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Test of Acceptance and Protein Levels in Soybean Flour Formulation Muffins as Snacks for Young Women with Chronic Energy Deficiency

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ABSTRACT

Chronic energy deficiency in young people is caused by a lack of nutritional intake, such as energy and protein. Consequently, the nutrients required for daily needs are insufficient. This study aims to determine the acceptability test results and protein content in soy flour muffins as a snack for young women with chronic energy deficiency. An experimental study was conducted with 25 participants to assess the acceptability of three muffin formulas, varying in wheat flour to soy flour ratios: 150:0, 90:60, and 80:70. Following processing and acceptability testing, the control and preferred formula were analyzed for protein content in soy flour muffins. The results indicate that the preferred formula among the panelists (DP18) was formula 3, with a wheat flour to soy flour ratio of 80:70, containing a protein content of 10.70%. This formula exhibited an energy density of 4.23 kcal/g and a Protein Energy ratio of 12.31%. Muffins supplemented with 60 g/serving of soy bean can fulfill 10% of daily calorie and protein requirements. Future researchers are encouraged to conduct community-based projects to assess the utility of these muffins in increasing body weight and average arm circumference.

INTRODUCTION

Adolescence is a period in which there is an increased need for nutrients compared to childhood. This is due to the physical growth and development that takes place during adolescence. If these nutritional needs are not met, it can result in various nutrition-related health problems in adolescents.[1] Currently, there are several nutritional problems that commonly occur in adolescents in Indonesia, and one of them is the Case of Chronic Energy Deficiency (CED). Although this problem often arises, its handling has not received serious attention.[2]

Chronic Energy Deficiency (CED) in adolescents often occurs due to lack of nutritional intake, especially energy and protein. As a result, nutrients that should be available to meet daily needs are not met adequately.[3] If a person experiences a lack of energy, it can cause weight loss and low energy reserves in the body, resulting in chronic energy deficiency.[4] This symptom can be observed through the measurement of upper arm circumference which is less than 23.5 cm. This indicator hints at the risk of CED in adolescents and increases the potential for the birth of babies with low birth weight.[5]

In Indonesia, CED problems are generally experienced by women of childbearing age, which includes women aged 15-49 years. However, many teenagers also experience CED. According to

the definition of the World Health Organization, adolescents are individuals between the ages of 10-19 years. Based on Basic Health Research 2018 data, the prevalence of CED in pregnant Women of childbearing age with CED conditions reached 17.3%, while the prevalence of CED in non-pregnant WUS was 14.5%. In terms of age group, the highest proportion of CED occurs in adolescents aged 15-19 years. In this age group, pregnant Women of childbearing with CED conditions of 36.3%, while for non-pregnant Women of childbearing with CED conditions of 33.5%.[6]

One of the eating habits that are often found in adolescents is eating foods that are not healthy for the body, such as fried foods, soft drinks, and fast food.[7] This has an impact on nutritional intake that is not in accordance with the recommended Daily Value (RDA). Based on the 2019 RDA, the average woman in Indonesia aged 10-19 years has an average body weight of 48 kg and a height of 155 cm. The energy needs needed are about 2100 kcal, protein is about 61 grams, fat is about 67 grams, and carbohydrates are about 310 grams per day.[8]

Related to the nutritional problems mentioned above, one of the nutritional contents that can help improve the occurrence of CED in adolescent girls is protein. Protein has an important role in the growth process, as well as functioning in the repair and regeneration of muscle tissue and organs.[9]

The results showed that the type of snack most liked by teenagers was Muffins, with the highest survey percentage reaching 83.3%. Muffins are a type of cupcake that is very popular in Indonesian society, because it can be processed quickly and easily. The shape of Muffin cakes generally has wrinkles on the top, a fairly dense texture, and a sweet taste.[10] This product is included in the food category with a short and easy processing process, so it can be an alternative snack that contains adequate nutrition.

