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Acceptability and Protein Content of Cookies Made from Cork Fish Flour and Cheese as an Effort to Prevent Chronic Energy Deficiency in Adolescent Girls

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ABSTRACT

Chronic Energy Deficiency is one of the health problems faced by adolescents due to nutritional deficiencies. Objective, To determine the acceptability of cork fishmeal and cheese-based cookies as an effort to prevent Chronic Energy Deficiency in adolescent girls. This study used Pre-Experimental design with three different formulations: CG1 (27 g wheat flour), CG2 (10 g wheat flour, 5 g cork fish, 12 g cheese), and CG3 (10 g wheat flour, 8 g cork fish, 9 g cheese). A total of 750 grams of samples were organoleptically tested using a hedonic scale in the laboratory of the Nutrition Department of Surabaya Polytechnic and analyzed with the Kruskal Wallis test and Mann Whitney test if there was a significant difference (p-value <0.05). Showed significant differences in color (p-value 0.041) and aroma (p-value 0.036) indicators, but there were no significant differences in texture (p-value 0.367) and taste (p-value 0.430). Formulation CG2 with 8.14% protein content was most favored by the panelists. Formulation CG2 was considered the best and qualified as a snack food. Suggestions It is hoped that the formulation of cookies based on cork fish flour and cheese can be improved and developed again for the results of a better formula.

INTRODUCTION

Based on data from the Health Research and Development Agency in 2018, one of the health threats that could jeopardize the future of adolescents in Indonesia is chronic energy deficiency (CED). CED is a health problem that arises from nutritional deficiencies in adolescents[1]. According to data from the Agency for Health Research and Development in 2013, chronic energy deficiency (CED) became the second health problem after stunting, with an increase in prevalence since 2010. Based on the results of Basic Health Research 2013, the prevalence of emaciation in adolescents aged 16-18 years increased from 8.9% (1.8% very thin and 7.1% thin) in 2010 to 9.4% (1.9% very thin and 7.5% thin) in 2013[1]

According to the Indonesian Ministry of Health (2013), Chronic Energy Deficiency occurs due to an imbalance in energy and protein intake, which causes the body to not get the nutrients it needs. Chronic Energy Deficiency is a condition in which a person experiences a prolonged deficit of macronutrients. CED can be identified if the upper arm circumference is less than 23.5 cm^2.The process of Chronic Energy Deficiency is influenced by environmental and individual factors, and is exacerbated by a lack of nutritional intake. In this condition, the body uses nutrient reserves to meet its needs. If this situation continues for a long period of time, nutrient reserves will be depleted and cause tissue damage. During adolescence, the body's need for nutrients increases, but most

adolescents tend to have inappropriate consumption habits, so the nutritional needs required by their bodies are not met[3].

Protein is important as a building block and regulator of growth, forms body cells, and can be used as a source of energy. Animal and vegetable proteins are the two main sources of food protein. Although local food products are available, their utilization by the community is still not optimal. Fish, as one of the local foods rich in protein, has the potential to be used in various food products as fortification ingredients. Fish can be processed into pulverized meat, food-quality fishmeal, and protein hydrolysate to increase the protein content in food products[4]. Fish, as a food component that is often consumed by the community, is highly valued for its high protein content, especially essential amino acids that are important for body health. Cork fish is one type of fish that is rich in protein content, with a protein content of around 25.2 grams per 100 grams of material[5]. Based on this background, researchers are interested in adding cork fish flour and cheese to cookies as an alternative protein source snack. The consideration for choosing cookies is because various kinds of cookie products have been widely accepted among the public, especially among teenage girls.

MATERIALS AND METHODS

This research uses experimental research because it gives treatment to the sample under study and aims to determine the effects that arise as a result of the treatment or experiment. This type of research is true experimental because laboratory tests are carried out to determine protein levels. The research used a completely randomized design with 1 control and 2 treatments, namely the addition of different proportions of wheat flour, cork fish flour, and cheese, namely CG1: 27 grams of wheat flour: 0 gram of cork fish flour: 0 grams of cheese, CG2: 10 grams of wheat flour: 5 grams of cork fish flour: 8 grams of cheese, CG3: 10 grams of wheat flour: 12 grams of cork fish flour: 9 grams of cheese.

