

# DEVELOPMENT VEGAN COOKIES BY USING FERMENTED SOYBEAN (TEMPEH)

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## ABSTRACT

Tempeh is a soybean fermented vegetarian food. It is made from soybean. The aim of this study was develop vegan cookies by using tempeh. The tempeh was replaced powder in cookies ingredient for plus nutrient in vegan cookies. The experiment was divided into 5 groups with difference weigh of tempeh; 50 grams, 75 grams, 100 grams, 125 grams and no tempeh. Sensory test was done with 40 persons for the experiment and raw data was analyzed by statistical method. The results of the experiment indicated that the cookie with 50 grams tempeh obtained the highest satisfaction score at 7.27.

**Keyword:** Development, Vegan cookies, Tempeh

## 1. INTRODUCTION

Tempeh is a traditional Indonesian fermented food in which fungi, particularly *Rhizopus* spp., play an important role. [1] Tempeh (pronounced TEM-pay) is a popular Indonesian fermented consisting of tender cooked soybeans bound together by mycelium of *Rhizopus* mold into compact. Tempeh is a high protein food, fresh soy tempeh contains an average of 19.5 percent protein, which compares with chicken (21%), beef (20%), hamburger (13%), eggs (13%) and milk (3%). [2] New product development is an important goal of the food industry. Consumers need food that adds new ingredients or more beneficial ingredients for health promotion or disease prevention. These kinds of food products are often called functional foods. [3] Functional foods has been a huge concern around the world recently that makes healthy lifestyle changes. [3] In the past several years there has been an increase in the number of people who avoid some or all animal food products. [4] Vegan tempeh cookies in this study add tempeh in to cookies for reduce carbohydrate and increase protein that will be a good choice for people who is vegetarian or avoid animal food products.

## 2. OBJECTIVES

1. To develop vegan cookie by replaced versatile wheat flour with paste tempeh in difference amount.
2. To select highly accepted recipe of vegan cookies that replaced versatile wheat flour with paste tempeh

## 3. METHODOLOGY

The raw material such as versatile wheat flour soy bean, trans-fat free butter flavor shortening, rice barn oil, icing sugar, vanilla flavor, salt, baking powder, etc. were purchased from local market.

### Cookies ingredients

The ingredients of original vegan cookie recipe that used in this study show in Table 1. In the experiment cookies were prepared by replaced versatile wheat flour with 0, 50, 75, 100, 125 g of paste tempeh in cookie recipe.

**Table 1** Cookie recipe

Ingredients	Amount
versatile wheat flour	350 g
trans fat free shortening	170 g
rice barn oil	45 ml
icing sugar	80 g
vanilla essence	5 ml
NaHCO <sub>3</sub>	2 g
salt	4 g

**Tempeh preparation**

Tempeh preparation was modified from Samson et. al., 1987 [5] and Esaki et. al., 1996 [6]. The method begins with soak soybean in water for 8-12 hrs. The soaking Soybean was boiled for 30 minutes. After drain off water. The cooked soybean was mixed with 4 ml of 10<sup>8</sup> spore per milliliter of *Rhizopus oligosporus* of spore suspension in 100 grams of cooked soybean after that incubated the cooked soybean with *R. oligosporus* spore in clean plastic zig lock bag that made small hole throughout for 24 hrs. at 30 °C . After incubation soybean should be completely penetrated with mycelium of *R. oligosporus* then soybean in zip lock bag become soybean clump.

**spore suspension preparation**

*Rhizopus oligosporus* obtained from the culture stock of Microbiology Laboratory, Department of industrial microbiology, Rajabhat suan sunundha University, Bangkok, Thailand was used in this study. The inoculum preparation was based on the method described by Kanchana Sitlaothaworn. [7], *R. oligosporus* was culture in potato dextrose agar tubes for 7 days or until spore full forming. A spore suspension was done by suspended *R. oligosporus* spores with sterile distilled water and 0.1% tween 20. A spore suspension was counted using a hemocytometer [8], an inoculum concentration of 1 × 10<sup>8</sup> spores per ml was obtained.

**Cookie preparation**

The basic formulation used for make cookies was show in Table 1. The cookies preparation was modified from BaJaJ et. al., 1991. [9] Tempeh paste was substituted at the rate of 0, 50, 75, 100 and 125 grams of versatile wheat flour (w/w basis). Cookies were baked in an electric oven at 130 °C for 30 minutes. Cooked cookies were packed in polyethylene zip lock bags and stored in airtight containers for further studies.

