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The Effect Of Adding Tempeh Dregs And Moringa Leaves On Protein Content in Catfish Meatballs: An Alternative High-Protein Food For Underweight Children Under Five Years Old

Anugrah Linda Mutiarani[1], *Rizki Nurmalya Kardina*[2]

[1, 2] *Faculty of Health, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia*

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CORRESPONDENCE

E-mail: anugrah_linda@unusa.ac.id
rizki_kardina@unusa.ac.id

A B S T R A C T

Basic Health Research in 2018 revealed that 13.4% of children under five years old were underweight. Providing high-protein foods such as meatballs can be an alternative problem-solving. Several ingredients (vegetable and animal protein) can be added to enrich protein. This study aims to determine the effect of adding tempeh dregs, and Moringa leaves on the protein content in catfish meatballs. This study was an experimental study with a completely randomized design (CRD) which formulated catfish, tempeh dregs, and Moringa leaves into four treatments with four repetitions. The formula in making meatballs were catfish 100% in the P0 group, catfish 60% + tempeh dregs 30% + moringa leaves 10% in the P1 group, catfish 60% + tempeh dregs 20% + 20% Moringa leaves in the P2 group, and 100% catfish + 10% tempeh dregs + 30% Moringa leaves in the P3 group. Meanwhile, the observation parameter was protein content. The data collection technique was carried out by proximate analysis of protein content with the Kjeldahl method. Data analysis used normality and homogeneity test, ANOVA test, and Least Significant Difference. The ANOVA test obtained p=0.000 (p<0.05). Thus, there were significant differences in protein content in catfish meatballs between the control and the treatment group, except in P3. The Least Significant Difference Test showed that the highest protein content was 9.0975% in the treatment with the formula 60% catfish meat, 30% tempeh dregs, and 10% Moringa leaves. In conclusion, adding tempeh dregs and Moringa leaves can increase protein content in catfish meatballs.

INTRODUCTION

Currently, Indonesia faces a major nutritional problem: Protein-energy Undernutrition (PEU). 17.7% of children under five years old in Indonesia had Underweight (weight for age is below the standard), reflecting stunting and wasting (Bappenas, 2019). Basic Health Research in 2018 revealed that 13.4% of children under five years old were underweight, and 3.3% were malnourished. The causes are food insecurity and low consumption of energy and protein in the daily diet so that it does not meet the recommended adequacy rate. The Ministry of National Development Planning in 2019 revealed that almost half of Indonesia's population (45.7%) had a low level of energy adequacy (<70% EAR/Energy Adequacy Ratio), and 36.1% had a low protein adequacy level (<80% PAR/Protein Adequacy Rate). In addition, economic access (affordability) to food is the leading cause of food insecurity. Further, PEU in children under five years old can cause stunting, susceptibility to infection, and decreased intelligence (Magdalena, 2017).

Providing high-protein foods such as meatballs can be an alternative problem-solving. Meatballs are processed products from animal protein sources (beef, chicken, and fish), popular among children and adults. Making meatballs is generally boiled and shaped round (Hasniar, M. and Ratnawaty, 2019). Several

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ingredients (vegetable and animal protein) can be added to enrich protein and minimize meatball production costs. Hasniar et al. (2019) found that protein content in meatballs added with Moringa leaves was 9.46%. In addition, Aprilianti's research (2016) showed that protein content in catfish meatballs added with Moringa flour was 15.26%. Both protein content has met the meatball protein quality requirements based on the Indonesian National Standard (SNI) 2891-1992 of at least 8%.

Total Diet Study in Indonesia (2014) showed that the consumption of animal protein for most Indonesian people came from fish, which was an average of 78.4 grams/person/day. Meanwhile, vegetable protein consumption was only 56.7g/person/day derived from soybeans (Siswanto, 2014). Fish is an animal protein that is rich in nutrients. The protein content in fish is 18%, and the heating cannot easily damage its amino acids (Putra, 2013). One of the affordable and easy-to-find Fish is catfish. Catfish can adapt to the environment, tastes good, and has a protein content of 17.7% and fat of 4.8% (Astawan, 2008 in Ubadillah and Hersoelistyorini, 2010). In addition, one of the advantages of catfish compared to other animal products is that it is rich in leucine and lysine. Leucine is an essential amino acid indispensable for children's growth, especially in nitrogen balance (protein breakdown and formation in the muscle) furthermore, lysine functions on bone growth and calcium absorption (Rustaman, 2015).

Previous studies showed that Moringa is a unique plant, almost every part of Moringa has nutritional value. Fresh Moringa leaves contain four times more vitamin A than carrots (6.80 mg), vitamin B (423 mg/100 g), vitamin C seven times more than oranges (220 mg), potassium three times more than bananas (259 mg), calcium four times more than milk without lactose (440 mg), iron twenty-five times more than spinach (0.7 mg), and protein twice more than yogurt (2711.8 mg). In addition, it is easy to digest and assimilate by the human body (Krisnadi, 2013).

