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Substitution of Tempeh Flour with Beetroot Flour *(Beta vulgaris L)* in Cookies as Alternative High Protein Snack

Substitusi Tepung Tempe dengan Tepung Bit Merah (Beta vulgaris L) pada Cookies sebagai Alternatif Camilan Tinggi Protein

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ABSTRACT

Background: Tempeh is a fermented soybean product which high in protein, that beetroot also contains protein and antioxidant compounds. The substitution of tempeh flour and beetroot flour for the cookies can increase the protein nutritional value in cookies.
Objectives: This research was to determine the nutrition value of the selected formulation cookies (F1) based on the result of acceptability test of cookies substitution with of tempeh flour and beetroot flour which compared with the SNI standard for supplementary feeding (MP-ASI biscuits).
Methods: This is an experimental research with completely randomized design (CRD) with 2 treatment for cookies F1 (substitution of 0.09% tempeh flour and 10% beetroot flour) and cookies F0 (without substitution tempeh flour and beetroot flour). Parameter observed were the nutritional value of cookies are protein, carbohydrate, fat, fiber, water value, and ash value with 3 repetitions. The result of the analysis will be compared the SNI standard for MP-ASI biscuits.
Results: From the results of the analysis of the nutrition value of the F1 cookies, that the protein value 12.19%, carbohydrate value 69.19%, fat value 22.73%, fiber value 11.15%, water value 2.96%, and the ash value 2.25% according to SNI requirements for MP-ASI biscuits with protein value of not less than 6 grams per 100 grams. There is a significant difference in protein nutrition value between F0 cookies and F1 cookies.
Conclusions: Cookies F1 has protein value, water value, ash value according to SNI standard while charbohydrate and fat value exceeds SNI standard. One serving (2 pieces of cookies equivalent to 20 grams) can meet 9 - 16% of protein needs in toddler 1 - 5 years.

ABSTRAK

Latar Belakang: *Tempe adalah hasil olahan fermentasi kacang kedelai yang mengandung protein yang tinggi. Bit merah juga mengandung protein dan senyawa antioksidan. Substitusi tepung tempe dan tepung bit merah dalam pembuatan cookies dapat meningkatkan kandungan protein dalam cookies.*
Tujuan: *Penelitian ini adalah untuk mengetahui kandungan zat gizi pada cookies formulasi terpilih (F1) berdasarkan dari hasil uji daya terima cookies substitusi tepung tempe dan tepung bit merah yang akan dibandingkan dengan standar SNI MP-ASI Biskuit.*
Metode: *Merupakan penelitian eksperimen dengan rancangan acak lengkap (RAL) dengan 2 perlakuan yaitu cookies F1 (substitusi tepung tempe 9,09% dan tepung bit merah 10,0%) dan cookies F0 (tanpa penambahan tepung tempe dan tepung bit merah). Parameter yang diamati adalah analisis kadar protein, karbohidrat, lemak, serat, kadar air, dan kadar abu pada cookies F1 dan cookies kontrol (F0) dengan 3 kali pengulangan. Hasil analisis dibandingkan dengan Standar Nasional SNI MP-ASI Biskuit.*
Hasil: *Hasil analisis kandungan gizi pada cookies F1 adalah kadar protein 12,19%, kadar karbohidrat 69,19%, kadar lemak 22,73%, kadar serat 11,15%, kadar air 2,96%, dan kadar abu 2,25% telah memenuhi persyaratan SNI biskuit MP-ASI dengan nilai protein tidak kurang dari 6 gram per 100 gram. Terdapat perbedaan signifikan kadar protein antara cookies F0 dengan cookies F1.*

Kesimpulan: *Cookies F1 memiliki kandungan protein, kadar air, kadar abu sesuai dengan standar SNI sedangkan kandungan karbohidrat dan lemak melebihi standar SNI. Satu takaran sajian cookies (2 keping cookies setara dengan 20 gram) dapat memenuhi 9 - 16 % kebutuhan protein pada balita.*

Kata Kunci: *Tepung bit Merah, Cookies, Kadar protein, Tepung tempe*

INTRODUCTION

In Indonesia, one of the nutritional problems in toddlers is malnutrition. Based on the results of the Riskesdas 2018, the prevalence of malnutrition status (weight for age) (BB/U) under five in Indonesia reached 3.9% while malnutrition was 13.8%[1]. One of the factors that can affect the nutritional status variable in toddlers is the mother's knowledge of nutritional status because the mother's ignorance of the nutritional needs of her child so that there are still many cases of children experiencing certain nutritional deficiencies. The protein adequacy rate for toddlers aged 6-8 months it is 15 grams/day, 1-3 years old 20 grams/day, and ages 4-5 years 25 grams/day[2]. The higher the age of the toddler, the more protein needs will also increase. Protein intake in toddlers is very necessary for development and growth[2].