According to Ariwibowo & Ayuningtyas, Data from the organoleptic test were analyzed using the Kruskal-Wallis method to evaluate the differences between cookie formulations based on cork fish meal and cheese[6]. The repetition of formula making used Federer's formula to determine the number of trials in experimental research. Based on the formula, the number of replicates for each treatment was 9 replicates. Due to time and cost constraints, the repetition was only done twice.

This research was conducted in December-March 2024. Making and Testing the Acceptability of Cookies based on Cork Fish Flour and Cheese was carried out at the Laboratory of the Department of Nutrition, Poltekkes Kemenkes Surabaya, Jl. Pucang Jajar Selatan No. 24B and Protein Content Testing was carried out at PT Saraswanti Indo Genetech, Jl. Dukuh Menanggal 1-A, Gayungan, Surabaya, East Java 60234.

The number of panelists in this test was 25 people with the category of moderately trained panelists. Each panelist was given 10 grams of cookies for each treatment. The number of samples of cork fish and cheese-based cookies needed for the acceptability test was 750 grams. The number of protein content test samples required for each repetition was 100 grams, with details: Formulation 1 (Control) = 100 grams, and the best formulation for organoleptic test = 100 grams. So that the number of cookie samples needed for the protein content test is 200 grams. The total sample required for both tests is 950 grams.

RESULTS

Table 1. Formulation of Cork Fish Flour and Cheese Based Cookies

Formula	Wheat Flour	Cork Fish Flour	Cheese
CG1	27 gram	-	-
CG2	10 gram	5 gram	12 gram
CG3	10 gram	8 gram	9 gram

Source: Primary Data, 2024

The results from table 1 are in Formula CG1 using only wheat flour. Formulas CG2 and CG3 use a combination of the three ingredients, but with different comparisons. Formula CG2 tends to have more cheese and less cork fish flour compared to CG3.

Table 2: Characteristics of Cookies Formulation Based on Cork Fish Flour and Cheese

Indicator	Wheat Flour	Cork Fish Flour	Cheese
	CG1	CG2	CG3
Color	Dark brown	Light brown	Chocolate
Aroma	Typical cookies	Typical cookies	Typical cookies
Texture	Crispy	Crispy	Crispy
Taste	Sweet	Sweet, Savory	Sweet, Savory

Source: Primary Data, 2024

The results from table 2 are CG1 has a dark brown color, CG2 has a light brown color, CG3 has a brown color, which is between CG1 and CG2. All formulas (CG1, CG2, CG3) had a typical aroma of cookies, indicating that the difference in the main ingredients did not significantly affect the aroma of the final product. All formulations had a crunchy texture, meaning that variations in the proportions of wheat flour, cork fish meal, and cheese did not affect the crunchiness characteristics of the final product. Formulation CG1 had a predominantly sweet taste due to the absence of cork fish meal and cheese, CG2 and CG3 had a sweet and savory taste, indicating that the addition of cork fish meal and cheese provided an additional savory flavor dimension that was absent in CG1.

Table 3. Average Distribution of Cookies Formulation Ratings

Parameters	Cookies Formulation		
Color	**CG1**	**CG2**	**CG3**
Aroma	3.52	3.88	4
Texture	3.88	3.84	3.28
Taste	3.56	3.72	3.88
Total	3.6	3.48	3.24
Mean	14.56	14.92	14.4
Parameters	3.64	3.73	3.6

Source: Primary Data, 2024

The results from table 3 show that CG3 excelled in color and texture, indicating that the brown color and crunchy texture of CG3 were highly preferred. CG2 performed well in color and texture. CG1 excelled in aroma and taste, indicating that the aroma and sweetness of CG1 were most liked by the panelists. CG2 had a balanced performance with high scores in almost all parameters. CG2 was the best overall formula based on the total score and mean, indicating that the combination of ingredients in CG2 provided the balance most favored by the panelists. CG1 also performed well, especially in aroma and flavor. CG3 excelled in color and texture, but was less preferred in aroma and taste.

Table 4. Kruskal Wallis Test Results of Cork Fish and Cheese Based Cookies

No.	Indicator	Kruskal Wallis Test Values
1.	Color	0.041
2.	Aroma	0.036
3.	Texture	0.367
4.	Taste	0.430

Source: Primary Data, 2024

The results from table 4 are that the color and aroma ratings had significant differences between the formulas, indicating that the changes in ingredients in the formulas did affect visual and aroma perception significantly. This is important to consider in product development, as color and aroma are the main factors that influence initial consumer appeal. There were no significant differences in texture and flavor ratings between the three formulas, indicating that all formulas managed to achieve the expected crunchy texture and flavor consistently.

