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Used of *Thalassina anomala* Protein Hydrolysate with Enzymatic Processes for Fortification in Instant Porridge

Pemanfaatan Hidrolisat Protein Thalassina anomala dengan Proses Enzim untuk Fortifikasi dalam Bubur Instan

Paridah Hasibuan[1*], Suparmi[1], Tjipto Leksono[1]
[1]Department of Marine Science, Postgraduate, Universitas Riau, Pekanbaru 28293 Indonesia
**email:* paridahpku16@gmail.com

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Abstract

This research aims to discover the characteristics of Thalasina anomala protein hydrolysate fortification with instant porridge. The method used in this research is an experimental procedure with a completely random design. The research was conducted in 2 stages. Stage 1 is the production of shrimp protein hydrolysate with the enzymatic process, namely papain enzymes with concentration levels (10, 15, and 20%); the observed parameters are the chemical composition of meat, shrimp protein hydrolysis, and total amino acids. Protein hydrolysis results in stage 1 as a fortification raw material in stage 2, which produces instant powder with treatment (0%,5%, and 10%). The parameters tested include the chemical composition of shrimp protein hydrolysate fortifications with instant powder, water absorption, and powder solubility. The study results showed that the protein content of the shrimp meat is 84.98% (dw). The characteristic of the protein is produced using yellow-white papain enzymes with protein content of A1=77.44%, A2=80.56%, and A3=84.56% (dw). The degree of hydrolyze produced is A1 = 56.34 %, A2 = 64.51 %, and A3 = 69.19%. Shrimp protein hydrolysate contains amino acids with a total of 12.25%. Protein hydrolysis fortified with instant porridge produces organoleptic characteristics such as appearance B0=5.4, B1=5.3 B2=5,3, flavor B0 = 5.1, B1= 5.2 B2 = 5.0, Taste B0=4.8, B1=5,5 B2=5.8, and Textures B0=3.2, B1=3.6 B2=4.4. The chemical composition of shrimp protein hydrolysis fortified with instant porridge showed protein content is B0= 9.59%, B1= 18.56%, and B2= 22.54% (dw), with the absorption of water produced, is B0=4.68% B1=5.31% and B2=6.08%, and the solubility of the instant porridge produced B0=43.58%, B1=37.21% B2=33.46%.

Keywords: *Thalassina anomala*, Papain Enzyme, Protein Hydrolysate

Abstrak

Penelitian ini bertujuan untuk mengetahui karakteristik fortifikasi hidrolisat protein *Thalasina anomala* dengan bubur instan. Metode yang digunakan dalam penelitian ini adalah prosedur eksperimental dengan desain yang sepenuhnya acak. Penelitian dilakukan dalam 2 tahap. Tahap 1 adalah produksi hidrolisat protein udang dengan proses enzimatik, yaitu enzim papain dengan tingkat konsentrasi (10, 15, dan 20%); Parameter yang diamati adalah komposisi kimia daging, hidrolisis protein udang, dan asam amino total. Hidrolisis protein menghasilkan tahap 1 sebagai bahan baku fortifikasi pada tahap 2, yaitu produksi bubuk instan dengan perlakuan (0%, 5%, dan 10%). Parameter yang diuji meliputi komposisi kimia fortifikasi hidrolisat protein udang dengan bubuk instan, penyerapan air, dan kelarutan bubuk. Hasil penelitian menunjukkan bahwa kandungan protein daging udang adalah 84,98% (dw). Karakteristik protein diproduksi menggunakan enzim papain kuning-putih dengan kandungan protein A1=77,44%, A2=80,56%, dan A3=84,56% (dw). Tingkat hidrolisis yang dihasilkan adalah A1 = 56,34 %, A2 = 64,51 %, dan A3 = 69,19%. Hidrolisat protein udang mengandung asam amino dengan total 12,25%. Hidrolisis protein yang diperkaya dengan bubur instan menghasilkan karakteristik organoleptik seperti penampilan B0=5.4, B1=5.3, B2=5,3, rasa B0 = 5.1, B1= 5.2, B2 = 5.0, Rasa B0=4.8, B1=5,5, B2=5.8, dan Tekstur B0=3.2, B1=3.6, B2=4.4. Komposisi kimia hidrolisis protein udang yang diperkaya dengan bubur instan menunjukkan kandungan protein adalah B0= 9,59%, B1= 18,56%, dan B2= 22,54% (dw), dengan penyerapan air yang dihasilkan adalah B0=4,68% B1=5,31% dan B2=6,08%, dan kelarutan bubur instan yang dihasilkan B0=43,58%, B1=37,21% B2=33,46%.

