soaking the soybean grains are washed and if there are floating soybean seeds, they are removed
5.	Boiling for 1 hour to facilitate the stripping of soybean granules
6.	After boiling, washing, and removing the epidermis is kneaded or stepped on with feet wrapped in plastic if the capacity is large until the entire seed coat is cracked, which is submerged with water to remove the epidermis.
7.	Soybean seeds that are not skinned are soaked again for 12 hours to remove the unpleasant odor of soybeans so that the total soaking of soybeans is 24 hours.
8.	After soaking, of course, washing again until clean and boiling for 30 minutes to keep the soybean seeds soft and easy to penetrate and the mycelium of the tempeh molds
9.	After cooking, the soybeans are removed, drained, and cooled by spreading them on a winnowing / nyiru so that they cool quickly so that the soybeans are not too wet so that the humidity can match the needs of the tempeh that will be grown.
10.	The process of mixing laru every 1 kg of soybean seeds is given 1 tablespoon and then stirred until smooth so that mold growth is good
11.	Wrapping tempeh can be done with banana/teak leaves, 1 pack containing 2 or 3 tablespoons of tempeh can also be the rest then tied with a rope so it doesn't open or uses a plastic bag not to be too tight so that the inside of the substrate gets enough air. Tempe mold requires a lot of oxygen for its growth.
12.	Tempering for 1-2 nights, tempeh ingredients that have been wrapped in all the ingredients will be fermented at room temperature 38-40 ° C in a slightly dark place. Which is placed on shelves with sparse surfaces. The wrapped must be arranged and then covered with a cloth or burlap sack, allowed to ripen until hot after the heat, the cover is immediately opened. If it is wrapped in plastic after one night, the next morning it is stabbed with a wire so that fresh air can enter the tempered material and the curing process is continued.
13.	Tempe which has been cured/fermented for 1-2 days, the mycelium grows around each piece of soybean seed so that the pieces become a compact whole (the dense mycelium is compact in shape like cotton)

2. Tempeh Processing

Tempe Tempe is a source of protein in the manufacture of Processed Tempe and raw materials for the manufacture of Tempe Nugget, Tempe Pudding. Soy protein, which is the raw material for tempeh, is hydrophilic so that it can absorb and retain water, can help form emulsions and can form membranes or films, form gels, has high adhesion, and is a thickener.

a. Tempeh Nuggets

Nugget Tempe is one of Tempe Processed products which is a product that contains vegetable protein and is usually made from fish or meat. With innovation and processing technology, products are created to increase people's consumption power in Tempe. Tempe nuggets are made from 50% Tempe with the addition of 50% other ingredients until they reach 100%. Which has standard quality criteria of taste, distinctive aroma, and dense texture with an attractive yellowish-brown shape and color.

b. Working Procedure for Making Spicy Tempe Nuggets

No	Process
1.	Fresh Tempe
2.	Tempe and other supporting materials are weighed
3.	Tempe is cut to facilitate the crushing process
4.	Soaking white bread with milk solution (250 ml of water)
5.	Crushing, in this process the tempeh that has been cut into small pieces and given the soaked bread is put in a blender then add little by little water to make it easier to crush but don't use too much water it will affect the final product
6.	Crushing spices: garlic, onion, small chili, Slicing onions
7.	The tempeh porridge is removed and put into a container mixed with other supporting ingredients (mashed spices, sliced onions, cornstarch, egg yolks)
8.	For printing, the mixed tempeh porridge is inserted into the tray.
9.	After printing do the steaming for 1 hour / until cooked
10.	The cooked dough is removed, cooled after it cools down, cut with a size of 1 x 2 cm
11.	Prepare beaten eggs and breadcrumbs/bread flour for frying preparation, namely nugget sticks moistened with beaten egg and then covered with breadcrumbs/bread flour which is then fried until golden brown.
12.	Spicy Tempe Nuggets

3. Tempe Pudding

Tempe Pudding is one of the processed Tempe products which contains vegetable protein and fiber and is usually made from jelly. With innovation and processing technology, products are created to increase people's consumption power of tempe. Tempe pudding is made from Tempe 50% with the addition of 50% other ingredients until it reaches 100%. Which has standard criteria for taste quality, distinctive aroma, and chewy texture with attractive shapes and colors