One way to increase the utilization of soybean flour is to process foods that can be consumed as snacks, one of which is muffins. In addition to muffins made from wheat flour, with the development of time, food processing methods can be innovated or modified with the addition of other ingredients, such as soybean flour, so that these muffins can have more diverse nutritional content compared to muffins made from wheat flour. The purpose of this study was to determine the results of the acceptability test and protein levels in soybean flour formulation muffins as snacks for adolescent girls with CED conditions.

MATERIALS AND METHODS

The type of research used in this study was experimental with a disguised random design. The research locations include the Food Delivery System Management Laboratory at the Health Polytechnic of the Ministry of Health Surabaya and Class 2.1 of the Department of Nutrition

Poltekkes of the Ministry of Health Surabaya, while testing was carried out at the Saraswanti Indo Genetech Laboratory. The study was conducted from November 2022 to March 2023.

The samples used were soybean flour muffins with two different formulations, as well as muffins without soybean flour as a control group. The data collection method chosen was an experiment on the addition of soybean flour to muffins, using an acceptability test. This acceptability test measures the level of receptivity to the color, aroma, taste, and texture of the muffin. In addition, to test the protein content of muffins with the addition of soybean flour, the Kjeldahl Method is used with a verified standard procedure.

Acceptability analysis was conducted on the color, aroma, taste, and texture of muffins with soybean flour substitution by a trained panel of 25 people to determine the most preferred formulation. After the acceptability test, an analysis was carried out using the Kruskal-Wallis test to determine the difference between each formulation in soybean muffin products.

RESULTS

Formulation Characteristics of Soybean Flour Muffins

In the muffin formulation there are 3 different comparisons. This difference is found in wheat flour and soybean flour. The different formulations in muffins intend to know the characteristics of soybean flour muffin in each formulation, the following can be seen in table 1 below:

Table 1. Characteristics of Soybean Flour Muffin Formulations

Indicator	Indicator Soybean Flour Muffin Formulations		
	DP01	DP09	DP18
Color	Dark brown	Slightly reddish dark brown	Slightly reddish dark brown
Aroma	Typical muffin	Typical muffin with soybean blend	Typical muffin with soybean blend
Taste	Sweet	Sweet, typical soybean	Sweet, typical soybean
Texture	Dense,soft	Dense,soft	Dense,soft

Source: Primary Data, 2023

Kruskal Wallis Test Results for Soybean Flour Muffins

Kruskal Wallis Test This test is carried out to determine whether there are differences in the acceptability test indicators, namely color, aroma, taste and texture in Soybean Flour Muffins. Results for the Kruskal Wallis test can be seen in table 2 below.

Tabel 2. Kruskal Wallis Test Results for Soybean Flour Muffins

No.	Indicator	Kruskal Wallis Test Value
1	Color	0.714
2	Aroma	0.923
3	Taste	0.112
4	Texture	0.059

Source: Primary Data, 2023

The results of the Kruskal-Wallis test analysis on indicators of color, aroma, taste, and texture showed p values > 0.05. This indicates that H0 is acceptable, indicating that there is no significant difference in the treatment (DP01, DP09, DP18) of color, aroma, taste, and texture in the three types of Muffins substituted by soybean flour.

Protein Content Test in Soybean Flour Muffins

The following is the result of protein content analysis in Muffins with soybean flour formulations with 2 different formulations, namely control formulations and preferred soybean flour formulations can be seen in table 3 as follows:

Table 3. Protein Content in Soybean Flour Muffins

Replication	Protein content per 100 grams	
	DP01	DP18
I	6.26%	10.69%
II	6.15%	10.72%
Average	6.20%	10.70%

Source: Primary Data, 2023

Based on the table above, it can be seen that the protein content in 100 grams of muffins for the average in the control formulation (DP01) is 6.20%, while the most preferred formula (DP18) is 10.70%, where the protein content in 100 grams of muffins in DP18 is higher than the protein content in DP01.