Kata kunci: *Thalassina anomala*, Enzim Papain, Protein hidrolisat

1. Introduction

Rama-Rama (*Thalassina anomala)* is a shrimp that lives on sloping and muddy coasts in tropical and subtropical areas. Rama-Rama has the potential to be a fishery product due to the nutrition and abundance of these shrimp (Rusmaniar, 2014). Due to the high nutritional content of rama-rama, it can be used as raw material for making protein hydrolysates. Protein hydrolyzate results from protein hydrolysis, the principle of breaking peptide bonds in proteins using protease enzymes (Edison et al., 2020). The papain enzyme is a protease enzyme that catalyzes the reaction of breaking down polypeptide chains in proteins by hydrolyzing peptide bonds into simpler compounds, such as peptides and amino acids (Suparmi et al., 2020).

Protein hydrolysates are commonly used in the health food sector. One use is to fortify rama-rama protein hydrolyzate with instant porridge. Instant porridge has the main component, namely carbohydrates from rice. The low protein content in porridge harms nutrition. Protein hydrolyzate, which is a health food product, can be fortified with instant porridge, which helps increase the nutritional value of instant porridge, so it is necessary to determine the chemical composition and characteristics of instant porridge fortification products and rama-rama protein hydrolyzate (Handayani et al., 2014).

The research aimed to determine the characteristics of the rama-rama protein hydrolyzate with the best papain enzyme produced. So, instant porridge formulations can be made further by adding rama-rama protein hydrolyzate (*Thalassina anomala*). The results of this research will provide information and increase insight regarding rama-rama protein hydrolyzate with the papain enzyme, which is fortified in instant porridge.

2. Material and Method

2.1. Time and Place

The research will be carried out from September-December 2023. Shrimp samples were taken from Bengkalis City, Riau Province. Sample analysis was carried out at the Fishery Products Chemistry Laboratory, Fisheries Products Microbiology Laboratory, Fisheries Products Technology Department, Faculty of Fisheries and Marine, Universitas Riau; Materials Analysis Laboratory, Department of Physics, Faculty of Mathematics and Natural Sciences, Bogor Agricultural Institute.

2.2. Methods

The method used is the experimental method, with an experimental design, namely a non-factorial Completely Randomized Design (CRD) with three replications, so the number of experimental units is 9. The data obtained was then analyzed statistically using the one-way ANOVA method. Then, the data was analyzed further with accurate difference analysis, namely Duncan’s, using a significance level of $\alpha = 0.05$.

2.3. Procedures

The research consists of 2 stages. In stage 1, the process of making rama-rama protein hydrolyzate using the papain enzyme consists of 3 stages, namely A1(10 %), A2 (15%) and A3 (20%). The results of the rama-rama protein hydrolyzate with the best results in stage 1 will be formulated with instant porridge. The parameters observed were an analysis of the chemical composition of the meat and protein hydrolyzate of rama-rama and an analysis of amino acids in the protein hydrolyzate with the best papain enzyme. In stage 2, instant porridge is made, which is fortified with shrimp protein hydrolyzate with treatment, namely B1 (5 %), B2 (10 %) B3(15 %). The parameters observed were chemical composition analysis of shrimp protein hydrolyzate fortified with slurry, water absorption test, and instant slurry water solubility test.

3. Result and Discussion

3.1. Proximate Analysis of Rama-Rama Meat

The results of the analysis of the proximate content of Rama-Rama include the content of water, protein, ash, fat, and carbohydrates. The results of the proximate analysis of Rama-Rama are presented in Table 1.

Tabel 1. Proximate content of Rama-rama (*Thalassina anomala*)

Composition	Meat
Water (ww)	5,45±0,78
Protein (dw)	84,98±0,15
Ash (dw)	3,21±0,54
Fat (dw)	3,49±0,43
Carbohydrate (dw) *by different*	4,46±0,98

Table 1 shows that Rama-Rama has a water content of 5.45 ± 0.78% (ww). The protein content is 84.98 ± 0.15 % (dw). The ash content is 3.21 ± 0.54% (dw). The fat content is 3.49 ± 0.43% (dw). Meanwhile, the carbohydrate content is 4.46 ± 0.98% (dw). The protein content of Rama meat is relatively high. This shows that rama-rama has good nutritional value as a food ingredient. Protein in the body can be food reserves, building blocks, and regulatory substances. The high protein content can be hydrolyzate (Edison et al., 2020).

The water content of rama-rama meat is relatively high. Water content dramatically influences the consistency of food ingredients, and most fresh ingredients have a water content of 70% or more. Yanar et al. (2011) stated that the nutritional content of wild shrimp is around 75.18%. The fat content of rama-rama meat is relatively low. The value of fat content in shrimp meat varies wildly, depending on the type, age, season, habitat, and feed. According to Chanmugan et al. (1992), the fat content of marine shrimp is not significantly different from freshwater shrimp, namely 1.0-1.1 g in 100 g of meat (Mahmud & Hermana, 1987).

