

Increasing energy values of biscuits with tempe purée and sardines flour as the ingredient substitutions

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Abstract. This research and development study aims to investigate the energy values of biscuits made of tempe purée ad sardines flour (sardinella). The experiment was conducted in the Laboratory of Home Economics Department (PKK) in Engineering Faculty of Universitas Negeri Makassar. The used data collection technique is documentation from proximate analysis. The used data analysis technique is descriptive analysis. The process of making biscuits using tempe purée and sardines flour starts with weighing all the ingredients, mixing, weighing the dough for 1 biscuit, moulding the dough, placing in the oven and baking, remove from the oven and cooling, then packing the biscuits. The results showed that the nutritional values based on the proximate test of the biscuit formula with the substitution of tempe purée and sardines flour showed that the calorie value increased to 7.8 kcal, fat value increased to 1.72 grams, and calcium value increased to 5.59 grams.

Keywords: Biscuit, Sardines Flour, Tempe Purée

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INTRODUCTION

The rapid world population growth raises awareness of the need to fulfill daily essentials, especially food. The foodstuffs should be available for all in terms of quantity and quality. Since the good quality of food will support the growth of human resources, eventually it will accelerate the resolution of problems raised in society (Van Wijngaarden, 2014; Legowo, 2015). The source of foodstuff could be from animals and vegetables. The good quality of foodstuffs will bring good effect to consumers. Better quality of foodstuffs will give good impact on health and good health will give good impact on performance enhancement of human resources. Foodstuffs can be fulfilled independently or imported from surrounding areas or other countries. This indicates that no region can provide all its own needs so it requires other regions to supply foodstuffs (Legowo, 2015; Widyastuti, 2019).

Availability of good food will maintain family health. Fulfillment of the availability of these foodstuffs for family does not always have to be expensive. It should have complete nutritional content, even though it is cheaper and convenient. One of these foods is tempe, which is a type of food that contains high nutrition, especially protein, calcium, zinc, iodine, but also a type of food that has a distinctive aroma that some people dislike. Usually, tempe is fried or cooked before it is consumed. Another alternative to process tempe and still get the nutrition is to make tempe purée, so it can be used as substitute ingredient for various foods (Astawan, 2016; Hidayat, 2015; Rosida, 2015).

Tempe also contains antioxidants that can prevent coronary heart disease, cancer, diabetes and hypertension, as well as cure night blindness and beriberi, producing lovastatin as lowering blood cholesterol, and lowering plaque atherosclerosis. Currently, people of South Sulawesi still consume less tempe than fish, this is due to the lower characteristics of tempe compared to fish (Astawan, 2016; Hidayat, 2015).

The other ingredients are sardines. Sardines are cheap and easy to obtain, but it has numerous small bones. The large number of bones gives the effect of many people do not like it to consume freshly (Widodo 2017; Tamm, 2015).

Tempe and sardines which are high in nutritional content have the potential to increase people's nutritional consumption by changing their forms to be safer and more acceptable, so that people who consume them do not have to worry and still get nutritional benefits. Both of these ingredients have the potential to be substituted for biscuits. The selection of biscuits is based on the type of food in the snack category which has a longer shelf life than fresh food ingredients and biscuits are widely liked by people of all ages. Regarding this consideration, it is possible to consume more biscuits and people can consume the nutrients contained in the ingredients of the biscuits. In the end, this type of food can be used as a nutrient enhancer and can be consumed for a long time and in large quantities. Eventually, biscuits can be used as food intervention to improve nutritional status for people experiencing nutritional problems. (Adams, 2017; Alam, 2014; Dainy, 2017; Fatmah, 2013; Manley, 2017; Widodo, 2017).

Based on these facts, it is necessary to formulate a highly nutritious supplementary food using tempe purée and sardines in the form of biscuits. The

advantages of biscuits are their small size, relatively long shelf life, and are well accepted by the community. The biscuits produced by the manufacturer are currently not enriched with local foods that contain high nutrition like tempe.

Based on the explanation above, it is urgent to conduct an in-depth study about the formulation of biscuits with the substitution of tempe purée and its acceptability. This study aims to determine the nutritional content of biscuits with the substitution of tempe purée and sardines (sardinella).

RESEARCH METHOD

Research Design

This experimental study is conducted in several steps. The first step is the process of making tempe purée and sardines flour, the second step is the formulation of biscuits using tempe purée and sardines flour according to the specified formula to get the best biscuits, the third step is the acceptance test of the biscuits to 36 trained panelists, and the last step is the nutritional content test of selected biscuits in a certified laboratory.

Ingredients

The ingredients to make the biscuits besides tempe purée and sardines flour are margarine, sugar, egg yolk, vanilla, baking powder, cornstarch, wheat flour, and chemical nutritional analysis ingredients.

Place and Time

This research was carried out from April 2020 to August 2020 at the Laboratory of Home Economics Department FT UNM for the formulation process and quality test of the biscuits, while the examination of the nutritional content was carried out at the Integrated Laboratory of Bogor Agricultural University (IPB) with testing certificate number: LT-10-20-0566.

Data/ Measurement Source

The data collected were the quality and acceptance of biscuits by observing and measuring the organoleptics to the 36 trained panelists. The organoleptic measurements are color with 7 scales (very dark brown-very light brown), aroma with 7 scales (very bad fragrant-very nice soy fragrant/ tempe), texture with 7 scales (very not very crispy-very crunchy), taste with 7 scales (very bad-very good), overall with 7 scale (very bad-very good), and hedonic with 11 scale (extremely dislike-extremely like). The nutritional content data uses the description method by presenting the results obtained directly from the nutritional content examination at the Integrated Laboratory of IPB.

