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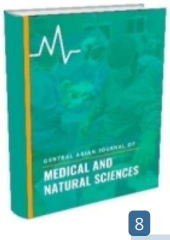

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Annotation: This study aimed to analyze the effect of squid meat fortification on the hedonic quality characteristics and nutritional value of tortilla chips formulated with seaweed and to determine the best formula for tortilla chips formulated from cassava and seaweed fortified with squid meat. The research treatment factor was the concentration of different squid meat, namely 25gr, 50gr, 75gr. Hedonic quality organoleptic consists of appearance, aroma, taste and texture, chemical analysis consists of water content, ash content, protein content, fat content and carbohydrate content. The results of the Kruskall Wallis test showed that different fortification of squid meat had a significant effect($p<0.05$) on the value of the hedonic quality of appearance, texture, aroma, taste. The results of Analysis of Variance (ANOVA) showed that different fortification of squid meat had a significant effect on the value of water content, ash content, protein, fat and carbohydrates. Bayes test results from hedonic and chemical quality showed that the selected product was 75gr squid meat fortification formula C. The results of the hedonic quality characteristics of the selected tortilla chips have the criteria of intact, neat, uneven thickness, dark brown color, slightly brittle dry texture, and less strong squid taste and aroma. Chemically, the selected tortilla chips contain 4.21% water content, 4.61% ash content, 23.09% fat content, 15.07% protein content, 53.04% carbohydrates and has a crispness of 1312.6 Force/g.

Key words: Hedonic quality, chemistry, fortification, tortilla chips, squid meat.

PRELIMINARY

Squid or in Latin Loligo sp. is a highly nutritious food source. The protein content of squid is about 67%, in addition there are essential and non-essential amino acids and contains macro and micro mineral elements as well as various other nutritional content that is needed by the body (Astawan, 2009).

The specific characteristic possessed by squid is the presence of melanin-rich ink sacs (Derby, 2014). Melanin or black pigment is a melanoprotein containing 10-15% protein, consisting of essential and non-essential amino acids and sulfated polysaccharides (Luo and Liu, 2013), anticoagulant (Pushpamali et al. 2008), antibacterial (Nirmale et al. 2002) and anti-tumor (Agusandi et al. 2013) so that it becomes a good source of protein equal to the protein content in fish meat (Astawan 2008). Okuzumi and Fujii (2000) stated that the melanoprotein of squid ink contains natural glutamic acid so that it tastes savory umami like cheese.

So far, squid ink has not been used or disposed of because it is considered waste that has a black color and produces a fishy taste, but in several countries squid ink has been used as a food additive, including arroz negro (black rice), txipirones en su ink (baby squid in ink sauce), squid ink is also used as food coloring (Derby et al. 2013).

The types of processed squid products for local consumption are still very limited, including salted squid, dried squid, squid crackers, and canned squid. So there is a need for product diversification, namely tortilla chips fortified with squid.

Tortilla chips are a snack product shaped like chips with different thickness sizes made from corn or other agricultural products. The results of Nur sa'adah's research (2017) show that the protein content of seaweed tortilla chips with the addition of mackerel ranges from 4.78% to 10.50%, the highest protein content is found in tortilla chips with the addition of 25% mackerel. The protein content of commercial tortilla chips products (based on tempeh) in Fathiarisa's (2016) study was 7.74%.

One of the seaweeds that can be used and is often used in processed products is seaweed *Kappaphycus alvarezii*. Use K. Alvarezii seaweed can cause a crunchy texture and make the crackers expand, because K. Alvarezii seaweed contains carrageenan.

Cassava or cassava (Manihot esculenta Crantz) has the most important economic significance compared to other types of tubers. Can be eaten raw, the main content is starch with a little glucose so it tastes a little sweet. Besides being able to be consumed in the form of boiled or fried cassava, tape, cassava, it is also often processed into cassava and cassava flour is a semi-finished ingredient.

