Original Research Article

CHARACTERISTICS OF PETIS WHITE LEGSHRIMP (*Litopenaeus vannamei*)WASTE WITH THE ADDITION OF KLUWAK FRUIT (*Pangium edule*)

ASBTRACT

The shrimp processing industry produces a lot of waste that can become a pollutant for the environment if not managed properly. Shrimp waste such as heads, tails and carapace, if processed properly, can become a fishery diversification product that is able to provide added value to the community. The high protein content can be a consideration in processing shrimp waste into by-products as a substitute for food products. This study aims to analyze the effect of the addition of kluwak fruit on water content, protein content and hedonic value of white leg shrimp waste petis. The research method used was an experimental method with petis treatment added by kluwak with 4 different concentrations, namely (A) 0 g concentration (control), (B) 10 g concentration, (C) 20 g concentration, and (D) 30 g concentration. The results showed that the addition of kluwak fruit provided a real difference in the value of water content and protein content in white leg shrimp waste petis. The addition of kluwak fruit to white leg shrimp waste petis produced the best hedonic scale organoleptic value in treatment (D) with a concentration of 30 g.

Keywords: white leg shrimpwaste; kluwak; water content, protein content, organoleptic

1. Introduction

White leg shrimp (*Litopenaeus vannamei*) is a species of shrimp with high economic value, being one of the fishery products that generates foreign exchange for the country. The shrimp processing process leaves waste in the form of shrimp shells and heads[1]. Processing shrimp waste as a processed fishery product has great potential and is expected to increase and utilize shrimp waste such as shrimp heads, tails and shells into food products.

Waste products from industrial processing are usually immediately disposed of and can cause environmental pollution if further processing is not carried out. Further processing can be done by utilizing it as a material for making petis [2]. Shrimp waste is treated with boiling water so that an extract is obtained in liquid form resembling broth [3].The broth from boiled white leg shrimp contains protein, carbohydrates and phosphorus, calcium and iron. Shrimp waste broth can be used as a flavoring agent [4].

Petis is a processed product made from fish, shrimp, or meat with the addition of other spices. Petis is categorized as a sauce or pasta because it has a thick, elastic texture and is usually black or brown in color, depending on the main ingredient. Petis is an important element in traditional food in various regions in Indonesia because it gives a distinctive taste to each dish. Petis is generally made with shrimp meat or shrimp waste such as carapace, heads and tails. This ingredient is boiled to produce a thick sauce that contains various amino acids, vitamins, minerals, and flavoring elements that give petis a distinctive taste [5]. The taste varies depending on the type of flavoring ingredient used, resulting in a similar taste, even though the base ingredients are different [6].

In making petis, filler is needed to increase the total solids, coat the flavor components and speed up the drying process [7]. Petis that is filled with filler will be thicker and can speed up the cooking process. [8]stated that fillers are added to make petis to speed up the thickening process. The type of filler used in this research is kluwak fruit as a substitute for wheat flour or rice flour which is commonly used in making petis. The addition of kluwak fruit filler also functions as a flavoring ingredient in petis to improve the taste and provide color, thereby increasing the quality and level of consumer acceptance of petis.

One of the flavoring ingredients used is the addition of kluwak fruit in petis to enhance the taste and provide color, so as to produce the best petis that consumers like. Kluwak fruit is a potential food ingredient that is currently not optimally utilized for food products, and has advantages in terms of nutritional elements [6]. Based on this description, this study aims to process and utilize shrimp waste into processed fishery products in the form of petis with the addition of kluwak fruit as a flavoring ingredient in petis so that it is expected to strengthen the taste and color in the product and can provide added value and quality of petis made from white leg shrimpwaste.

