

The Use of Tempeh in the Instant Tempeh Pudding as Functional Food

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Abstract

Additional food feeding has limitations in terms of processing and variations. However, it can be modified in various forms by utilizing tempeh, a highly functional food ingredient. This study aims to (1) explore the acceptability of instant tempeh pudding based on the parameters of color, taste, aroma, and texture, and (2) analyze the content of the chemical test including water, ash, protein, fat, and carbohydrate content. This research employed an experimental design and a completely randomized design (CRD). Chemical properties were analyzed using the proximate method. Meanwhile, the organoleptic properties were analyzed using the hedonic test. This study employed 30 moderately trained panelists and conducted a statistical analysis using the ANOVA test and Duncan's follow-up test (DMRT). This research was conducted in June 2021 at the Organoleptic Laboratory and Goods Quality Testing and at the Certification Center to analyze chemical properties. The organoleptic test examined the categories of color, taste, aroma, and texture of three pudding treatments with the addition of 80 grams (A1), 100 grams (A2), and 120 grams (A3) of tempeh flour. The chemical test has discovered that the average water content of the pudding from the three treatments is 67.1–69.8, the ash content is 0.63-0.68, the protein is 3.80-4.22, the fat is 0.28-0.47, and the carbohydrates are 24.9-27.7%. The addition of 80 grams, 100 grams, and 120 grams of tempeh flour does not significantly affect the organoleptic properties of the pudding. Finally, the chemical analysis shows that the addition of 80 gr, 100 gr, and 120 grams of tempeh flour significantly affects water and carbohydrate content but does not significantly affect ash, protein, and fat content.

Keywords: chemical test, organoleptic test, tempeh flour, tempeh pudding

Introduction

Good nutritional status is a valuable investment to make Indonesian Human Resources (HR) healthy, intelligent, and productive. Nutritional disorders in infants and toddlers must be addressed seriously because a lack of macronutrients and micronutrients can decrease the quality of life and prosperity of a nation. The 2007-2019 Basic Health Research deploys that the incidence of nutritional problems is still high. Meanwhile, the 2016 to 2017 national food consumption survey has discovered that seven out of ten children under five years old still experience a lack of calories, and five out of ten toddlers still experience a protein deficiency. Inadequate food consumption can cause malnutrition, which, in the long term, will become a chronic nutritional disorder, such as stunting (Kemenkes RI, 2019). Nutritional problems in toddlers can be overcome by providing high intake of calories and proteins through additional food.

Additional food feeding or nutritional supplementation, especially for children, is a program to increase access to nutritious food and meet the needs of children to overcome nutritional problems. Supplementary food is given to all toddlers aged 6 months to 59 months (Kemenkes RI, 2019). Based on the 2019 additional food feeding technical guidelines for toddlers, the provision of additional food to toddlers must meet a minimum nutritional content of 160 calories, ranging from 3.2 to 4.8 grams of protein and from 4 to 7.2 grams of fat. Supplementary food for toddlers is more frequently given in the form of biscuits or other forms of nutritional preparations, such as processed pudding.

Pudding is a type of snack commonly consumed by the public. This food is made from starch and processed by boiling, steaming, and baking gel with a soft texture. Pudding is made of instant pudding flour consisting of dry ingredients, such as milk powder, cocoa powder, agar powder, and sugar; the instant pudding flour is then processed by mixing water until the solution is homogeneously mixed (Darmawan et al., 2014).

Pudding is usually served as an appetizer (Darmawan et al., 2014). In general, pudding is grouped into wet snacks, which are usually served on certain occasions. Pudding is children's favorite food. Moreover, pudding has a fresh taste, soft texture, and ease of processing practices (Arysanti et al., 2019).

In addition, pudding provides several nutritional content and benefits. According to Naligar (2014), pudding contains nutrients in the form of fat, calcium, potassium, and many minerals. For example, calcium is useful to maintain electrolyte balance and body fluids, and potassium is useful to optimize cell formation and maintain heart health. In addition, the fiber content in the pudding is useful to maintain intestinal health to make bowel movements more regular; as a result, the stomach becomes more comfortable. In this case, fiber can facilitate digestion systems in toddlers.

Ordinary pudding commonly consumed by children does not contain many nutrients; thus, it is necessary to add other food ingredients to make nutritious pudding. In this case, one of the food ingredients with good nutritional content and is applicable in the development of pudding is tempeh.

Tempeh is one of the functional food ingredients originating from Indonesia. It is made of soybean seeds or other ingredients and is processed through fermentation using tempeh yeast (BSN, 2012). Tempeh provides many benefits because the fermentation process in tempeh changes the soybean components into nutritional content and bioactive components; thus, consuming tempeh offers better content and benefit values than only consuming soybeans (Astawan et al., 2017). Tempeh has more advantages than soybeans, such as high protein complement, 8 essential amino acids, low saturated fat, low cholesterol levels, high vitamin B12, ease of digestion, antibiotics, and stimulates growth. In addition, the decomposition of phytic acid in tempeh fermentation could increase the absorption of Fe, Ca, Zn, and Mg which are useful to increase people's appetites, including toddlers. Meanwhile, Fe and Zn are useful to absorb protein and micronutrients, which ultimately help the growth and development process in toddlers (BSN, 2012).