Based on this, the researchers tried to use squid, seaweed and cassava in making tortilla chips in order to increase the level of utilization and nutritional value for people who consume them.

RESEARCH METHODS

This research was conducted from September to December 2018 in Gorontalo City.

Tools and materials

The tools used in making seaweed porridge, cassava and tortilla chips are oven, analytical scale, knife, container, spoon, cutting board, stove, dryer, stopwatch, oven, thermometer. The ingredients to be used are squid, seaweed, cassava, rice flour, garlic, salt and water.

Research procedure

Based on preliminary research experiments, the tortilla chips formula in the main study used squid with concentrations of 0%, 25%, 50% and 75%. The process of making tortilla chips was carried out as in the preliminary study. Then the four tortilla chip formulas, namely 0 gr, 25 gr, 50 gr and 75 gr, were tested for hedonic and proximate quality organoleptic tests. After that, they were analyzed using the Bayes method to determine the selected product.

RESULTS AND DISCUSSION

Appearance

Histogram of the appearance of squid fortified tortilla chips can be seen in Figure 1.

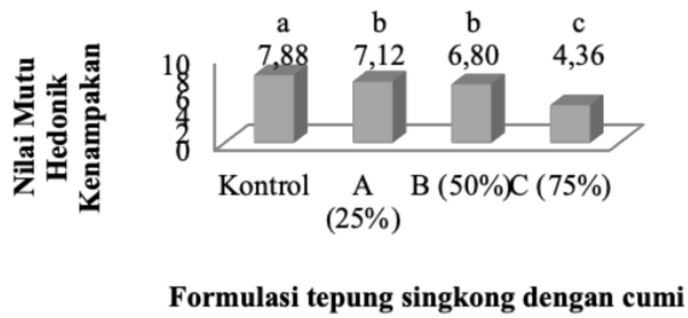

FIGURE 1. HISTOGRAM OF APPEARANCE VALUES

Figure 1 shows the organoleptic value of the hedonic appearance of the tortilla chips in the range of 4.36 – 7.88. The highest hedonic quality value was found in the control formula (without squid fortification) which was 7.88 with the criteria of intact, neat, flat thickness, bright cream color. While the lowest hedonic quality organoleptic value was found in formula C (75gr squid fortification) which was 4.36 with the criteria of intact, neat, uneven thickness and dark brown color.

The results of the Krukal Wallis test showed that the addition of squid to tortilla chips made from cassava flour had a significant effect on the appearance of the product.

The results showed that the appearance of tortilla chips made from cassava flour with squid substitution resulted in the appearance of different colors and integrity, this was probably due to the addition of squid. Tortilla chips with control treatment had a high appearance value, because the appearance of the color of the tortilla chips had a bright, uniform and intact color, so that the panelists still liked the color of the tortilla chips. This is in accordance with the results of Ariani et al. (2016), that pound cake and sponge cake made from cassava flour have a bright color, because cassava flour has a slightly yellowish milky white characteristic. The uniformity and integrity of a product will certainly attract panelists and are preferred when compared to products that are diverse and incomplete.

Torttilla chips with treatment A (25%), B (50%) have a light brown color, this is in accordance with the results of research by Octavi and Suhartiningsih (2017), crackers with the addition of squid meat 20%, 40% have brownish cream color criteria. While the results of the research on tortilla chips with the addition of high C (75%) squid have a dark brown color, this is because the squid used in this study are still mixed with ink. Vioni et al. (2018), reported that the appearance of the color of the squid ink cup cake in the 2% treatment resulted in the appearance of the color of the cup cake being darker or tending towards black, because it came from the melanin pigment contained in the squid ink.

Aroma

Histogram of the aroma of the fortified squid tortilla chips can be seen in Figure 2.