2. Materials and Methods

2.1. Origin of samples and Research Site

Samples of white leg shrimpwaste (*Litopenaeus vannamei*) were obtained from household waste, while kluwak fruit (*Pangium edule*) was obtained from the Parigi market, Lappariaja District, Bone Regency. Sample testing was carried out at the Laboratory of the Fishery Product Quality Application Center located on Jl. Prof. Ir. Sutami No. 2 Makassar, and the hedonic scale organoleptic test was carried out on the campus of the Institute of Maritime Technology and Business.

2.2. Tools and Materials

The tools used in this study include; testing laboratory tools, *styrofoam*, digital scales, blenders, strainers, knives, basins, cutting boards and other kitchen tools. The ingredients used are boiled water, shrimp waste, kluwak fruit, sugar and salt.

2.3. Research Procedure

The preparation stage includes the preparation of tools and materials in research and sampling. The process of making petis with the addition of kluwak fruit includes: washing, boiling and filtering, adding kluwak fruit, sugar and salt, and heating/thickening. Shrimp waste in the form of skin and head is washed with clean running water. The boiling of shrimp waste is carried out for ± 15 minutes at a temperature of 100°C. Next, the waste is smoothed with the boiled water with a blender and then filtered so that shrimp waste broth is obtained. After that, the addition of kluwak fruit (kluwak fruit is separated from the skin and mashed first), sugar and salt, then cooked until it thickens and becomes petis. The petis made is vanname shrimp waste petis with the addition of (A) 0 g, (B) 10 g, (C) 20 g, and (D) 30 g. Petis samples that have been treated are then tested for water content, protein content, and organoleptic on a hedonic scale in the laboratory.

The research consisted of 3 stages, namely the preparation stage, the petis making stage and the petis testing stage as described below.

2.3.1Preparatory stage

The preparatory stage includes preparing tools and materials for research. The samples used were white leg shrimp (*Litopenaeus vannamei*) waste in the form of shrimp shells and heads and kluwak fruit obtained from the Parigi Market, Lappariaja District, Bone Regency. The criteria for kluwak fruit to be used are that it is ripe, the fruit seeds are dark black with a round shape and are intact.

2.3.2Petis making stage

Making white leg shrimp (*Litopenaeus vannamei*) waste paste with the addition of kluwak fruit is done as follows:

1. Wash the shrimp waste thoroughly with running water.
2. Boil the shrimp waste with water in a pan for ± 15 minutes at a temperature of 100°C followed by grinding the waste using a blender and then blending it to obtain shrimp waste broth. The ratio of water and shrimp waste is 1.3: 1, namely 1300 ml water and 1000 g shrimp waste. The boiling process is carried out until 1000 ml of shrimp waste broth is obtained.
3. Separate the kluwak fruit from the skin and then grind the kluwak seeds.
4. Weigh the shrimp waste broth, kluwak, granulated sugar and salt according to the formulation (Table 1).
5. Mix all the ingredients in each container until all the ingredients are evenly mixed.
6. Carry out the process of reheating the broth accompanied by stirring for ± 20 minutes at a temperature of ± 80°C.
7. Keep stirring until the mixture forms a paste. Dough that is cooked is characterized by heavy stirring or when it is dropped from the mixing spoon the dough does not slide but drips (drop by drop).

Table 1. Shrimp waste paste formulation (modified from [9]

Material	Po (control)	Treatment 1 (P1)	Treatment 2 (P2)	Treatment 3 (P3)
Shrimp waste broth 1000 g	250 ml	250 ml	250 ml	250 ml
Kluwak fruit	0 g	10 g	20 g	30 g
Sugar	5 g	5 g	5 g	5 g

Garam	6 g	6 g	6 g	6 g

2.3.3 Testing stage

The testing stage was carried out to analyze water and protein content as well as organoleptic tests

2.4. Research Design

This study is included in an experimental study that aims to assess the effects of various treatments and investigate possible causality by providing one or more treatment conditions. The study used white leg shrimpwaste petis with treatment through the addition of kluwak fruit (A) 0 g, (B) 10 g, (C) 20 g, and (D) 30 g. Each treatment was repeated 3 times so that 12 experiments were obtained.