Tempe Pudding Working Procedure

No	Process
1.	Fresh Tempe
2.	Tempe and other supporting materials are weighed
3.	Tempe is cut to facilitate the crushing process
4.	Crushing, this process tempeh that has been cut into small pieces and put in a blender then add little by little water to make it easier to crush but don't use too much water it will affect the final product
5.	The tempeh porridge is removed and put into a container mixed with other supporting ingredients (chocolate flour, powdered milk, cornstarch, coconut milk)
6.	Boiling until boiling while stirring
7.	After that do the printing let stand to cool until cold (recommended put in the refrigerator cooler)
8.	For printing, the mixed tempeh porridge is inserted into the tray.
9.	Tempeh Pudding

Quality Test Analysis

In carrying out the food processing process, it is necessary to test the quality of chemical analysis and organoleptic tests, chemical analysis carried out is water content analysis using the

Thermogravimetric method and protein content analysis using the Kadjedal method which was carried out at the chemical laboratory of Haluoleo Kendari University. Meanwhile, the organoleptic test was carried out with a preference sample study consisting of three panelists.

Chemical analysis test of material quality:

1. Analysis of the water content of the thermogravimetric method

In principle, this analysis is to evaporate the water present in the material by heating and then weighing the material to a constant weight which means all the water has been evaporated.

Tools and materials needed:

- a. Ingredients
 - Tempe Flour
- b. Tool
 - The bottle comes with a cap
 - Porcelain cup
 - desiccator
 - Oven
 - Analytical balance
 - Geget/clamp
- c. Work steps
 - Carefully weigh 1-2 samples in a closed weighing bottle whose weight is known.
 - Dry in the oven at ^{105o} for 3 hours.
 - Cool in the desiccator.
 - Re-weigh this work until a constant weight is obtained.
- d. Calculation

$$\text{Water content} = \frac{W1}{W} \times 100\%$$

W = Weight of sample before drying, in grams

W1 = Weight loss after drying, in grams

2. Organoleptic Test

Food quality testing is carried out by sensing with three categories, including the sense of taste (tasting), smell (sense of smell), and sense of touch. This aims to determine the level of food quality assessment in the development of new products and product modifications in consumer acceptance to be marketed.

The method used in this organoleptic test uses a taste sensitivity test, namely:

- a. Prepare products with three samples made differently, products that are steamed without smoking, products that are smoked only, products that are steamed and given smoking treatment.
- b. Each panelist was asked to taste each sample and provide a numerical scale based on the intensity of the resulting taste.
- c. Taste sensitive test results

Tabulation of the test data for the taste sensitivity of Processed Tempe (Spicy Tempe Nuggets and Tempe Pudding)

➤ Spicy Tempe Nuggets

Panelists	Sample code			Information
	567	678	789	
Fatimah	3	2	1	
woman	2	3	1	
Sainab Beddu	2	3	1	

Sample code description:

567 = Product Without Seasoning

678 = Seasoning Added Products

789 = Product Addition of Seasonings and other additions

Description of test value:

1 = I like it

2 = Dislike

3 = Dislike

The results of the sensitivity test of the taste test of the three product samples tested by three product panelists coded 789 were products that were treated differently with other additives.

➤ **Tempe Pudding**

Panelists	Sample code			Information
	567	678	789	
Fatimah	3	2	1	
woman	2	3	1	
Sainab Beddu	2	3	1	

Sample code description:

568 = Products Without Additional Ingredients

678 = Product Addition of Other Materials 25%

789 = Product Addition of Other Materials 50%

Description of test value:

1 = I like it

2 = Don't like it

3 = Dislike

The results of the sensitivity test of the taste test of the three product samples tested by three product panelists coded 789 were products that were treated differently with other additives.

Marketing

After we carry out all production activities, we continue to market it as the market potential in Southeast Sulawesi in particular, quite a lot of consumers support the development of this production which is a snack food for people who want to consume products from processed tempe products.

The people who are expected to become users of this processed product are:

- Orderer
- School residents, Academics
- Public
- Government/private agencies
- Cooperative

Here are some of the above activity documents:



CONCLUSION

After we carried out all production activities, it can be concluded that soybean tempeh is not liked as food by the community, so soybean tempeh is processed, one of which is tempeh nuggets and tempeh pudding products, which have very market potential, quite a lot of consumers support the development of this production which is an alternative food for consumers. people who want to consume products from tempeh flour.

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