Cookies are one type that is popular with the public as snacks or snacks from all economic categories and all age groups. Based on the Indonesian National Standard (SNI 2973: 2011) cookies are dry bakery products made by baking dough made of wheat flour with or without its substitution, oil/fat, with or without the addition of other food ingredients, and additives[3]. Cookies are snacks that have high sugar and fat value but have a low nutrition value[4]. The main ingredients for making cookies are flour, fat, and sugar. In Indonesia, the use of wheat flour to meet the needs of the pastry industry is import, because wheat flour in Indonesia is still not sufficient for the needs of the food industry[5]. Based on this, it is necessary to develop and make alternative cookies with raw materials other than wheat flour. One of the ingredients that can be used as a substitute for wheat flour is tempeh flour and or flour from tubers, one of which is beetroot flour.

Malnutrition experienced by children under five includes stunting, wasting, and underweight[6]. Based on the result of Riskesdas 2018, the problem of malnutrition in Indonesia is 3.9% and 13.8%. Nutrition intake is one of the direct causes that can affect the nutrition status of children[7]. Nutrition intake can be obtained from macronutrients (carbohydrates, proteins, and fats). From the result of previous research, there is a relate between the level of energy and protein consumption with the nutritional status of children under five. Toddlers with energy and protein consumption levels needs will be directly proportional to nutritional status[8], besides that low energy and protein intake has an impact on the risk of nutrition problems such as chronic energy deficiency and protein energy deficiency cognitive growth and development. Provision of food intake important in the growth and development of toddlers, one of the efforts is to provide snacks from cookies that can motoric skills in children self-feeding.

Tempe is one of the traditional Indonesian foods obtained from fermented soybeans. Tempe has high nutrition value, especially protein, fiber, and vitamins. It is used as an alternative food that has a dual role, namely as a source of nutrition for the body and as a health food ingredient[9]. In this research, tempeh flour was used to have a texture resembling wheat flour, that did not interfere with the characteristics of the cookies. Beetroot is one type of tuber that has high nutritional value that is beneficial for health and has the potential to be developed as food diversification. The nutrition value of beetroot is vitamins A, B, C, phosphorus, calcium, and iron[10]. One of the simplest forms of processed beetroot is making flour. Flour is an alternative form of semi-finished product that is recommended because it can extend the shelf life, is easy to mix or make composites, shaped, and processed into food products[11].

According to results of the preliminary test, 4 cookies formulations with different formulation, cookies F0 as control (without substitution of tempeh flour and beetroot flour), cookies F1 with substitution of tempeh flour 9.09% and 10.90% beetroot flour, cookies F2 with substitution of 9.09% tempeh flour and 13.64% beetroot flour, and cookies F3 with substitution of 9.09% tempeh flour and 16.36% beetroot flour. Based on the results of the cookie acceptability test, formulation 1 (F1) was the most accepted by the panelists. Based on these results, this study measures the nutritional value of F1 cookies which will be compared with control cookies (F0) and SNI MP-ASI-Biscuit standard. Therefore, the purpose of this study was to analyze the nutritional content of tempeh flour substitute cookies based on the selected formulation and adjust it to the requirements of SNI MP-ASI.

METHODS

This type of research with an experimental method using Completely Randomized Design (CRD) with 2 treatments for cookies F1 (substituted tempeh flour 9.09% and beetroot flour 10%) and cookies F0 (without substitution tempeh flour and beetroot flour). The parameter observed were the nutritional value of cookies for protein, carbohydrate, fat, fiber, water value, and ash value with 3 repetitions. The data obtained were analyzed using analysis of variance (Anova) and further tested with Duncan's multiple range test (DMRT) at the 5%.

Analysis of protein value used the Kjeldahl method, carbohydrate value used the Luff Schoorl method, fat value used the Soxhlet method, fiber value used the gravimetric method, water value used the gravimetric method, and ash value used the gravimetric method for 3 repetitions. This research of preliminary research was conducted from May to July 2021. The stages of making cookies at the Culinary Nutrition Laboratory, Kusuma Husada University Surakarta, Indonesia, and the nutrition analysis test at the Chemistry Laboratory, Faculty of Mathematical Sciences, Satya Wacana Christian University Salatiga, Indonesia.