DISCUSSION

The acceptability test carried out was a hedonic test (favorability test) involving as many as 25 panelists. The panelists involved in this test were somewhat trained and had a Body Mass Index condition of less than 24 kg/m². This favorability test was conducted at the Department of Nutrition, Health Polytechnic, Ministry of Health, Surabaya.

Panelists were asked to comment on the level of preference for different formulations in Muffins with soybean flour formulations.[11] The results of this test will provide information on the extent to which panelists like and accept each Muffin formulation, as well as provide insight into the preferences and choices preferred by panelists. In this study, the sample indicators carried out by the hedonic test included 4 indicators assessed, namely color, aroma, taste, texture of each soybean flour muffin formula.

a. Color

Color assessment is a subjective assessment obtained using the sense of sight.[12] Based on the acceptability test, the average value on the color indicator showed that the results of the three formulations had almost no difference, the DP01 code with a value of 3.96 was included in the color

like category in this formulation was dark brown, while the DP09 code formulation and DP18 code with a value of 4.16 were included in the like category. This is because, the formulation on the soybean flour muffin tested has almost the same color, namely the soybean flour muffin, the DP01 code formulation has a brown color, while the DP09 code and DP18 code formulation have a slightly reddish dark brown color, this is because the DP09 code and DP18 code have the addition of soybean flour so that the color indicator is almost different from the control formulation, namely the DP01 code.

b. Aroma

Aroma is one of the components that need to be considered in taste testing that uses the sense of smell. A scent or odor, can be known or accepted if it can produce a specific scent.[13] The assessment of the aroma of Soybean Flour Muffins is a subjective assessment that can be obtained from the sense of smell.

Based on the results of the acceptability test that has been carried out that the aroma indicator shows the results of the three formulations there is almost no difference, the results of the DP01 code formulation have a distinctive aroma muffin with a value of 4.00 included in the like category. In the formulation of the DP09 and DP18 codes have a distinctive muffin aroma and a combination of soybean aromas with values of 3.96 and 3.92 are included in the like category.

c. Taste

Taste plays an important role in determining consumer acceptance of a food product.[14] Taste quality has a significant role, especially if a food product is rich in nutrients but less acceptable to consumers. In this case, efforts to improve people's nutrition may not succeed in achieving the desired target if the product does not have rational appeal.[15]

Based on the results of the acceptability test that has been carried out that the taste indicators show the results of the three formulations there is almost no difference, the results of the DP01 code formulation have a sweet taste typical of muffins with a value of 4.16 included in the like category. While the formulation with the code DP09 and DP18 has a distinctive muffin taste with a combination of soybeans with each value of 3.76 and 4.12, this is included in the category of like.

d. Texture

Texture is a perception related to touch or touch. Sometimes, texture is also considered important in testing such as color, aroma, and taste, because texture can affect taste sensations in food. It is used to determine whether a product is acceptable to consumers, as consumers may

reject food if the texture is too hard, soft, or Kenyanl.[16] Texture is the sensation of pressure that can be felt through the mouth (when biting, chewing, and swallowing) or contact with fingers.[17]

Based on the results of the acceptability test that has been carried out that the texture indicator shows the results of the three formulations there is almost no difference that has a dense and soft texture with, the results of the DP01 code formulation with a value of 3.64 in the like category. While the formulation with the code DP09 with a value of 4.20 is included in the category of likes and the formulation with the code DP18 with a value of 4.04 is included in the category of likes.

Protein Content in Soybean Flour Muffins

Soybean flour muffins are a food product that is quite high in protein.[18] Due to the addition of soybean flour is widely used as a Food Mixture Ingredient in this food formulation has a high source of protein.[19] It is expected that muffin products using additional soybean flour can be well accepted and can overcome the occurrence of nutritional problems, namely the condition of Chronic Energy Deficiency (CED) in adolescents.