The ash content of rama-rama meat is relatively low. Ash is the residue left after a material is burned until it is carbon-free. The amount of ash content is influenced by the size of the shrimp and the ratio of meat to bone. The carbohydrate content obtained from shrimp meat is 4.96% (bk), higher than the carbohydrate content in freshwater shrimp of 3.01% (bk) (Dompeipen et al., 2016).

3.2. Characteristic of Rama-Rama Protein Hydrolyzate

The highest degree of hydrolysis was obtained from treatment A3, amounting to 69.19%, and is the optimum condition in the hydrolysis process of the Rama-Rama protein (Figure 1). The greater the concentration of the papain enzyme added, the greater the value of the degree of hydrolysis of the protein hydrolyzate; however, at a specific concentration, the value of the degree of hydrolysis tends to remain the same or does not experience significant changes (Nurhayati et al., 2013).

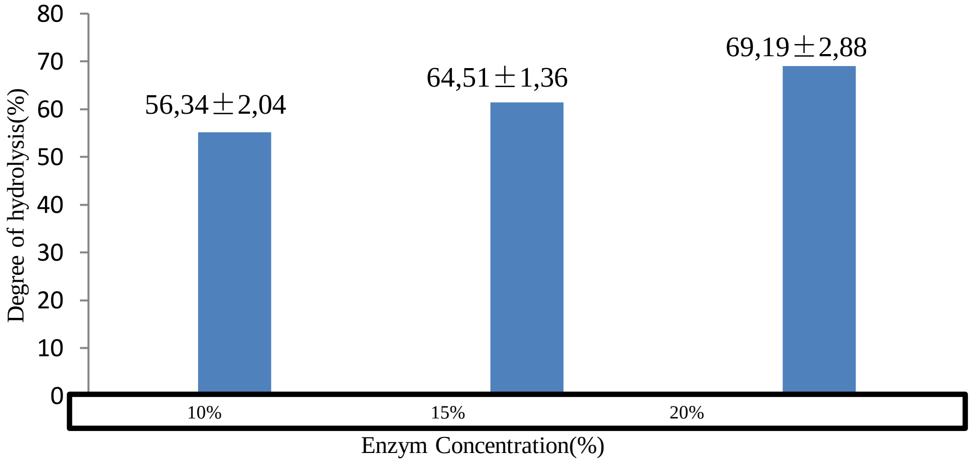

Figure 1. Effect of enzyme concentration on hydrolysis protein Rama-Rama

The hydrolysis of Rama-Rama protein hydrolyzate is higher than other fishery products; African catfish protein hydrolyzate is 47.24% (Nurhayati et al., 2013). The degree of hydrolysis of tuna fish protein is 61.79% (Edison et al., 2020). Differences in the use of raw materials and the enzymes used are thought to influence the protein hydrolysis process. According to Rutherfurd (2010), hydrolysis results in proteolytic enzymes breaking protein peptide bonds. The percentage of released peptide bonds is called the degree of hydrolysis. Charoenphun et al. (2013) stated that the higher the degree of hydrolysis, the more influential the hydrolysis process is in breaking peptide bonds.

3.3. Proximate Analysis

The water content contained in the Rama-Rama protein hydrolyzate was respectively 9.17% (A1), 8,73% (A2), and 5.73% (A3), so it can be concluded that the higher the additional concentration, the lower the water content value of the shrimp protein hydrolyzate. The moisture content of shrimp protein hydrolysate is lower because water will evaporate when it comes into contact with heat during the drying process, so the moisture content in the food will decrease (Table 2).

Table 2. Proximate analysis

Ingredient	Percentage (%)		
	10% (A1)	15% (A2)	20% (A3)
Water (ww)	9,17 ± 0,47	8,73 ± 0,18	6,73 ± 0,18
Ash (dw)	3,89 ± 0,76	3,03 ± 0,31	2,69 ± 0,31
Protein (dw)	77,44 ± 0,13	80,56 ± 0,68	84,56 ± 0,68
Fat (dw)	2,56 ± 0,57	1,46 ± 0,26^{b}	1,21 ± 0,57
Carbohydrate (dw) *by different*	6,91± 0,21	6,17± 0,89	5,81± 0,23

Water content shows the stability and shelf life of food products. The higher the water content, the shorter the shelf life or the less durable the product. Water content greatly influences physical and chemical product properties and damage by microbes because microorganisms can use water for their growth and development. One effort to reduce water content is drying (Edison et al., 2020).

The ash content contained in the Rama-Rama protein hydrolyzate was 3.89% (A1), 3,03% (A2), and 2.69% (A3), respectively. The addition of alkaline compounds, such as NaOH, and acidic compounds, such as HCl, in the protein hydrolysis process aims to achieve the enzyme's optimum pH value and keep the pH constant during the hydrolysis process so that the breaking of peptide bonds by the enzyme can continue (Wijayanti et al., 2016).