2.5. Data Collection Techniques

The data collection technique is to determine the water content and protein content of white leg shrimpwaste petis referring to the work procedure [10], [11], and [12]. Meanwhile, the hedonic scale organoleptic test uses the results of 25 panelists. The hedonic scale is 1-5, namely 1 = very unsportsmanliked, 2 = disliked, 3 = neutral, 4 = liked and 5 = strongly liked. The data from the test results were analyzed in Anova to see the effect on the observed variables.

2.6 Data Analysis

The results of the water and protein content tests were analyzed by Anova and if the results obtained had a very significant effect then it was continued with the Tukey test, while the organoleptics were analyzed descriptively.

3. Results and Discussion

3.1 Water content

Based on the test results on the water content of processed petis using several treatments, the results obtained in the 0 g treatment were water content ranging from 24.9-25.24% (25.02 ± 0.120%), 10 g ranging from 39.02-39.25% (39.17 ± 0.130%) 20 g ranged from 47.21 to 47.43% (47.32 ± 0.110%) and 30 g ranged from 54.26 to 54.60 (54.39 ± 0.181%). These results show that the higher concentration of kluwak added to petis is accompanied by an increase in water content(Figure 1).The results of the analysis of variance showed that the addition of kluwak fruit had a very significant effect ($P < 0.05$) on the water content of white leg shrimp waste paste. After Tukey's test, the results were obtained that each treatment provided unequal water content and the treatment averages were significantly different. This is predicted to be related to the concentration and ability of the kluwak to absorb water in each treatment. According to the National Standardization Agency [12], the moisture content value of petis is maximum 50%, while the water content of treatment A, B and C meets the requirements [13]. The highest water content was obtained in treatment D with the addition of 30% kluwak fruit at 54.39%. This shows that the higher the concentration of adding kluwak fruit, the higher the water content in the petis. The water content in a food product is affected by the composition of the ingredients used in the product. The high water content in treatment D is suspected to be influenced by the high water content of the kluwak fruit. [14] revealed that the moisture content of fresh (wet) kluwak contained a water content of 43.84%.

The water content in food products or food ingredients refers to the amount of water contained in them, and this is an important factor because the water content in food affects the shelf life of food products [15]. The water content in processed fish is one of the factors that determines the shelf life of a product. Adawyah and Puspitassari [16], stated that the amount of water contained in the body of fish ranges from 50-80%. The required water content limit ranges from 30-40% so that the development of decaying bodies can be stopped. However, enzymatic and chemical processes as well as bacterial growth require a certain amount of water, so the moisture content must be maintained as needed. High water content can accelerate deterioration while low water content is able to maintain the quality of food [16].

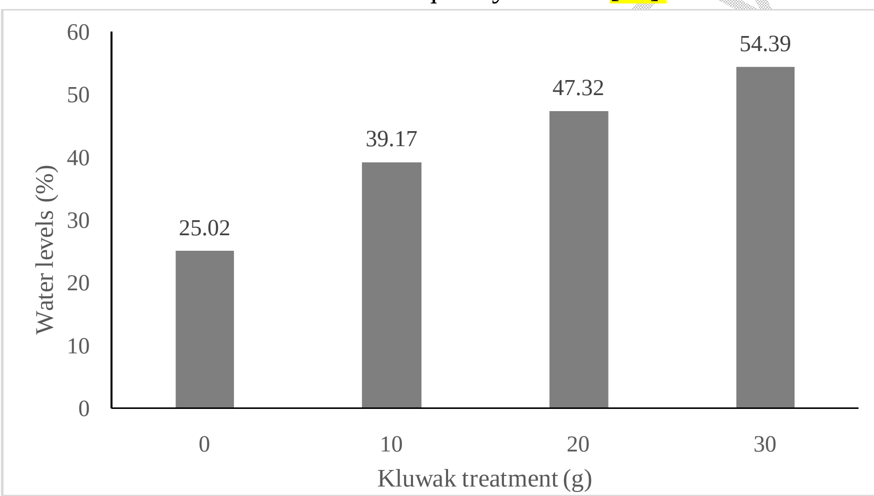

Figure 1.Average value of water content test results of petis product samples from white leg shrimpwaste based on treatment

