

The Effect of Fermentation Time on Protein and Fat Content in The Red Beans (*Phaseolus Vulgaris* L.) Tempeh

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ABSTRACT

*Red beans is one of the local foods that is included in the type of legume and has a high nutrition content of vegetable protein and low fat. Red beans can be processed into red beans tempeh, with a fermentation time treatment that can affect protein and fat levels. This research aims to describes the protein and fat content in fermented red beans tempeh for 3 days. This study uses Experimental Design research using a one-shot case study design, which is to provide treatment time of red beans tempeh for 3 days, each 3 pieces of tempeh / day with each treatment using 100 grams of red beans mixed with 0.1 gram of yeast tempeh *Rhizopus* sp. Tempeh that has been formed will be analyzed for the nutritional content of protein and fat. The result showed that the protein content in red beans tempeh on day 2 contained as much protein (13.64 grams), on day 3 (13.64 grams) and on day 4 (9.64 grams). While the fat content in red beans tempeh on day 2 is (0.62 grams), day 3 (1.11 grams) and day 4 (1.14 grams). The protein and fat content in red beans tempeh, the longer the fermentation, the more it will affect the nutrients.*

Keywords: fermentation time, protein, fat, red beans tempeh

INTRODUCTION

Red bean (*Phaseolus vulgaris* L.) is a type of legume (Leguminoceae). The nutritional content of fresh red beans is a fairly high source of energy, protein and carbohydrates. Red beans have low protein content, highest carbohydrate content, lower fat content and higher fiber content compared to soybeans and peanuts (TKPI, 2018). The nutritional content of red beans per 100 grams is 314 kcal of energy, 22.1 grams of protein, 1.1 grams of fat, 56.2 grams of carbohydrates. Red beans are classified as foodstuffs that can support increased nutrition because they are classified as cheap and easy to develop vegetable protein sources (Sulistyowati, 2008).

Red bean production is abundant in Indonesia and easy to

obtain. This is in accordance with data from the Central Statistics Agency (2019) which states that red bean production in Indonesia in 2019 will reach 61,520 tons. Red bean production has increased every year, making it easy to find in the market (Kementrian Pertanian, 2014).

So far, the use of red beans is still lacking, even though red beans are one of the abundant local food supporters in Indonesia. According to Presidential Regulation No. 68 of 2002 concerning food security, namely the development of the use of local foodstuffs such as tubers and nuts, it is necessary to empower local food that is not inferior in nutritional value. Tempeh is a food that is very popular with the people of Indonesia.

The effect of the long duration of fermentation of red bean tempeh

needs to be tested for protein and fat levels, with this nutritional content test, it is hoped that the public will know the levels of protein and fat contained in red bean tempeh from the long fermentation. The results of the protein and fat content tests carried out can be applied in the food industry as nutritious food, rich in protein and fat and of interest to all levels of society.

Based on this description, researchers are interested in conducting research on the effect of fermentation time on protein and fat content in red bean tempeh (*Phaseolus vulgaris* L.).

METHOD

This research is a research Experimental Design. By using a one-shot case study design, namely giving treatment to the independent variables, then observing the results of the related variables. The making of red bean tempeh is carried out at the Ngudi Waluyo University Food Laboratory. The nutritional content analysis test was carried out at the Satya Wacana Christian University Chemical Laboratory in August 2020. The tools used in the manufacture of red bean tempeh are

digital kitchen scales, digital spoon scales, basins, steamed pots, pans, filters, spoons, stoves, tins and trays. Red beans are obtained from Celancang Market, Cirebon Regency. The analysis test for protein content used the Kjeldahl method and fat using the Soxhlet method.

Research procedure

The research was conducted by giving long treatment of red bean tempeh fermentation for three consecutive days as follows: day 2, day 3 and day 4, each 3 pieces of red bean tempeh / day. Each treatment used 100 grams of red beans mixed with 0.1 gram of tempeh yeast *Rhizopus* sp.

Data analysis

The data analysis was done, namely describing the nutritional content of protein and fat in red bean tempeh with a long fermentation treatment for 3 days, then the data was processed using Microsoft Excel.