The protein content contained in the Rama-Rama protein hydrolyzate was respectively 77.44% (A1), 80,56% (A2), and 84,56% (A3) lower than the protein content of fish 91.04% (Prastari et al., 2017). The protein content of milkfish protein hydrolyzate was 85.00% (Wijayanti et al., 2016). The results of adding different concentrations of Rama-Rama protein hydrolyzate showed that the protein content value had increased.

The higher the protein content value, the greater the concentration of Rama-Rama protein hydrolyzate, and the higher the protein content value. This shows that there is an increase in protein levels after the hydrolysis process. The protein in this hydrolyzate product is soluble, while the insoluble protein is removed during filtration. The increase in protein content in the hydrolyzate product is due to the conversion of insoluble protein into soluble nitrogen compounds during hydrolysis, which decomposes into simpler compounds, such as peptides and amino acids.

Thrash content contained in the Rama-Rama protein hydrolyzate was respectively 2.56% (A1), 1,46% (A2), and 1.21% (A3). Some fat contained in the protein hydrolyzate is thought to be separated along with the insoluble protein, namely when centrifugation. Protein hydrolysates with a low-fat content are generally more stable against fat oxidation reactions than fish protein hydrolysates with a high fat content (Nilsang et al., 2005). According to Dewita et al. (2017), the higher the solvent extraction power for water and fat, the more concentrated the protein will be and the lower the fat.

The Carbohydrate content contained in the Rama-Rama protein hydrolyzate was respectively (A1), 6,17% (A2), and 5.81% (A3). Carbohydrates are the primary source of calories for humans. Carbohydrates also have an essential role in determining the characteristics of food ingredients, such as taste, color, and texture. In contrast, carbohydrates help prevent the onset of ketosis, excessive breakdown of body protein, and loss of minerals. They help with fat and protein metabolism (Winarno, 2002). A decrease in carbohydrate levels indicates that carbohydrates are dissolved during hydrolysis. Carbohydrates are generally classified into monosaccharides and their derivatives, oligosaccharides, and polysaccharides. Each group has unique advantages and functions in food. Monosaccharides and oligosaccharides are soluble in water. Monosaccharides also dissolve in ethanol but not in organic solvents, namely ether, chloroform, and benzene.

3.4. Types and Levels of Amino Acids

The protein quality of Rama-Rama protein hydrolyzate can be determined by the type and levels of amino acids contained. The amino acid composition of Rama-ramaprotein hydrolyzate is presented in Table 3. Table 3 shows that Rama-rama protein hydrolyzate with an enzyme concentration of 20% (A3) contains nine and eight non-essential amino acids. The highest essential amino acid content in Rama-Rama protein hydrolyzate is leucine, while the highest non-essential amino acid is glutamic acid. Prastari et al. (2017) stated that high-quality protein is a protein that contains all types of amino acids in proportions suitable for growth.

Amino acids are the smallest part of the protein structure, whereas amino acids are the simplest form of protein. The body can absorb this amino acid, which helps carry out protein functions. The higher the protein, the higher the levels of amino acids produced. Based on Table 3, it was found that the number of amino acids formed was less, which is thought to be because the protein dissolved in the Rama-Rama hydrolyzate is still partly in the form of peptides, causing low levels of amino acids.

Table 3. Amino acid composition of rama-rama protein hydrolyzate

Amino Acid	Results (%)
	A3
Aspartic Acid	1,27
Glutamic Acid	2,55
Serine	0,50
Glycine	0,75
Histidine	0,43
Arginine	0,62
Threonine	0,98
Alanin	1,02
Proline	0,38
Tyrosine	0,57
Valine	0,72
Methionine	0,25
Cysteine	0,19
Isoleucine	0,27
Leucine	0,68
Phenylalanine	0,32
lysine	0,75
Total Amino Acids	12,25

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The amino acid profile of the Rama-Rama protein plays a vital role in various biological and physiological activities and in maintaining human health. Amino acids such as asparagus, glycine, and glutamic acid promote wound healing. Tyrosine, methionine, histidine, lysine, and tryptophan have vigorous radical scavenging activity in oxidative reactions. Hydrophobic amino acids can act on membrane lipid bilayers to reach targets and help to remove radicals. Histidine significantly increases antioxidant capacity due to the protonation of the imidazole ring acting as a hydrogen donor (Girgih et al., 2016). Amino acids with antioxidant properties can chelate Fe^{2+} and Cu^{2+}, reducing their activity and inhibiting lipid peroxidation.