Table 5. Mann Whitney Test Results of Cork Fish and Cheese Based Cookies

No.	Indicator	Mann Whitney Test Value		
		CG1:CG2	**CG1:CG3**	**CG2:CG3**
1.	Color	0.031	0.031	0.400
2.	Aroma	0.027	0.027	0.027

Source: Primary Data, 2024

The result from table 5 is that the p value <0.05 indicates that there is a significant difference in color assessment between CG1 and CG2. This indicates that the panelists can distinguish the color between these two formulas clearly. The p value <0.05 indicates that there is a significant difference in color assessment between CG1 and CG3. Panelists were also able to distinguish the color between these formulas. The p value > 0.05 indicated that there was no significant difference in color assessment between CG2 and CG3. This indicates that the panelists rated the color of these two formulas similarly. A p value of <0.05 indicated that there was a significant difference in aroma ratings between all pairs of formulas. This indicates that each formula has a unique aroma and can be distinguished by the panelists.

Table 6. Protein Content Test Results of Cork Fish-Based Cookies and Cheese

Formula	Berat (gram)		Kadar Protein (%)	
	1 resep	1 porsi	1 resep	1 porsi
CG1	100 gram	60 gram	7.12	4.27
CG2	100 gram	60 gram	13.57	8.14

Source: Primary Data, 2024

The analysis showed that cookies with a formulation of 10 grams of wheat flour, 5 grams of cork fish flour, and 12 grams of cheese (CG2) had the highest protein content, reaching 8.14%. Meanwhile, the protein content in CG1 cookies is 4.27%.

DISCUSSION

Organoleptic test of Cork Fish Flour and Cheese Based Cookies formulation was conducted using hedonic assessment. Hedonic assessment was carried out on 4 indicators including color, aroma, texture and taste using a hedonic scale. The organoleptic test was conducted at the Department of Nutrition, Poltekkes Kemenkes Surabaya by 25 moderately trained panelists. The results of the level of liking for the three formulations of cork fishmeal and cheese-based cookie products were obtained from the panelists' personal responses.

Color is a major factor that influences consumer decisions in choosing food. The more attractive the color of the food, the greater the attractiveness of the food. Based on the sensory evaluation, it was found that formulation CG3 has a higher acceptability in terms of color in cookies with an average value of 4. The color in the cookies varies from mixing cocoa powder with cheese. cheese has a milky white color, the more cheese, the fainter the brown color in the cookies.

From the results of the Kruskal Wallis statistical test, the color indicator has a pvalue of 0.041 <0.05 which indicates that there is a significant difference in terms of the color of the three cookie formulations. Furthermore, from the Mann Whitney test results, it shows that CG1 with CG2 and CG1 with CG3 cookies have the same value of 0.031 <0.05, which indicates that there is a significant

treatment difference in color indicators in cookie formulations. In CG2 with CG3 cookies, the p-value result is 0.400> 0.05, which indicates that there is no significant treatment difference in color indicators.

Aroma is one of the aspects assessed by the sense of smell in evaluating food. This aroma comes from the combination of food ingredients used in the presentation. From the organoleptic evaluation, it can be concluded that CG1 cookies received a better assessment in aroma, with an average value of 3.88, including in the category that likes, then formula CG2 with a value of 3.84 including the category of likes and formula CG3 with a value of 3.28 including the category of likes. Panelist acceptance of Cookies is influenced by the aroma of spikulas and cork fish flour, so panelists dislike the aroma in formula CG3 which has a higher concentration of cork fish. From the results of the Kruskal Wallis statistical test, the aroma indicator has a p-value of 0.036 <0.05 which indicates that there is a significant difference in aroma indicators in the three cookie formulations. Furthermore, from the results of the Mann Whitney test, it shows that in the comparison of CG1 with CG2, CG1 with CG3 and CG2 with CG3 cookies, the p-value is 0.027 <0.05, which indicates a significant difference in treatment. It can be concluded that the addition of cork fishmeal and cheese can affect the aroma of cork fishmeal and cheese-based cookies.