Tempeh dregs are soybean husks from the tempeh-making process that generally still have high nutritional value. They contain 12.67% protein and 9.71% fat (Listiyani, 2017). So far, there is a suboptimal use of tempeh dregs, only used as animal feed or fertilizer.

The authors are interested in researching catfish, tempeh dregs, and Moringa leaves as the essential ingredients for making meatballs because they have high nutritional content, especially protein, and have affordable prices. This study aims to determine the effect of adding tempeh dregs and Moringa leaves on the protein content in catfish meatballs. It can be used to diversify high-protein foods. Further, it can contribute to reducing malnutrition cases in East Java.

METHOD

This study was an experimental study with a completely randomized design (CRD) which formulated catfish, tempeh dregs, and Moringa leaves into four (4) treatments with four (4) repetitions. The details of

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the formula in making meatballs were catfish 100% in the P0 group, catfish 60% + tempeh dregs 30% + moringa leaves 10% in the P1 group, catfish 60% + tempeh dregs 20% + 20% Moringa leaves in the P2 group, and 100% catfish + 10% tempeh dregs + 30% Moringa leaves in the P3 group. Meanwhile, the observation parameter was protein content.

The tools were a basin, cutting board, pan, meat grinder, stove, knife, ladle, strainer, and a digital scale. The test pieces of equipment were Petri Dish, Bunsen burner, 30 ml Kjeldahl flask, distillation apparatus, Erlenmeyer, and condenser. In addition, the materials were catfish meat, tempeh dregs, Moringa leaves, tapioca flour, salt, pepper, powdered mushroom broth, garlic, and ice cubes. The materials for testing were K2SO4, HgO, H2SO, 0.02 N HCl, NaOH-Na2S2O3 solution, and H2BO3 solution.

The research procedure was divided into two stages. The first stage was making meatballs which consisted of preparation and processing. Then the second stage was to analyze the protein content. In the preparation stage, we filleted catfishes, picked tempeh dregs, and separated Moringa leaves from the stems. We weighed each ingredient according to a predetermined weight. We washed all the ingredients and blanched Moringa leaves and tempeh dregs for 10 seconds. We did a preliminary experiment to find the composition of tapioca flour that matched the texture of the meatballs, which was 70 grams.

Further, the steps in the processing stage were:

1. We prepared 250 grams of catfish meats in the P0 group; also 150 grams of catfish meats, 75 grams of tempeh dregs, and 25 grams of Moringa leaves in the P1 group. In addition, we prepared 150 grams of catfish meats, 50 grams of tempeh dregs, and 50 grams of Moringa leaves in the P2 group; also 150 grams of catfish meats, 25 grams of tempeh dregs, and 75 grams of Moringa leaves in the P3 group.
2. We mixed two cloves of sliced garlic, 2 tsp salt, half tsp mushroom broth, quarter tsp pepper, and ice cubes, then ground them together using a meat grinder for each group.
3. We mixed tapioca flour until smooth in each treatment.
4. We prepared a pot filled with water, brought it to a boil, then turned off the stove.
5. We shaped the dough into a round shape, then put it in a pot of boiling water until the dough ran out in each group.
6. We boiled the meatballs until they floated and drained.

The data collection technique was carried out by proximate analysis of protein content with the Kjeldahl method. Data analysis used normality and homogeneity test, ANOVA test, and Least Significant Difference.

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RESULTS

The analysis of protein content in catfish meatballs with the addition of tempeh dregs and moringa leaves can be seen in the table.1.

Table 1. Protein content in catfish meatballs

Group	Mean ± SD	Notation
P0: Control (Catfish meat 100%)	7,05 ± 0,464	a
P1: Catfish meat 60 %, tempeh dregs 30%, Moringa leaves 10%	9,09 ± 0,310	b
P2: Catfish meat 60 %, tempeh dregs 20%, Moringa leaves 20%	7,67 ± 0,368	c
P3: Catfish meat 60 %, tempeh dregs 10%, Moringa leaves 30%	6,93 ± 0,151	a

Description: Numbers followed by the same letter in the same column are not significantly different

The ANOVA test obtained p=0.000 (p<0.05). Thus, there were significant differences in protein content in catfish meatballs between the control and the treatment group, except for the treatment with formula catfish 60%, 10% tempeh dregs, 30% Moringa leaves (P3). Then, we did the Least Significant Difference Test to determine the treatment with the highest protein content in catfish meatballs.