Shrimp protein is easily digested and abundant in essential amino acids limited in land meat proteins, such as methionine and lysine (6.5% and 19.6%) of shrimp's total essential amino acids. Zou et al. (2016) tracked preferential amino acids for antioxidant activity among selected antioxidant peptides and found that 33.7% of the total amino acids were glycine, proline, and leucine; 18.7% is alanine, tyrosine, and valine; and 4.9% are methionine, glutamine, and cysteine. They emphasized that the high proportion of hydrophobic amino acids gives the peptide the ability to scavenge radicals (Edison et al., 2020).

3.5. Organoleptic of Instant Porridge with the Addition of Rama-Rama Protein Hydrolyzate

The appearance parameter values range from 5.3 to 5.4. Regarding instant porridge color parameters, on average, the panelists liked the color of instant porridge samples with the addition of Rama-Rama protein hydrolyzate at a concentration of 10%. The appearance results in this study were that the sample produced a white color after dehydration with warm water. Several factors that can influence the color of instant porridge samples are the composition level of the porridge, shrimp, drying temperature, and drying time (Tien-Chen, 2016).

Table 4. Organoleptic of instant porridge with the addition of Rama-Rama protein hydrolyzate

Quality characteristics	Value		
	B0	B1	B2
Appearance	5,4	5,3	5,3
Flavor	5,1	5,2	5,0
Taste	4,8	5,5	5,8
Textures	3,2	3,6	4,4

Table 4 shows the aroma parameter values ranging from 5.0 – 5.2. The sample that got the best value for the aroma parameter was the instant porridge sample with the addition of 5% Rama-rama protein hydrolyzate. So, from the results of this research, samples of instant porridge with the addition of Rama-Rama protein hydrolyzate do not smell too fishy. The results of this research have a higher aroma value than Adebayo-Oyetoro et al. (2013), namely the range from the research ranged from 2.3 to 3.1, where the ingredients used were sorghum, walnuts, and ginger. Low values in aroma parameters can also reduce the acceptance level of an instant porridge sample.

Table 4 shows that the taste parameter values range from 4.8 – 5.8. The porridge sample with the best value on taste parameters was the instant porridge sample with the addition of 10% Rama-rama protein hydrolyzate. The panelists liked the taste of all porridge samples with the addition of 5% Rama-rama protein hydrolyzate and did not like it. Meanwhile, the panelists added 10% Rama-rama protein hydrolyzate to the porridge samples, giving a neutral value. The panelists also gave notes on the resulting sweet and savory taste. The sweet taste in the sample is due to the raw material of Rama-Rama protein hydrolyzate used in the sample. Table 4 also shows the texture parameter values ranging from 3.2 to 4.4. This can be seen in the location of the same subset in all samples. The instant porridge sample with the best value was the instant porridge sample with 10% Rama-rama protein hydrolyzate. According to SNI (2005), instant porridge must also be in the form of particles of sufficient size to encourage babies to chew

3.6. Proximate Analysis of Instant Porridge with the Addition of Rama-Rama Protein Hydrolyzate

The protein content of porridge products with the addition of Rama-Rama protein hydrolyzate was respectively 9.59 ± 0.13% (B0), 18,56 ± 0,68% (B1), and 22,54 ± 0,68% (B2). It can be seen that the highest protein content in porridge is B2, with a protein content of 22.54 ± 0.68%. This is influenced by the amount of Rama-Rama protein hydrolyzate added. In porridge, the addition of Rama-Rama protein hydrolyzate can be done up to high concentrations, but in the industry, the addition is usually limited by the cost of production. The higher the shrimp protein hydrolyzate added, the higher the cost of production.

Tabel 5. Proximate of instant porridge with the addition of Rama-Rama protein hydrolysate

Composition	Percentage (%)		
	B0	B1	B2
Water (ww)	12,86 ± 0,47	8,49 ± 0,18	8,73 ± 0,18
Ash (dw)	4,87 ± 0,76	2,98 ± 0,31	2,73 ± 0,31
Protein (dw)	9,59 ± 0,13	18,56 ± 0,68	22,54 ± 0,68
Fat (dw)	5,76 ± 0,57	4,72 ± 0,26	2,20 ± 0,57
carbohydrate (dw) by different	66,92 ± 0,35	65,25 ± 0,35	63,80± 0,35

Heating decreases total protein concentration due to changes in protein structure. However, it can improve protein quality by inactivating or destroying anti-nutrient components, inhibiting protein absorption, and altering its bioavailability. Heating processes that reduce water content have a more significant effect on increasing protein content. The instant powder water content was respectively 12.86 ± 0.13% (B0), 8,49 ± 0,68% (B1), and 8,73 ± 0,68% (B2), with the lowest water content in treatment B2. Food with low water content is considered to suppress the growth of microorganisms, so controlling the water content in food is one strategy for food storage (Syamaladevi et al., 2016). During the storage period of this instant powder product, the drying process is repeated after mixing all the ingredients (dry mixing) to avoid a decrease in food quality. Apart from that, this effort is so that the water content in the product can reach SNI standards and increase the product's shelf life.