Texture refers to the sensation felt through touch or feel. Texture is also considered to have comparable significance to flavor and aroma in determining food perception. The presence of texture is crucial especially in foods that have soft or crunchy properties. Based on the results of the organoleptic assessment, it can be seen that the acceptability of cookies is most in demand in terms of texture, namely in code CG3 with an average value of 3.88, including in the like category. While in formula CG1 with an average value of 3.56 included in the like category and CG2 with an average value of 3.72 included in the like category. From the results of the Kruskal Wallis statistical test, the texture indicator has a p-value of 0.367> 0.05 which indicates that there is no significant difference in texture indicators in the three cookie formulations. In all three cookie textures are crunchy, but it is necessary to add egg white so that the crunchy texture of the cookies can last longer.

Taste is one of the influential factors in product acceptance by consumers. Flavor is the perception felt by the tongue. In the human taste experience, there are four main flavors: sweet, bitter, sour, and salty, and sometimes additional responses when there are modifications. Based on the results of the organoleptic assessment, it can be seen that the acceptability of cookies in terms of taste is most in demand in CG1 cookies with an average value of 3.6, including in the like category. While in the CG2 formula with an average value of 3.48 included in the like category and CG3 with an average value of 3.24 included in the like category. From the results of the Kruskal Wallis statistical test, the texture indicator has a p-value of 0.430> 0.05, which indicates that there is no significant

difference in taste indicators in the three cookie formulations. There is a slightly bitter taste in the cookie formulation due to the content of too much spikulas.

In CG1 formulation, it was found that 1 CG1 recipe contains 7.12% protein content, which is equivalent to 13.38 grams of protein. For 1 serving of CG1 cookies, it contains 4.27%, which is equivalent to 8 grams of protein. While in CG2 cookies, the results show that 1 CG2 recipe contains 13.57%, which is equivalent to 25.5 grams of protein. For 1 serving of CG2 cookies, it contains 8.14% which is equivalent to 15.2 grams of protein.

It can be seen in Table 6 where the higher protein content is found in formula CG2 with the formulation of wheat flour, cork fish flour, and cheese 10: 5 : 12, which is 1 serving of 2 pieces of cookies with a result of 8.14% protein. These results can also be influenced by other ingredients such as egg yolk and margarine. While the lower protein content is found in CG1 cookies as a control with the addition of 27 grams of wheat flour without the addition of cork fish flour and cheese, namely 1 serving of 2 pieces of cookies with a result of 4.27%.

Based on the Nutritional Adequacy Rate, protein needs in adolescents with an age range of 10-12 years old are 55 grams, 13-15 years old are 65 grams, 16-18 years old are 65 grams, 19-29 years old are 60 grams. So the protein requirement for daily snacks is 12.2 grams. To meet the daily snack protein needs, 1 serving of cookies based on cork fish flour and cheese is 15.3 grams.

According to Susanto, Protein Consumption Level is measured as a percentage of daily protein consumption[7].. Protein consumption is calculated based on the amount of protein consumed per day in grams, while the Protein Adequacy Rate is the recommended amount of protein per day in grams. Nutrient consumption levels are classified into the following four categories:

1. Good: ≥ 100% OF THE RDA
2. Moderate: 80 - 99% RDA
3. Deficient: 70 - 80% RDA
4. Deficit: < 70% RDA

The recommended Nutrition Adequacy Level for Indonesians refers to the Minister of Health Regulation No. 28/2019. The amount of Nutrition Adequacy Rate for each individual is determined based on gender and age group.

At the level of protein and energy consumption, it was found that the CG2 formulation in adolescents aged 10-12 years could fulfill 27.6% of protein, at the age of 13-18 years 23.3% of protein, at the age of 19-29 years 25.3% of protein.

The average result was obtained that : In cookies formula CG2 is known to fulfill 9% Energy and 25% Protein AKG. So the consumption of cork fishmeal and cheese-based cookies can meet

daily protein needs only as an alternative to main meals because it does not meet the Nutritional Adequacy Rate in a day.

CONCLUSIONS

Based on the test results of acceptability and protein content of cookies based on cork fish flour and cheese as an effort to prevent chronic energy deficiency in adolescent girls, the following conclusions were obtained Cookies made with cork fish flour and cheese (particularly formula CG2) show high acceptability and significantly increased protein content, making them a potential functional snack to help prevent chronic energy deficiency in adolescent girls. CG2, with a 10:5:1 ratio of wheat flour, cork fish flour, and cheese, achieved the highest organoleptic scores and provided 15.2 grams of protein per serving.

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