**Sensory evaluation**

The cookies were evaluated for sensory attributes by 40 non-trained participants that was students in the Faculty of Science and Technology, Suan Sunandha Rajabhat University, Bangkok, Thailand. The participants were mix gender and in the age range 18-21 years old. The 9-point Hedonic scale system for 6 parameters, appearance, color, crispiness, teste, odor and overall preference was use for cookies sensory evaluation. [10 - 12]

**Statistical Analysis**

The results were analyzed by comparison of the mean values that obtained in the different treatments. For sensory evaluation of mean descriptive values, Tukey test ( $p < 0.05$ ) was applied.

**4. RESULTS**

The results of the tempeh cookie sensory evaluation test that contains 5 different recipes, including 50, 75, 100,125 grams tempeh per recipe and without tempeh recipe. The test was composed of 40 students. The results for 6 parameters, appearance, color, crispiness, teste, and odor, overall preference were analyzed using comparison of the mean values the result shown in Table 2 and each tempeh cookie all acceptance score was analyzed by Tukey test ( $p < 0.05$ ) the results shown in Table 3.

**Table 2** Overall scores of the sensorial analysis attributes of soybean fermented cookies\*

Tempeh amount (g)	Sensory evaluation					
	appearance	color	odor	crispiness	teste	Overall preference
Control	7.65±0.05	7.68±1.09	7.28±1.01	5.28±1.04	6.10±1.08	7.08±0.94
50	7.73±0.78	7.60±0.98	6.58±1.06	7.20±1.07	7.03±1.10	7.50±1.06
75	6.83±1.08	7.15±1.08	5.88±1.02	7.13±1.07	7.20±1.07	6.85±1.00
100	5.95±0.93	6.73±1.09	5.25±0.98	6.55±1.09	6.05±0.96	4.88±1.16
125	5.28±1.04	4.28±1.04	2.95±1.04	6.35±0.98	2.90±1.01	3.38±1.13

\*Mean values of forty (40) scores.

**Table 3** The all acceptance score of each tempeh cookie recipes.

Tempeh amount in cookie recipe(g)	All acceptance score
Control(0)	6.84±1.34b
50	7.27±1.08a
75	6.84±1.14b
100	5.90±1.22c
125	4.19±1.64d

\*Same lowercase letters in the same column do not differ by the Tukey test at 5% significance ( $P < 0.05$ ).

From the results in Table 2, the score of 0 g (control) and 50 g tempeh per recipe were highest in appearance, color, odor and overall preference. For the crispiness and test the scores of 50g and 75 g tempeh per recipe were highest. For the all acceptance scores.

The result from Table 3, the 50 g tempeh per recipe were highest, 7.27±1.08 followed by the 0g (control) and 75 g tempeh per recipe, 6.84±1.34. That is worth noting that the control and 75 g tempeh per recipe, the all acceptance value was the same.

## 5. CONCLUSION AND FUTURE WORK

The results of the vegetarian cookie sensory evaluation test that contains 5 different recipes, including 50, 75, 100, 125 grams tempeh per recipe and without tempeh in recipe. The test was done with 40 students. The results of the multi-layered comparison and satisfaction score using Tukey's method found that 50 grams of tempeh recipe was 7.27 points, 75 grams of tempeh recipe was 6.84 points, 100 grams of tempeh recipe was 5.90 points, 125 grams tempeh recipe was 4.19 points and the recipe that is no tempeh was 6.84 points from all information found that the highest satisfaction score is 7.27 was a tempeh cookie recipe that contains 50 g of tempeh. The all acceptance scores of control, 50 g and 75 g tempeh per recipe were interesting, all of them receive high value from 9-point Hedonic scale system. The participants were highly accepting vegan cookies that contain 50g, 0g and 75g tempeh per recipe.

In the further, researchers will choose cookies with tempeh 50 g and 75 g of tempeh cookie recipes to develop cookies to commercial. Both of them will be tested to improve the calories appropriate and measure the amount of protein, fiber, fat and other components to create a vegan cookie product that is health benefits and great taste that is acceptable to consumers.

## 6. ACKNOWLEDGMENTS

The author thanks the Research and Development Institutes, Suan Sunandha Rajabhat University, including Dean and Industrial microbiology department of faculty of science and technology who provided insight and expertise that greatly assisted this research.

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