The ash content in instant powder was respectively 4.87 ± 0.13% (B0), 2,98 ± 0,68% (B1), and 2,73 ± 0,68% (B2), with the lowest ash content found in treatment B2. This research used Rama-rama protein hydrolyzate, which is considered to have a high protein content and contributes to the high ash content obtained in this research. Ash is an inorganic mineral with relatively high resistance to temperature and storage time, so its presence in food ingredients, although it can decrease, tends to remain constant. The amount of minerals in the body must be within optimal limits. This is because excess and deficiency of minerals can disrupt health.

The fat content in instant powder was respectively 5.76 ± 0.13% (B0), 4,72 ± 0,68% (B1), and 2,20 ± 0,68% (B2), with the lowest fat value found in treatment B2. Fat plays a vital role in baby formula milk and can provide essential fatty acids (linoleic acid and α-linolenic acid) and fat-soluble vitamins (A, D, E, K) for babies. In this study, Rama-Rama protein hydrolyzate fortification was used. The low-fat content in this product is thought to be due to the low-fat content of the main ingredient, which is not supported by fat sources from other ingredients.

The carbohydrate content in instant powder was respectively 66.92 ± 0.13% (B0), 65,25 ± 0,68% (B1), and 63,80 ± 0,68% (B2), with the highest protein content found in treatment B2. Carbohydrates are a significant part of the diet and vary significantly in their chemical makeup. Most foods are thermally processed before consumption. The changes that occur due to thermal processes are also quite varied. Carbohydrates are involved in browning during the heating process. As a result of browning, many changes occur in the color and aroma of food. Changes in starch by the heating process with water significantly influence the texture and taste.

3.7. Water Absorption and Solubility

The water absorption value in the research results ranges from 4.68 to 6.08 g. Research by Lumentut (2018) shows that the water absorption capacity of commercial instant porridge products ranges from 3.60 – 6.20 g. Adding more and more Rama-rama protein hydrolyzate can increase the water absorption capacity of the porridge. The Rama-Rama protein hydrolyzate is hygroscopic, which means the resulting slurry absorbs water more efficiently. The carbohydrate content in the hydrolyzate in the form of sugar, which is also hydrophilic, can also increase the water absorption capacity. Other constituent elements, namely fat, also influence the water absorption capacity of porridge. The higher the fat content in porridge or food ingredients, the lower the ability of the ingredients to absorb water (Farida, 2016).

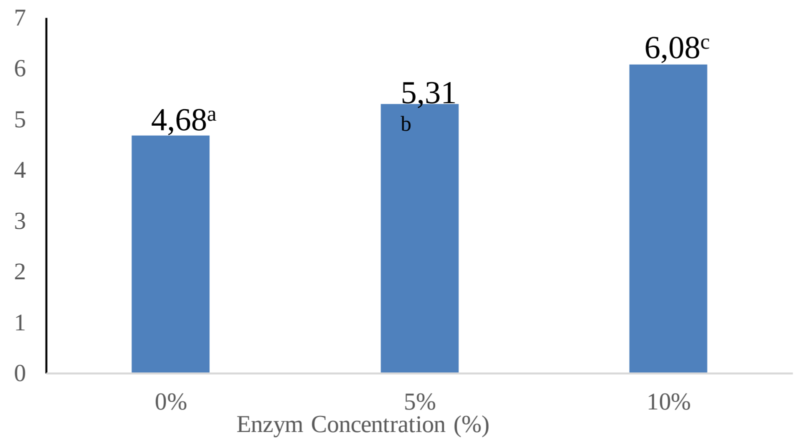

Figure 2. Test results for the water absorption capacity of instant porridge

The research results show that the higher the concentration of protein hydrolyzate, the higher the water absorption capacity of the slurry. According to Lumentut (2018), high protein is hydrophilic, absorbing water more efficiently. This opinion follows Alsuhendra & Ridawati (2009), who stated that water absorption capacity is also influenced by carbohydrate levels, both starch and crude fiber, as well as protein and its constituent components, especially hydrophilic components. It is known that the protein content of Rama-Rama is 81.47% (Ghazali et al., 2020).