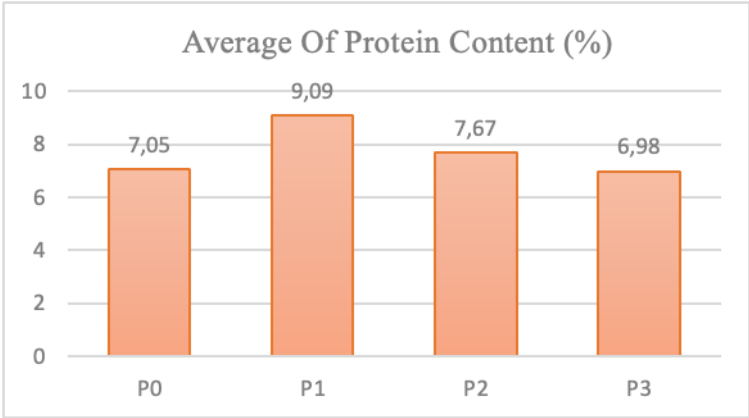

Figure 1. Average Protein Content in Catfish Meatballs

P0: Catfish meat 100%

P1: Catfish meat 60%, tempeh dregs 30%, Moringa leaves 10%

P2: Catfish meat 60 %, tempeh dregs 20%, Moringa leaves 20%

P3: Catfish meat 60 %, tempeh dregs 10%, Moringa leaves 30%

The Least Significant Difference Test showed that the highest protein content was 9.0975% in the treatment with the formula 60% catfish meat, 30% tempeh dregs, and 10% Moringa leaves (figure 1).

DISCUSSION

Protein-energy Undernutrition is a state of malnutrition caused by low consumption of energy and protein in daily food so that it does not meet the recommended adequacy (Andriani and Wirjatmadi, 2012). Malnutrition in children under five years old can cause a decrease in body resistance. It can disrupt a toddler's healthy life span, and a more profound impact is the emergence of disability, high morbidity, and

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death (Mardisantosa, Huri, and Edmaningsih, 2018). One of the solutions is providing a variety of high-protein foods. Meatballs are a food source of animal protein that is very popular with people of all ages. They are easy to accept, have good taste, and are easy to process. Various kinds of meatball variations have developed, one of which is from fish.

This research showed significant differences in protein content in catfish meatballs between the control and the treatment group, except for the treatment with formula catfish 60%, 10% tempeh dregs, and 30% Moringa leaves (P3). A previous study revealed that adding 10% and 20% tempeh could increase the protein content of skewered catfish meatballs (Ikawati and Retty, 2016). Similar research by Jannah and Sulistiastutik (2018) also stated that the substitution of catfish and Moringa leaves significantly affected the protein content in mackerel dumplings.

Our findings revealed differences in protein content between the P0 and the P1 also P2 groups (table 1). The formulation in the P0 group contained only catfish meats, while the P1 and P2 contained catfish meat, tempeh dregs, and Moringa leaves. Catfish is a source of animal protein-rich in the amino acids' leucine and lysine, with a protein content of 17.7%. In addition, tempeh dregs were soybean husks that still have a high protein content of 12.67% (Listiyani, 2017), and other studies mentioned that the protein content of dry tempeh dregs was 14.53%. Furthermore, Moringa leaves had 28.66% protein content using the blanching method (Irwan, 2020).

However, this paper showed no significant difference between the P0 and P3 groups (table 1). It could be because the formulation in the P3 group contained 30% of Moringa leaves, while only 10% of tempeh dregs and 60% of catfish meats. Differences in the use of ingredients affect the protein retention process in boiling. It is in line with Suhandari's research (2015). The study found no significant difference between animal and vegetable proteins in the boiling process. Still, there was a difference in protein retention (resistance of an ingredient to various cooking types) between boiling and frying. Protein retention in boiling was higher than in frying.

Our findings indicated that the highest protein content was 9.0975% in the treatment with the formula 60% catfish meat, 30% tempeh dregs, and 10% Moringa leaves (P1). The protein content has met the meatball protein quality requirements based on the Indonesian National Standard (SNI) 2891-1992 of at least 8%. In addition, this study also indicated that the higher the use of tempeh dregs, the higher the protein content (figure 1). It is a discovery because tempeh dregs have not been widely used as a protein source for humans. They are only used as animal feed. Many research supports an increase in farm animals' nutritional status by giving tempeh dregs. A study by Listiyani (2017) found a significant difference in the effect of feeding added with tempeh dregs on the growth of weight and body length in the Sangkuriang

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catfish. In addition, Evavianto's research (2018) showed that adding soybean skin (tempeh dregs) and fermented cassava *Rhizopus sp* could increase the bodyweight of merino sheep.

CONCLUSION

In conclusion, adding tempeh dregs and Moringa leaves can increase protein content in catfish meatballs. The community could utilize tempeh dregs, Moringa leaves, and catfish as an alternative high-protein food for underweight children under five years old. Further study should develop the use of tempeh dregs.

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