Protein content testing using the Kjeldahl method.[20] It can be seen in table 3 that the highest protein content is found in the DP18 code formula with a ratio of wheat flour and soybean flour which is 80:70, which is with an average of 10.70% which means the protein content in muffins is 10.7 grams per 100 grams of muffins. These results can also be influenced by other ingredients such as cornstarch, eggs, sugar, butter, lowfat liquid milk, fresh milk, skim milk powder, dark chocolate, cocoa powder, chocolate liquid, chocohips, peanuts. As for the low protein content in the DP01 code formula due to the formulation without the addition of soybean flour, which is an average of 6.20%, which means the protein content in muffins is 6.2 grams per 100 grams of muffins.

According to the 2019 Daily Value Figures, it is recommended that to be able to meet daily nutritional needs, the Indonesian people must fulfill nutrition to achieve better health so that the energy needs per day of adolescents aged 10-19 years with an average of 2075 kcal.[21] So the calories of food needs per snack are 207.5 kcal so that muffins that can be consumed are 253.73 kcal per serving with a protein content of 7.81% in one snack per day. While the daily protein needs of adolescents aged 10-19 years with an average protein of 61.25 grams / day, the protein needs per snack are 6.12%. So, the need for 1 serving of muffins weighing 60 grams has a total energy of 253.73 kcal with a protein content of 7.81%, so that one serving of soybean flour muffins can meet the needs of snacks 10% per day for the nutritional value needs in calories and protein.

As for calculations using Energy Density and Protein Energy Ratio (PER), formulation 1 control (DP01) with KE 3.48 kcal / gram and PER 7.49%, while the most preferred formulation (DP18) with KE 4.23 kcal / gram and PER 12.31%. Where the calculation has met the standards of

Energy Density which is 1.5 kcal / gram and Protein Energy Ratio 12%. Protein Energy Ratio is one index to meet the needs of protein in the body because consuming protein can meet the quantity and quality.

One way to prevent chronic energy deficiency in adolescents can be done by eating a nutritionally balanced diet.[22] You can use alternative snacks, namely muffins with the addition of soybean flour formulations in this muffin product will be rich in protein so as to prevent CED.

Protein Energy Ratio is one of the nutritional needs to meet food needs. The energy ratio of protein is needed to meet food needs, especially to meet energy needs. Adequacy recommendation from WHO of 10%.[23] In addition to protein which is essential for tissue repair and growth, protein also plays a role in maintaining and regulating processes that take place in the body.[24] Protein accounts for 4 calories per gram.[25]

In a study conducted by Wiranata, 2017.[26] which states that the more soybean flour added to the formulation, it can contain snacks that are nutrient-dense and high in protein.

CONCLUSION

1. Based on the results of the acceptability test, the muffin with the addition of soybean flour formula most preferred by the panelists was formulation 3 with the code DP18 with a ratio of wheat flour: soybean flour of 80:70 and obtained an average score of 4.06.
2. Based on laboratory test results, protein levels in soybean flour muffins in formulation 3 with the code DP18 with an average result of 10.70% protein. In calculations using the Indonesian Food Consumption Table, the DP18 formula is obtained per snack serving, which is with energy of 253.73 kcal with a protein content of 7.81%. So that consuming one serving of muffins weighing 60 grams in the DP18 formula can meet 10% of snack needs per day, namely with 207.5 kcal of energy and 6.12 grams of protein and in calculations using Energy Density of 4.23 kcal / gram and Protein Energy Ratio (PER) of 12.31% so that it meets the needs as an alternative snack for adolescents suffering from Chronic Energy Deficiency (CED).

SUGGESTION

1. Soybean flour is a food that has many benefits, is easy to obtain and has high nutritional value, one of which is protein, so that adolescents do not occur Chronic Energy Deficiency (CED) then researchers can then carry out varied food products.
2. For further researchers, it is recommended to conduct socialization to the public to find out whether this muffin product is useful and can increase BB and Upper Arm Circumference.

3. For further researchers, it is recommended to carry out further tests, namely conducting other checks for the nutritional content of soybean flour muffin products so that they can meet the Quality Standards on Sweet Bread.

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