Table 1. Cookies formulation of substitution of tempe flour and beetroot flour

Material	Formulation (grams)	
	F0	F1
Wheat flour (grams)	220	176
Tempeh flour (grams)	0	20
Beetroot flour (grams)	0	24
Butter (grams)	25	25
Powdered sugar (grams)	50	50
Eggs (grams)	60	60
Baking powder (grams)	4	4

RESULTS AND DISCUSSION

In this research, the formulation of cookies F0 (control) and cookies F1 in the analysis of nutrients was used because based on a preliminary study of the acceptability test of 3 cookies formulations, the results of the F1 cookies were the most preferred by the panelists and were acceptable based on the parameters of color, scentaroma, taste, and texture. In this study, nutrient analysis was carried out on F1 cookies and F0 cookies as control indicators.

Based on the results of the nutrition value analysis on F0 cookies and F1 cookies, there were differences in the measured nutrition value, increased that protein and fat value. The increase in protein and fat levels can the effect of substitution of tempeh flour and beetroot flour, tempeh flour is a food source with nutrition protein value 46% and 24.7% fat value[14]. which can increase protein value in cookies compared to control cookies (without substitution of tempeh flour and beetroot flour). Nutrition of protein and fat value in wheat flour is lower than protein and fat value in tempeh flour[10].

From the result for carbohydrate an fiber value in cookies F1 is also influenced by the raw materials used, where tempeh flour and beetroot flout have a lower carbohydrate value than wheat flour, thus affecting the value of carbohydrate and fiber in cookies.

Table 2. Result of the analysis of nutritional value in cookies

Parameter	Cookies	
	F0	F1
Protein value (%)	7.11[a]	12.19[b]
Carbohydrate value (%)	91.32[a]	69.19[b]
Fat value (%)[ns]	21.77	22.73
Fiber value (%)	30.16[a]	11.15[b]
Water value (%)	4.60[a]	2.96[b]
Ash value(%)[ns]	2.67	2.25

Result of the Analysis of variance (ANOVA) Numbers followed by different letters on the same line showed a significant difference ($p<0.05$); ns : non significant

Protein Nutritional Value

The selection of cookies as a high-protein snack with the target of toddlers is based on the energy and protein needs of toddlers. The protein nutrition requirement for toddlers aged 6-11 months is 15 grams per day, 1-3 years is 20 grams per day, 4-5 years is 25 grams per day. Protein requirements increase with age[2]. So it is that the presence of high-protein snacks can meet the daily protein needs of toddlers.

From the results of the analysis protein nutritional value in F0 cookies (control cookies) and F1 cookies (formulation cookies based on acceptance test), there are significant differences. The protein value of F1 cookies is 12.19 grams per 100 grams, which is higher than the protein nutritional value of F0 cookies, which is 7.11 grams per 100 grams. The increase in protein nutrition value could be due to the addition of tempeh flour and red beet flour as a substitute for wheat flour in cookies. Tempeh has a high protein value while beetroot also has a good protein value. Protein is an important nutrient for the body, because as a producer of energy in the body and building and regulatory substance[12]. This is in line research where the tempeh flour nuggets produced had a higher protein value than nuggets without the addition of tempeh flour[14]. Based on Pertiwi[15] research for dry noodle with beetroot substitution have a higher protein and lower carbohydrate than control dry noodles.

The results of this study are in line with Murni[13] research, the effect of adding tempeh flour to the quality of chicken nuggets, it is found if the protein nutritional value increases with the addition of tempeh flour in the nuggets. In line with the results of Permatasari[14] research, tempe nugget provision imports energy and protein intake in underweight underfive children, it can be concluded that tempeh flour has an effect on increasing protein levels in nuggets. This study is also in line with the research of Pertiwi, et al[15] with the title of substitution of red bean flour in dry noodles with the addition of beetroot extract, it was found that the more addition of beetroot extract the protein value will increase in noodles.

Cookies substituted with tempeh flour and beetroot flour for the SNI standard regarding the requirements for complementary foods for breast milk (MP-ASI) part 2: biscuits[16], where the protein value requirement is not less than 6 grams per 100 grams. In addition, the manufacture of these cookies does not use

additional ingredients that are prohibited by the requirements for making biscuits based on SNI. Based on these results, it can be proven that the substitution cookies of tempeh flour and beetroot flour are suitable for consumption by toddlers aged 1-5 years as a high-protein snack.

CONCLUSIONS

Based on the results of the analysis of nutrients obtained cookies F1 protein 12.19%, carbohydrates 69.19%, fat 22.73%, fiber 11.15%, water content 2.96%, and ash value 2.25% has met the requirements of SNI MP-ASI biscuits with a protein nutritional value requirement of not less than 6 grams per 100 grams. Based on one serving of cookies, 1 serving (2 pieces of cookies is equivalent to 20 grams) can meet 9-16% of protein needs in toddlers.

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CONFLICT OF INTEREST

All authors have no conflict of interest in this article

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