Tempe products can be diversified into tempeh flour to optimally utilize tempeh; thus, society loves consuming this food. Tempeh flour is more flexibly used and has a longer shelf life. One of the flexibilities of tempeh flour is its ability to be a food ingredient to make pudding (Murni, 2013). The addition of tempeh flour in the pudding is expected to be one of the

additional food products functioning as a source of energy, protein, fat, carbohydrates, and other nutrients. Thus, toddlers who consume tempeh can meet their nutritional needs.

Attempts to develop tempeh products and create more nutritional food are in line with government programs that initiate nutritional improvement for toddlers. The development of instant tempeh can solve nutritional problems because it offers nutritious food products in the form of and help people save time to make it. Therefore, the researchers are interested in investigating the use of instant tempeh pudding development as a functional food.

This research aims to (1) investigate the acceptability of instant tempeh pudding by considering the parameters of colors, tastes, aromas, and textures, and (2) analyze the content of chemical tests including water, ash, protein, fat, and carbohydrate content.

Methods

This experimental research employed a completely randomized design (CRD) with three treatments and three repetitions. The chemical analysis employed a proximate test to examine the content of water, ash, protein, fat, and carbohydrates. The organoleptic analysis using the hedonic test examined color, taste, aroma, and texture. This study employed 30 moderately trained panelists and conducted the statistical analysis using the ANOVA test and Duncan's follow-up test (DMRT). This research was carried out in June 2021 at the Organoleptic Laboratory of the Department of Nutrition and the Laboratory of the Aceh Goods Quality Testing and Certification Center (BPSMB) to analyze the chemical properties of pudding.

Results

Organoleptic Test

This research investigates the organoleptic characteristics (color, taste, aroma, and texture) of the pudding with the addition of tempeh. This investigation has revealed that the panelists strongly like tempeh pudding made of the treatment with the addition of 80 grams of tempeh because it has a preferred color (3.77) and taste (3.48). Meanwhile, the panelists somewhat like 100 grams of tempeh flour and 120 grams of tempeh flour.

Table 1. Organoleptic Test Results on Tempeh Pudding

Treatments	Average Preference for tempeh pudding			
	Color	Taste	Aroma	Texture
Addition of 80 grams of tempeh flour	3.77	3.48	3.45	3.43
Addition of 100 grams of tempeh flour	3.55	3.26	3.28	3.58
Addition of 120 grams of tempeh flour	3.55	3.22	3.41	3.55

Table 1 concludes that the panelists strongly like pudding with the addition of tempeh flour because it has excellent organoleptic characteristics of colors, tastes, aromas, and textures. The panelist assessment signifies that pudding with the addition of tempeh 80 grams of flour is the most preferred treatment.

Color parameters were assessed using senses of vision. Color is a pivotal aspect of a meal because interesting colors will invite consumers or panelists to taste it and will influence consumers' acceptance (Winarno, 1997 in Mustar, 2013). The results of this study show that

each treatment is visibly applied, and the color produced by each treatment tends to be equal, namely brown. Meanwhile, the instant tempeh pudding with an addition of 80 grams of tempeh flour has a concentrated brown color. If this ingredient is added with the treatment of 100 grams and 120 grams of tempeh flour, the pudding's color will become a little pale chocolate.

The impression of brown colors produced at any treatment of tempeh pudding is influenced by the addition of the same amount of chocolate powder in each treatment. This finding agrees with Farida et al. (2008) who opine that the addition of chocolate powder in a food product can affect the resulting color. Adding more chocolate powder to the food will make the produced food browner (Langkong et al., 2019). The tempeh flour also contributes to the color of the instant tempeh pudding because the flour affects the level of concentration and the produced color. However, the impression of brown is more dominating so that this color covers the whole tempeh flour.

The results of the ANOVA analysis show that the addition of tempeh flour in different amounts does not significantly affect the color of the instant tempeh pudding with an F-count value of 1.186 and a significant level (p-value) of $0.310 > 0.05$. These results conclude that the instant tempeh pudding with the addition of 80 grams, 100 grams, and 120 grams of tempeh flour does not significantly affect the color of the pudding.

The taste of pudding produced in this study is sweet and typical-tempeh flavor. The sweetness of the pudding is obtained from the addition of refined sugar while the typical taste of tempeh is obtained from the addition of tempeh flour. The three treatments (the addition of 80 grams, 100 grams, and 120 grams of tempeh flour) tend to produce a similar taste of the pudding, namely sweet and typical-tempe. Although the food is made of several flavors, it tends to have one taste. Winarno (1991) states that the taste of food can be influenced by various factors, namely chemical compounds, temperatures, concentration, and linkages between one to another flavor component (Zulistina, 2019).

The ANOVA analysis has discovered that the taste of the instant tempeh pudding has an f-value of 0.809 and a significant level (P-value) of $0.449 > 0.05$. These results conclude that the addition of tempeh flour in different amounts does not significantly affect the flavor of tempeh pudding because the produced flavors are strange and brown aroma.