3.2 Protein levels

Based on test results on the protein content of processed petis using several treatments, the results obtained in the 0 g treatment were protein levels ranging from 16.23-16.71% (16.42 ± 0.253%), 10 g ranging from 15.12-15.75% (15.50 ± 0.333%) 20 g ranged from 14.02 to 14.18% (14.11 ± 0.085%) and 30 g ranged from 12.74 to 12.99 (12.82 ± 0.144%). These results show that the higher concentration of kluwak added to petis is accompanied by a decrease in protein content(Figure 2). After analysis of variance, it showed that the addition of kluwak fruit had a very significant effect on the protein content of white leg shrimp waste paste with a sig value ($P < 0.05$). After Tukey's test, the results were obtained that each treatment provided protein levels that were not the same as the treatment average, which was significantly different. The protein content produced in petis products using white leg shrimpwaste raw materials with the addition of treatment cluwak C and D has been in accordance with the quality requirements of petis that have been determined according to [17] where the maximum protein content value is 15%. The protein concentration in petis which is the final product of this research may be related to the deposition of protein resulting from the reaction with the compounds contained in kluwak.

The protein content in the addition of 30 g of kluwak fruit has the lowest protein content while the highest protein content is found in the addition of 0 g of kluwak fruit. The concentration of adding kluwak fruit is suspected to affect protein levels, where the increasing concentration of kluwak fruit, the petis protein level tends to decrease. Syarief and Halid [18] argue that the decrease in protein content occurs due to an increase in water content, which has the potential to reduce protein content, and vice versa.

Protein is a food substance that has an important role in the body. The main function of protein is as a fuel, building and regulating substance in the body [15]. Protein analysis in foodstuffs generally focuses on determining the total protein content or known as crude protein. Crude protein is the amount of nitrogen (N) contained in a foodstuff, which is then multiplied by a factor of 6.25. This approach is based on estimates that the average nitrogen content in foodstuffs is about 16 grams per 100 grams of protein [19].

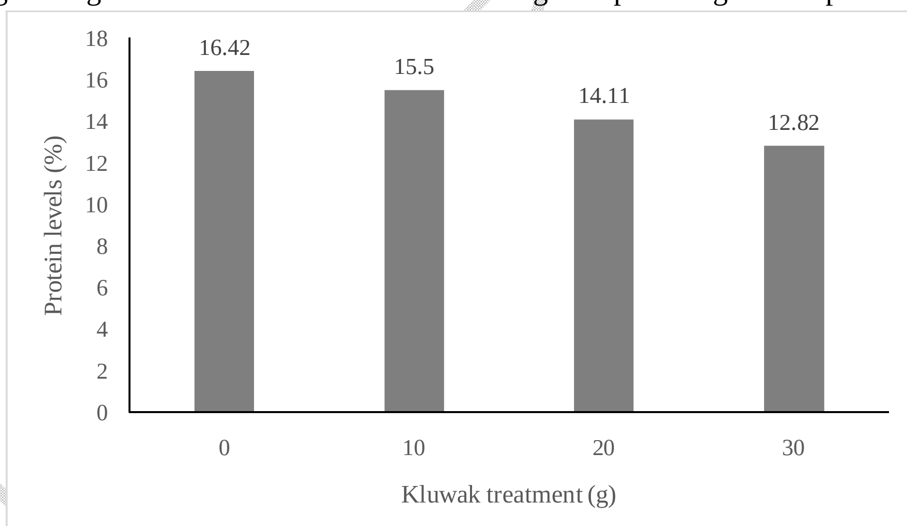

Figure2. Average value of protein content test results of petis product samples from white leg shrimpwaste based on treatment

[20] revealed that the high protein content in snack food raw materials can affect the binding of water molecules by starch molecules because proteins have molecular groups that are hydrophilic and ionic, so they can be soluble in water. This condition causes starch molecules to find it difficult to expand and the cell pore structure becomes low and dense, resulting in the texture of snack products that tend to be hard.