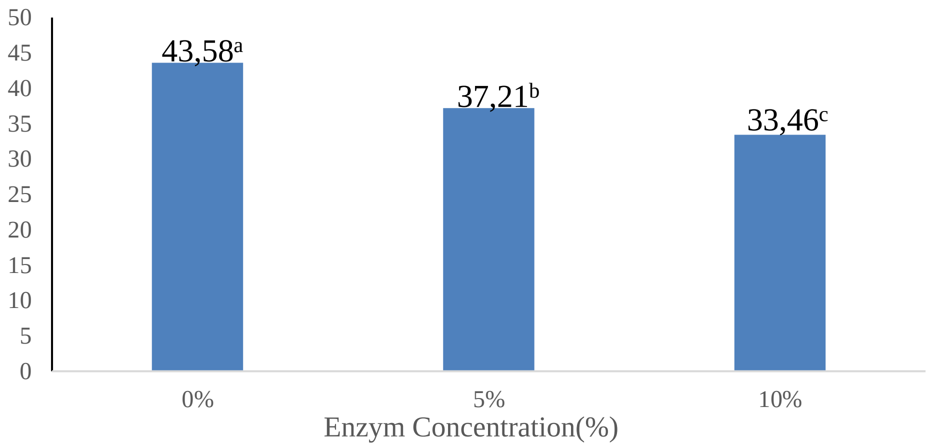

Figure 3. Solubility of Instant Porridge with the Addition of Protein Hydrolyzate

In Figure 3, the solubility level in the slurry ranges from 33.46 – 43.58%. The solubility of a product in water is one of the physical characteristics of a powdered product, and it correlates with the dehydration process in presentation. The solubility of a material is defined as the ability to dissolve in water. The solubility of a material or slurry is not expected to be close to or below 100%. This is because the solubility of the product, in this case, slurry, can dissolve entirely in water, so it is not desirable or not suitable for consumption. Sample B0 has the highest solubility value. This is also in line with what Winarno (2002) stated: the higher the protein content of a material, the more solubility it can increase or improve.

4. Conclusions

Rama-Rama protein hydrolyzate (*Thalassina anomala*) contains relatively high levels of protein, namely with a papain enzyme concentration of 20% (A3) of 84,56% (dw), relatively low water content 6,73 % (ww), fat content of 1.21% (dw) and ash content of 2,69 % (dw) and carbohydrates of 5.81% (dw), with a total diversity of amino acids of 12.25%, and the degree of hydrolysis produced is 69, 18%. So, it can potentially be used as a source of additional ingredients for instant porridge to increase nutrition (fortification).

5. References

[SNI] Standar Nasional Indonesia. (2005). *Syarat Mutu Kandungan Gizi MP-ASI*. Badan Standarisasi Nasional. Jakarta.

Adebayo-Oyetoro, A. O., Ogundipe, O. O., & Adeeko, K. N. (2016). Quality Assessment and Consumer Acceptability of Bread from Wheat and Fermented Banana Flour. *Food Science & Nutrition*, *4*(3): 364-369.

Alsuhendra, A., & Ridawati, R. (2009). *Pengaruh Modifikasi Secara Pregelatinisasi, Asam dan Enzimatis terhadap Sifat Fungsional Tepung Umbi Gembili (Dioscoreaesculenta).* Jakarta. Universitas Negeri Jakarta.

Chanmugam, P., Boudreau, M., Boutte, T., Park, R. S., Hebert, J., Berrio, L., & Hwang, D. H. (1992). Incorporation of different types of n-3 fatty acids into tissue lipids of poultry. *Poultry Science*, *71*(3),: 516-521.

Charoenphun, N., Cheirsilp, B., Sirinupong, N., & Youravong, W. (2013). Calcium-Binding Peptides Derived from Tilapia (*Oreochromis niloticus*) Protein Hydrolysate. *European Food Research and Technology*, 236: 57-63.

Dewita, D., Syahrul, S., Suparmi, S., & Lukman, S. (2017). Utilization of Fish Protein Concentrate from Patin Fish (*Pangasius hypopthalmus*) on Street Foods for Under Five Years Children at Kampar District, Riau Province. *International J. of Oceans and Oceanography*, 11 (1): 2017: 75-88.

Dompeipen, E.J., Kaimudin, M., & Dewa, R.P. (2016). Isolasi Kitin dan Kitosan dari Limbah Kulit Udang. *Indonesian Journal of Industrial Research*, *12*(1): 32-39.

Edison, E., Dewita, D., Karnila, R., & Yoswaty, D. (2020). The Hydrolisis of Fish Protein From Giant Mudskipper (*Periophthalmus schlosseri*) Using Papain Enzyme. *Journal Food and Nutrition*, 8(3).

Farida, S.N, Ishartani, D., & Affandi, D.R. (2016). Kajian Sifat Fisik, Kimia dan Sensoris Bubur Bayi Instan Berbahan Dasar Tepung Tempe Koro Glinding (*Phaseolus lunatus*), Tepung Beras Merah (*Oryza nivara*) dan Tepung Labu Kuning (*Cucurbita moschata*). *Jurnal Teknosains Pangan*,1(1).