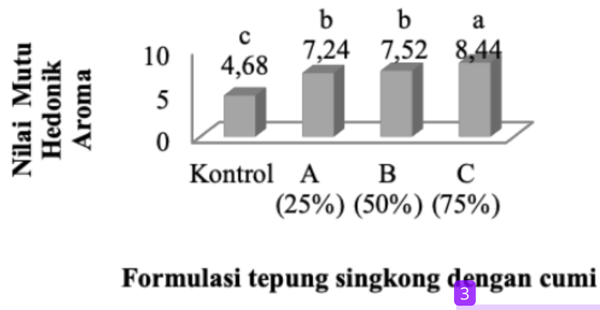

FIGURE 2 HISTOGRAM OF THE AROMA VALUE OF TORTILLA CHIPS

Figure 2 shows the organoleptic value of the hedonic quality of the aroma of tortilla chips in the range of 4.68 – 8.44. The highest hedonic quality value is found in formula B (50%), C (75%) which is 7.52-8.44 or 8 with the criteria of less strong squid. The lowest hedonic quality organoleptic value was found in the control formula (without the addition of squid) which was 4.68 or 5 with no squid aroma criteria.

The results of the Krukal Wallis test showed that the addition of squid to tortilla chips made from cassava flour had a significant effect on aromatortilla chips. The hedonic quality value of the tortilla chips aroma increased with the addition of squid. The factor that affects the aroma of the tortilla chips produced is the addition of squid.

The research results of Koiiumi et al. (1990), there are 44 volatile squid meat flavor components including 2 hydorcarbons, 10 alcohols, 5 aldehydes, 1 ketone, 1 furan, 3 sulfide compounds, 7 pyrazines, 2 pyridines, 1 amino, 2 phenols and 10 acids. , identified as flavor compounds cooked from squid meat. Squid ink contains melanin or black pigment, proteins, lipids that affect aroma, glycosamines, oglycans and muco-saccharides (Kim 2014 in Vioni et al. 2018).

Aroma in food can be caused by volatile components where squid contains protein which will produce aroma in the processing process, because there is a decomposition reaction of protein and fat compounds into volatile compounds due to degradation of food by heat (Harmain et al (2017). During the heating process, various very complex physical and chemical reactions occur from non-volatile precursors in fat and lean tissue. The resulting components interact with each other further in various secondary and tertiary reactions that produce volatile components that form flavor (Sundari et al. 2015).

Texture

Histogram texture of fortified squid tortilla chips can be seen in Figure 3.

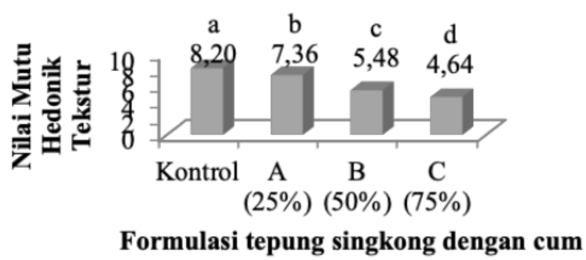

FIGURE 3. HISTOGRAM OF THE TEXTURE VALUE OF TORTILLA CHIPS

Figure 3 shows the organoleptic value of hedonic quality of tortilla chip texture in the range of 4.64 – 8.20. The highest hedonic quality value was found in the control formula (without squid fortification) which was 8.20 with very brittle dry criteria. The lowest hedonic quality organoleptic value was found in formula C (75gr squid fortification) which was 5.00 with dry criteria, slightly brittle. The results of the Krukal Wallis test showed that the addition of squid meat to tortilla chips made from cassava flour had a significant effect on the texture of tortilla chips.

Tortilla chips with control treatment have a high hedonic quality value with dry criteria very brittle (crispy), this is presumably because the basic ingredients used are cassava flour, and the texture of the tortilla chips is not thick.

Crackers that have high fiber and starch content will expand greatly when fried, on the contrary if the fiber and starch content is low, the crunchiness and expansion of the crackers will also decrease (Nurainy et al. 2015).

Research by Octavia and Suhartiningsih (2017) squid meat crackers have a high protein content, and the higher the addition of squid meat to the crackers, the less crispy it is. Apriyani et al. (2015) golden snail crackers decreased as the concentration of gold snail meat was added, this was due to the high protein content which tends to reduce the percentage of cracker development.