RESULTS AND DISCUSSION

The results of the analysis of nutrients in red bean tempeh with a fermentation time of 3 days include protein and fat content in 100 grams of food

1. Protein and Fat Nutrient Content

Table 1. Protein and Fat Content in 100 grams of red bean tempeh

Red Beans Tempeh per 100 grams				
Long Fermentation	Nutrients			
	Protein (gram)	Fat (gram)	Average protein (grams)	Average fat (gram)
Day 2				
Deuteronomy 1	19.39	1.16	13.64	0.62
Deuteronomy 2	17.66	0.71		
Deuteronomy 3	3.87	0.01		
Day 3				

Deuteronomy 1	19.39	0.72	13.64	1.11
Deuteronomy 2	17.66	1.28		
Deuteronomy 3	3.87	1.34		
Day 4				
Deuteronomy 1	14.68	1.08	9.64	1.14
Deuteronomy 2	5.46	1.26		
Deuteronomy 3	8.79	1.09		

a. Protein Content

The protein content in fermented red bean tempeh for 3 days has decreased, presumably due to the steaming (heating) and fermentation time, from the original red bean tempeh containing protein on day 2 of 13.64 grams to 9.64 grams on day the fourth after doing the fermentation process for 3 days. This is in accordance with the statement of Kuswanto (2013), the longer fermentation can reduce protein levels because the protease enzyme produced by fungi can hydrolyze protein into amino acids which can be used by mold for growth and development. According to Admin's (2010) statement, excessive heat used during food processing will reduce protein digestibility. Damage by heating reduces the availability of the essential amino acid lysine due to denaturation of these proteins. In line with Sadli's (2014) statement, the heating process will also denature the protein, protein denaturation will damage the protein, so that more denatured protein causes a decrease in protein levels.

According to (Wicaksono, 2014) on red bean tempeh which shows that the crude protein content is 12.92 grams, it can be said that the duration of

fermentation for 3 days will affect the protein content.

Based on the AKG 2019, the protein requirement for male adults is 65 grams and for female adults is 60 grams. This is the second day of red bean tempeh products can contribute about protein content (20.9%), day 3 (20.9%) and day 4 (14.8%) of the total AKG for adult men. Of the three, the highest on day 2 and 3 could contribute protein content (20.9%) from the total AKG. Whereas for women on day 2, red bean tempeh products can contribute protein content of (22.7%), day 3 (22.7%) and day 4 (16.0%) of the three, the highest on the day. 2nd and 3rd can contribute protein content (22.7%) of the total AKG.

b. Fat Content

The fat content in fermented red bean tempeh for 3 days has increased, this is because in this study the fat content increases with increasing variation in the inoculum which is influenced by the activity of the lipase enzyme produced by the fungus *Rhizopus* sp, from which originally red bean tempeh contains protein in The second day of 0.62 grams to 1.14 grams on the 4th day after the fermentation process for 3 days. During the fermentation process the lipase enzyme will hydrolyze triglycerols into fatty acids,

resulting in an increase in the fat content of tempeh along with the addition of laru concentration (Astuti, et al. 2002). This is supported by research (Rarumangkay, 2002), which states that during the fermentation process an oxidation-reduction reaction occurs which produces energy as an electron donor and acceptor. as well as chemical changes which are subsequently changed by a reduction reaction with an enzyme catalyst, and the high fat content can inhibit the fermentation process. According to the results of previous tests conducted in the laboratory by (Wicaksono, 2014) which showed that the fat content of red bean tempeh was 0.11%. It can be said that the fermentation time for 3 days will affect the fat content. The longer the fermentation, the fat content of red bean tempeh will increase. It can be said that the fermentation time for 3 days will affect the fat content. The longer the fermentation, the fat content of red bean tempeh will increase. It can be said that the fermentation time for 3 days will affect the fat content. The longer the fermentation, the fat content of red bean tempeh will increase.

Based on the AKG 2019, the protein requirement for adult men is 75 grams and for adult women is 65 grams. This is the second day of red bean tempeh products can contribute fat content of about (0.82%), day 3 (1.48%) and day 4 (1.52%) of the total AKG for adult men. Of the three, the highest on day 4 contributed fat content (1.52%) from the total AKG. Whereas for women on day 2, red bean tempeh products can

contribute fat content around (0.95%), day 3 (1.70%) and day 4 (1.75%) of the three, the highest on the day. the fourth can contribute fat content (1.75%) of the total AKG.

CONCLUSION

Based on the results and discussion, it can be concluded that:

1. The protein content in red bean tempeh, the longer the fermentation, the lower the protein content, with treatment on day 2 of (13.64 grams), day 3 (13.64 grams) and day 4 (9.64 grams).
2. Fat content in red bean tempeh, the longer the fermentation, the fat content will increase, with treatment on day 2 of (0.62 grams), day 3 (1.11 grams) and day 4 (1.14 grams).

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