Ghazali, T.M., Sitinjak, F.R., & Simanullang, W. (2020). Description and Composition Chemistry of Meat and Carapace (*Thalasina Anomala*). *Jurnal Perikanan dan Kelautan*, 25(2): 138-144.

Girgih A.T., He, R., Malomo, S., Offengenden M., Wu J., & Aluko R.E. (2016). Structural and Functional Characterization of Hemp Seed (*Cannabis sativa* L.) Protein-Derived Antioxidant and Antihypertensive Peptides. *J. Funct. Foods*, 6:384–394.

Handayani, N.A., Santosa, H., & Kusumayanti, H. (2014). Fortifikasi Inorganik Zink pada Tepung Ubi Jalar Ungu sebagai Bahan Baku Bubur Bayi Instan. *Reaktor*, 15(2): 111-116.

Liceaga-Gesualdo, A. M., & Li-Chan, E.C.Y. (1999). Functional Properties of Fish Protein Hydrolysate from Herring (*Clupea harengus*). *Journal of Food Science*, 64(6): 1000-1004.

Lumentut, G. (2018). *Formulasi Bubur Bayi Instam dari Tepung Pregelatinisasi Umbi Uwi Ungu (Dioscorea alata L.) dengan Tepung Kedelai (Glycine max L. Merr) sebagai Alternatif Makanan Pendamping Air Susu Ibu.* Ilmu dan Teknologi Pangan. Universitas Hasanudin Makassar. Makasar.

Mahmud, M. K.M.S., & Hermana. (1987). *Kadar Asam Lemak Omega-3 dalam Ikan di Indonesia*. Makalah pada Seminar Manfaat Ikan Bagi Pembangunan Sumberdaya Manusia. Departemen Kesehatan dan Kantor Menteri Negara KLH. Jakarta.

Nilsang, S., Lertsiri, S., Suphantharika, M., & Assavanig A. (2005). Optimization of Enzymatic Hydrolysis of Fish Soluble Concentrate By Commercial Protease. *Journal of Food Engineering*, 70(1): 571-578.

Nurhayati, T., Nurjanah, N., & Sanapi, C.H. (2013). Karakteristik Hidrolisat Protein Ikan Lele Dumbo (*Clarias gariepinus*). *Jurnal Pengolahan Hasil Perikanan Indonesia*, 16(3).

Prastari, C,, Yasni, S., & Nurilmala, M. (2017). Karakteristik Protein Ikan Gabus yang Berpotensi sebagai Antihiperglikemik. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 20(2).

Rusmaniar, R., Muhammad, A., & Windarti, W. (2014). *Karakteristik Bioturbasi oleh Rama-rama (Thalassina Spp.) di Lingkungan Pesisir Bukit Batu, Bengkalis, Riau*. Universitas Riau

Rutherfurd, S.M. (2010). Methodology for Determining Degree of Hydrolysis Protein Hydrolysates: a review. *J AOAC Int*, 93(5):1515-1522.

Suparmi, S., & Dahlia, D. (2020). Studi Fortifikasi Hidrolisat Protein Udang Rebon (*Mysis relicta*) pada Mie Sagu. *Jurnal Agroindustri Halal*, 6(1): 39–48.

Syamaladevi, R.M., Tang, J., Villa-Rojas, R., Sablani, S., Carter, B., & Campbell, G. (2016). Influence of Water Activity on the Thermal Resistance of Microorganisms in Low-Moisture Foods: A Review. *Comprehensive Reviews in Food Science and Food Safety*, *15*(2): 353-370.

Tien-Chen, T. (2016). Computer Self-Efficacy and Factors Influencing E-Learning Effectiveness. *European Journal of Training and Development*, 36 (7): 670- 686.

Wijayanti, I., Romadhon, and Rianingsih, L. (2015) Characteristics of Milkfish (*Chanos chanos* Forsk) Protein Hydrolysate as effect of Different Bromelin Enzyme Concentration. *Indonesian Journal of Fisheries Science and Technology* 11 (2): 129–133.

Wijayanti, I., Romadhon, R., & Rianingsih, L. (2016). Karkateristik Hidrolisat Protein Ikan Bandeng (*Chanos chanos* F) dengan Konsentrasi Enzim Bromelin yang Berbeda. *J. Saintek Perikanan*, 11(2)

Winarno, F.G. (2002). *Kimia Pangan dan Gizi.* Gramedia Pustaka Utama. Jakarta.

Yanar, Y., Gocer, M., & Kucukgulmez, A. (2011). Differences in Nutritional Composition Between Cultured and Wild Green Tiger Shrimp (*Penaeus semisulcatus*). *Journal Food,* (436-440).

Zou T.-B., He T.-P., Li H.-B., Tang H.-W.,& Xia E.-Q. (2016). The Structure-Activity Relationship of the Antioxidant Peptides from Natural Proteins. *Molecules*. 21:72.