Data Analysis

The organoleptic data were analyzed using mean and average discrimination test, while the nutritional content was presented in a descriptively.

RESULTS AND DISCUSSIONS

The Process of Making Tempe Purée

Tempe puree is one of the processed soybean which aims to make it easier for further processing and consumption. The form of tempe purée is coarse pulp. The process begins with tempe cut into cubes with a size of 1.5 cm X 1.5 cm X 1.5 cm to make it easier to steam and to grind. Next, the cubes tempe are steamed for 20 minutes at 100°C, then mashed with meat grinder until it smooth. Tempe purée is characterized by its fragrant aroma, creamy color, smooth texture, and delicious taste.

The color of puree is influenced by the main ingredients of tempe, namely mold for its white and soybeans for its cream. The fresh aroma of tempe is not influenced by other ingredients, the smooth texture is caused by the refining process of the tempe and the savory taste is due to the integration of the protein and fat content in the tempe. These are in line with the results of previous studies on tempe in 2020 (Faizah, 2020; Wahyu, 2020; Kadar, 2020)

The Process of Making Sardines Flour

Sardines are one of the marine fish with lots of small bones but the high of minerals and calcium, relatively affordable, and delicious taste. To avoid the risks when consuming and still get the high nutritional benefits of sardines, it can be processed into sardines flour. The process of making sardines flour starts with cleaning the fish, then removing the fins, tail, scales, head, and stomach contents because these parts have low nutritional content and can affect the quality of the sardines flour. The clean sardines are then steamed to soften the bones for 30 minutes using pressure cooker. After 30 minutes, the fish is removed and cooled, then it is grinded using a meat grinder until you get a smooth sardines puree. The sardines puree is then dried in an oven at 60-70 °C for 6 hours. The dried sardines puree is then ground using a grinder until it is smooth. In using it as a substitute ingredient in biscuits, the sardines flour is sieved using an 80 mesh sieve. The distinctive features of sardines flour are light brownish color, nice fish aroma, dry smooth texture, and savory taste.

The color change from gray to light brown was caused by the denaturation of protein and the heating process of fat in the sardines, while the fine texture was due to grinding and filtering using a fine size of 80 mesh, and the delicious taste was also caused by the collaboration of fat and protein when heating sardines. These are in line with previous studies on biscuits and sardines flour (Manley, 2001; Widodo, 2017; Widodo, 2017).

Formulating Biscuits Using Tempe Purée and Sardines Flour as Substitute Ingredients

The aim of this formulation is to get delicious biscuits, attractive, and accepted by the community. The biscuit formulation can be seen in the Table 1.

Based on the data in Table 2, it can be seen that the quality of the biscuits produced after being substituted with tempe purée and sardines flour shows that the more substituted ingredients are added, the darker the color, the less fragrant the aroma, the less crunchy the texture, the more unpleasant the taste, the overall score is decrease, and the level of preference is dislike. the result of the acceptance test shows that the most preferred formula is the FPTI 1 (47% panelists) with the substitution amount of tempe purée is 2.7 grams (10%) and sardines flour is 3%.

The darker color of the biscuits after being substituted was because of the roasting process of ingredients and also due to denaturation of the protein in ingredients. The aroma is getting less fragrant due to the breakdown of protein in tempe which causes the ingredients to smells scorched. The texture is not crispy because the substitute ingredient has low gluten content. The process of making biscuits and bread is influenced by gluten in the ingredients, therefore the lower the gluten, the crumbly/ shapeless the resulting product. However, if the gluten is too high, it will make the biscuits hard. The unpleasant taste is resulted from the excessive amount of tempe used in the formula. Tempe has its own taste and smell that many people dislike if it is in big portion. Meanwhile, the acceptance rate is shrink because the quality is decrease. This is in accordance with previous studies over the last decade (Manley, 2017; Widodo, 2015, Widodo, 2017, Man, 2014 Van Stuijvenberg, 2001 Sharma, 2012 Weston, 2017)

Nutritional Content of the Biscuits

The nutritional content of biscuits using tempe purée and sardines flour is the combination of nutrients in the constituent ingredients and will experience changes either decreasing or increasing according to how it processed. The nutritional content of biscuits using tempe purée and sardines flour is presented in Table 3.

Table 3. Changes in the nutritional content of biscuits after substituting tempe puree and sardines flour (Certificate Number LT-10-20-0566), UJPKS LAB IPB 2020

Nutritional Elements	Fo	FTPI	Nutritional Changes
Calorie (Kkal)	428,86	436,66	7,8
Water (%)	4,56	4,73	0,17
Protein (%)	11,17	10,78	-0,39
Fat (%)	10,18	11,9	1,72
Ash (%)	0,95	0,99	0,04
Fiber (%)	0,34	0,27	-0,07
Carbohydrate (%)	73,14	71,61	-1,53
Zinc (mg/Kg)	18,01	16,82	-1,19
Calsium (%)	0,73	6,32	5,59
Iron (mg/Kg)	52,86	38,99	-13,87

Based on the data in Table 3, biscuits with tempe purée and sardines flour have higher calories, water, fat and calcium. The increase was because of these elements contain in ingredients and affecting the final result of the biscuits. The

increase gave an indication that the substitution of tempe purée and sardines flour had a significant effect on calories but needed to anticipate the increase of water content. Water is a living medium of micro-organisms that can damage food. For this reason, the less water content in a product, it is assumed that the product will last longer. This is in accordance with previous studies on biscuits (Kartika, 2014, Manley, 2017; McIntyre, 2010, Widodo, 2017; Man, 2014)

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