Istanti (2005) in Natalia et al. (2018), stated that high protein content can cause the air pockets of crackers produced to be smaller because the density of the air pockets is filled with other ingredients, namely fish meat which contains a lot of protein so that it can cause the swelling power to be smaller which can eventually lead to crunchiness. drop. Protein serves to thicken amylopectin granules, so the more protein the crackers will be harder (Zulfahmi et al. 2014).

Flavor

Histogram of the taste of tortilla chips fortified squid can be seen in Figure 4.

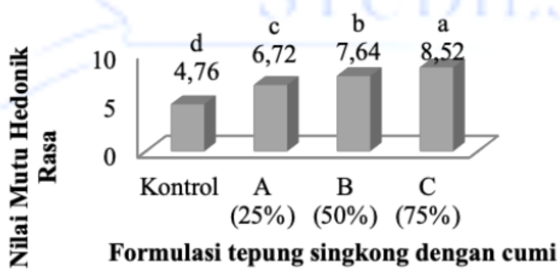

FIGURE 4 HISTOGRAM OF THE TASTE OF TORTILLA CHIPS

Figure 4 shows the organoleptic value of the hedonic quality of tortilla chips in the range of 4.76 – 8.52. The highest hedonic quality value is found in formula C (75%) which is 8.52 with the criteria for squid being quite strong. The lowest hedonic quality organoleptic value was found in the control formula (without squid fortification) which was 4.76 or 5 with the criteria of not tasting squid.

The results of the Krukal Wallis test showed that the fortification of squid on tortilla chips had a significant effect on the aroma of tortilla chips. The different taste of tortilla chips is due to the addition of different squid. The higher the amount of squid added, the hedonic quality value of the taste increases because the taste of the squid is getting stronger or savory. Octavia and Suhartiningsih (2017), reported that increasing the amount of squid meat affects the taste of crackers because squid meat contains amino acids and TMAO.

Water content

Histogram of water content analysis results on tortilla chips for each treatment can be seen in Figure 5.

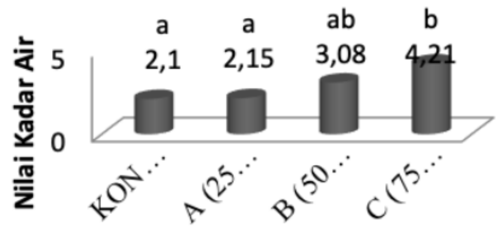

FIGURE 5. HISTOGRAM OF THE WATER CONTENT OF TORTILLA CHIPS

Figure 5 shows the water content of tortilla chips in the range of 2.10% – 4.21%. The highest water content value was found in formula C (75% squid meat fortification) which was 4.21%. Meanwhile, the lowest water content was found in the control formula (without squid meat) which was 2.10%. The water content of tortilla chips formula A is 2.15% and formula B is 3.08%.

Based on the results of the Analysis of Variance (ANOVA) that the addition of squid meat to tortilla chips made from cassava has a significant effect on the water content of the product..

The water content in this study was quite low when compared to the standard quality of crackers (Max. 12%). The low water content in this study was caused by the frying process for tortilla chipsalso thought to be caused by drying carried out with a time of 4 hours at a temperature of 60-65°C. Thin tortilla chip products can also affect the water content produced.

The results of Deborah et al. (2016) and Putra et al. (2015) the addition of fish bone meal to crackers causes an increase in the moisture content of the crackers. According to Wahyuningtyas (2013),Thickness and texture will affect the moisture content of the crackers. Water will easily evaporate in thin products so that the water content is getting smaller and the opposite will happen if the texture of the product is getting thicker.

Ash Level

Histogram of ash content analysis results on tortilla chips for each treatment can be seen in Figure 6.