3.3 Organoleptic

Based on the results of the test on the organoleptic test which includes the appearance, aroma, texture and taste of processed petis using several treatments, the results are obtained as seen in Figure 3.

3.3.1 Appearance

The average value of the organoleptic test for the appearance of white leg shrimpwaste petis showed that the acceptance rate of the panelists ranged from 3.04-3.64 with the criteria of brownish and blackish-brown color, homogeneous, elastic and brilliant. The highest appearance value in treatment (D) with the addition of 30 g of kluwak fruit was 3.64. The appearance of white leg shrimpwaste petis with an additional concentration of 30 g was most liked by the panelists. The more kluwak fruit is mixed in the petis, the stronger the dark brown color produced by the petis. Meanwhile, the lowest average value of appearance was found in the 10 g treatment with a value of 3.14 because it looked light brown and not brilliant.[20] also found that the higher the concentration of kluwak used, the higher the organoleptic value of the appearance.

Astawan [21]states that a good petis has bright (not dull) color characteristics, generally blackish-brown. Appearance includes the color aspect, playing an important role in the subjective assessment by the panelists. The color of the product, like the petis, greatly affects how the product is perceived visually. High-grade petis products usually have a shiny blackish-brown color and are free of contaminants.

The appearance characteristics of petis with the addition of kluwak fruit show that the more the concentration of kluwak is added, the more brilliant the color will be. An addition of 0 g in concentration indicates pale petis, 10 g in concentration indicates brownish color. A concentration of 20 g produces a dark brown color, while petis with a concentration of 30 g is blackish brown and brilliant.

3.3.2 Aroma

Aroma in the context of a food product is a collection of gaseous compounds that produce a specific odor. Odor can be described as a mixture of four main aromas, namely fragrant, sour, rancid, and charred. In the food industry, aroma testing is very important because it can provide a quick assessment of how the product will be received by consumers.

The highest average value of aroma was found in the treatment with an additional concentration of 30 g with a value of 3.4. It is suspected that kluwak has an aromatic aroma that is typical of spices where kluwak, if used as a kitchen spice, can provide a more pleasant aroma. Meanwhile, the lowest average value of aroma in the treatment of adding a concentration of 0 g with a value of 2.9. The results of the hedonic scale organoleptic study showed that the increase in the concentration of kluwak was inversely proportional to the level of preference of the panelists for the scent of petis. This is in accordance with the statement [22] that the addition of kluwak paste in the manufacture of Almond Cripsy by 0.05%, 0.07% and 0.08% does not affect consumer acceptability in aroma parameters.

The aroma characteristics produced in petis with the addition of 0 g concentration produce petis products with a very thick shrimp odor. Meanwhile, the aroma produced on petis with the addition of 10 g, 20 g, and 30 g is relatively the same. The aroma of white leg shrimpwaste petis with an additional concentration of 30 g was preferred by the panelists and the additional concentration of 20 g and 30 g was included in the somewhat liked category, while the concentration of 0 g (control) was included in the neutral category.

The research results of [23]stated that kluwak pulp flour has a fairly high nutritional content, especially carbohydrates and minerals, so it has the potential to be used as a substitute flour, one of which can be used for the processing of danish pastry bakery products. The panelists' level of acceptance of danish pastry products with the addition of kluwek pulp flour was on a scale of 3.88, namely neutral, tending to "like". The added value of danish pastry which is prepared using additional kluwek pulp flour is the addition of a distinctive cheese aroma to the product which is not found in the control danish pastry.