The aroma is generated by the addition of tempeh flour and a brown aroma from the chocolate powder. Adding more tempeh flour will increase the flavor of tempeh. Soekarto (1985) in Mustar (2013) asserts that the aroma produced from food can be used as an indicator to determine the level of delicacy. Moreover, a delicious or typical aroma can affect consumers in tasting the food (Mustar, 2013).

The ANOVA analysis has discovered that the tempeh pudding aroma has a calculated f-value of 0.510 with a significant level (p-value) of $0.602 > 0.05$. These results conclude that the addition of tempeh flour does not significantly affect the aroma of tempeh pudding. The texture of tempeh pudding is solid and soft. The solid texture is influenced by the addition of tempeh flour while the soft texture is influenced by the addition of gelatin powder. This study has revealed that the three treatments have a similar texture. The food texture can be observed using fingers to reveal three elements: mechanics (violence and elasticity), geometric (sandy and misguided elements), and mouthfeel (oily and runny elements). The results of the Variety analysis (ANOVA) demonstrate that the addition of tempeh flour does not significantly affect the pudding texture with the F-count value of 0.316 and a significant level of $0.730 > 0.05$.

Analysis of Nutritional Content

The statistical analysis of water content has proven no significant difference in the test parameters of tempeh pudding. In addition, the average value of the highest water content is 69.8%. and is found in the pudding with the addition of 100 grams tempeh flour.

Table 2. Nutritional Values of Pudding

Test Parameters	Treatment		
	A1	A2	A3
Water content	67.1%	69.8%	67.9%
Ash content	0.68%	0.68%	0.63%
Protein	4.07%	4.22%	3.80%
Fat	0.34%	0.28%	0.47%
Carbohydrate	27.7%	24.9%	27.0%

Water content and water activities in foodstuffs have a major influence in determining the texture of the foodstuffs. Water content plays a very influential role in the quality of the product. Therefore, if the water content exceeds food standards, microbes or other microorganisms will grow in the food spoilage quickly emerge (Pratama et al., 2014 in Normilawati et al., 2019).

Ash content is an organic residue resulting from the ashing of organic compounds. In the combustion process, organic compounds will be burnt while inorganic compounds are not; thus, they become ash. More minerals in the raw materials used will result in more ash content in the material (Yulianti, 2016). The results of this study show no significant difference in ash content.

The analysis of protein content has proven that the highest protein content is 4.22% and is found in the pudding with the addition of 100 grams of tempeh. This result indicates no significant difference in protein content. Protein is crucial for the body, especially for children who are in a period of growth and have fairly dense activities. The nutritional intake from pudding is expected to maintain health and endurance. The additional food feeding guideline (2019) explains that good protein levels in additional foods range from 3.2 to 4.8 grams. The analysis of protein levels has discovered that all puddings have good categories of proteins, which range from 3.2 to 4.8 grams.

Furthermore, the analysis of fat content has discovered that pudding with the addition of 120 g of tempeh has the highest fat content of 0.47%. This result interprets no significant difference in fat content. Fat is an important substance to maintain the human's healthy body. In addition, fat is a source of reserve energy that is used apart from carbohydrates and protein (Winarno, 2004 in Yulianti, 2016).

The additional food feeding guideline (2019) explains that the good fat levels in additional foods range from 4 to 7.2 grams. The analysis of the fat content in the pudding has discovered that the fat content in the pudding ranges from 0.28 to 0.47 grams. This result concludes that the fat content in the pudding does not follow the nutritional standards for additional foods. This can be initiated by adding other sources of fat to increase the nutritional value of fat in tempeh pudding.

The highest carbohydrate content in tempeh pudding is 27.7% and is found in the addition of 80 grams of tempeh flour. Winarno (2004) in Yulianti (2016) calculated carbohydrate content using different methods and has discovered that carbohydrate content is influenced by other

nutritional components. Carbohydrates are the main source of calories for the human body. Moreover, carbohydrates play an important role to determine the characteristics of foodstuffs (Winarno, 2002 in Mustar, 2013)

CONCLUSION

Instant tempeh pudding is an alternative snack for toddlers and is made of local food ingredients, namely tempeh. This tempeh is then processed into tempeh flour, which offers good nutritional content to meet the nutritional needs of toddlers and reduce the risk of nutritional problems in toddlers. The development of instant tempeh pudding consists of three selected formula designs: formula pudding with the addition of 80 grams of tempeh flour, formula pudding with the addition of 100 grams of tempeh flour, and formula pudding with the addition of 120 grams of tempeh flour. The organoleptic test has discovered that the highest values of color, taste, and aroma categories are found in the 80 grams of tempeh flour formula. Moreover, the organoleptic test has discovered that the highest texture value is found in the 120 grams of tempeh flour formula. Pudding with the addition of 80 grams, 100 grams, and 120 grams of tempeh flour significantly affects water content and carbohydrate content. In contrast, pudding with the addition of 80 grams, 100 grams, and 120 grams of tempeh flour does not significantly affect ash, protein, and fat content.

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