3.3.3 Flavor

The taste characteristics produced in petis with the addition of 30 g of kluwak showed the highest average taste value of 3.12. The panelists preferred petis with the addition of kluwak with a concentration of 30 g because it tasted more savory, delicious, and more pleasant to the throat when tasting. Meanwhile, the lowest average taste was found in the treatment of adding a concentration of 10 g with a value of 2.76 because the taste was not good.

Kluwak fruit contains a number of carbohydrates, protein and dietary fiber, so it has the potential to be used as a processed food ingredient. Kluwek fruit flesh has a distinctive flavor and aroma which can be added value and a delicious taste when used in processing food products [24].

3.3.4 Texture

Texture is one of the important aspects in assessing food ingredients and their processed products. These characteristics play a central role in the consumer experience, and products with hard-to-use or hard-to-consume textures can have an impact on consumer satisfaction levels and panelists' ratings. Therefore, in the development of food products, it is important to pay attention to the texture to match consumer preferences and meet expectations for the desired taste and texture experience. The highest average texture value was found in the treatment of adding a concentration of 30 g (D) with a value of 3.6, The texture characteristics produced on petis with the addition of 30 g kluwak showed a thicker, homogeneous and soft texture. Meanwhile, the lowest average texture value was found in the concentration treatment of 10 g (B) with a value of 2.76 and was less in demand because the texture was less thick and not homogeneous.

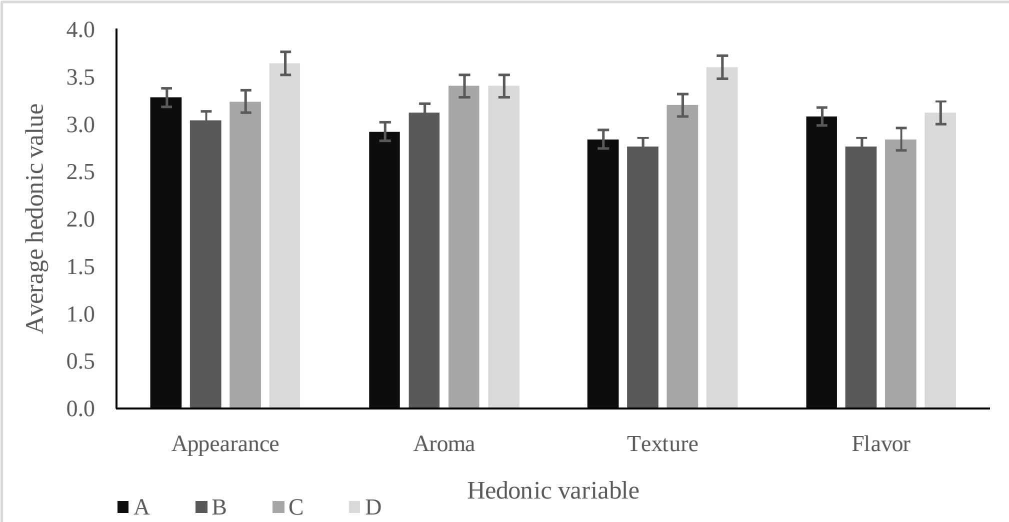

Figure 3. Average value of hedonic scale organoleptic test results of petis samples from white leg shrimpwaste

4. Conclusion

The moisture content values for treatments A, B and C met the requirements [9], while the protein values for treatment C and D were in accordance with the quality requirements of petis that had been determined according to [17]. The higher the concentration of kluwak added to petis is accompanied by the increasing water content but the protein content decreases. The organoleptic values of the hedonic scale of white leg shrimpwaste petis with the addition of kluwak fruit produced the best appearance, taste, and texture parameters of treatment D and the best aroma parameters were treatment B. The organoleptic values of the appearance, aroma, taste and texture parameters of treatments A, B, C and D fulfil the requirements[17].

Disclaimer (Artificial intelligence)

NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text to image generators have been used during writing or editing of manuscripts.

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