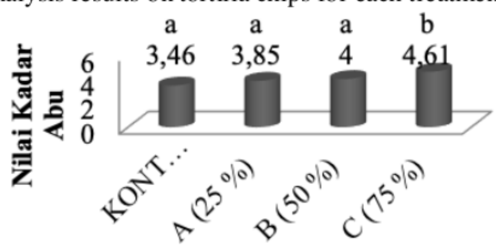

FIGURE 6 HISTOGRAM OF THE ASH CONTENT OF TORTILLA CHIPS

Figure 6 shows the content of abutortilla chips in the range of 3.46% - 4.61%. The highest ash content value was found in formula C (75% squid fortification) which was 4.61%, while the lowest ash content was found in the control formula (without squid) which was 3.46%. The ash content of tortilla chips formula A is 3.85% and formula B is 4%.

Based on the results of Analysis of Variance (ANOVA) that the addition of squid to tortilla chips made from cassava and seaweed has a significant effect on the ash content of the product. The more fortification of the squid, the higher the ash content of the tortilla chips.The ash content in these tortilla chips is thought to come from the mineral content of the ingredients used in making tortilla chips, namely squid. In this study, in addition to squid meat, squid ink was also used in making tortilla chips, so that the meat and squid ink used could increase the ash content of the product.

Based on the research of Vioni et al. (2018), the results of the analysis of cup cake ash content with the addition of squid ink tend to increase compared to without the addition of squid ink. The increase in the ash content in the cup cake was due to the squid ink containing minerals, which contributed to the contribution of minerals to the cup cake.

Fat level

Histogram of fat content analysis on tortilla chips for each treatment can be seen in Figure 7.

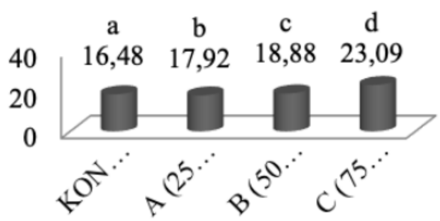

FIGURE 7. HISTOGRAM OF FAT CONTENT VALUES

Figure 7 shows the fat content of tortilla chips in the range of 16.48% – 23.09%. The highest fat content value was found in formula C (75% squid fortification) which was 23.09%, while the lowest fat content was found in the control formula (without squid) which was 16.48%. The fat content of tortilla chips in formula A is 17.92% and formula B is 18.88%.

Based on the results of Analysis of Variance (ANOVA) that the addition of squid to tortilla chips made from cassava and seaweed has a significant effect on the fat content of the product. The more fortification of the squid, the higher the fat content of the tortilla chips.The fat content in these tortilla chips is thought to come from the fat content of the ingredients used in making tortilla chips, namely squid. Fat content is also influenced by the cooking oil used when frying the product. Squid has a low fat content so that the high fat content in tortilla chips is thought to come from the cooking oil used.

Squid ink has a low fat content. According to Gonzalez et al. (2010), the fat content of squid ink is 0.2%, while according to Prabawati (2005) the body fat content of squid is 0.2% - 1.4%, derived from saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids.

Protein Level

Histogram of protein content analysis results on tortilla chips for each treatment can be seen in Figure 8.

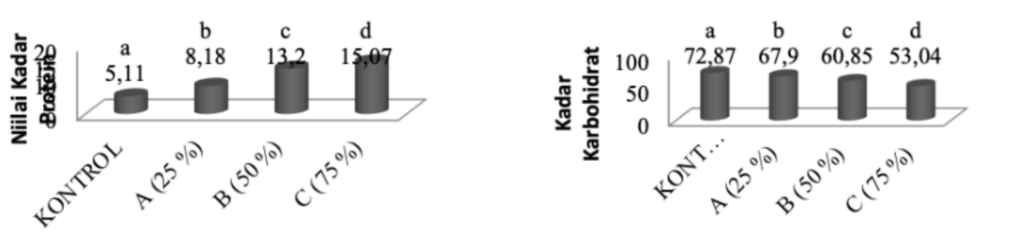

FIGURE 8 HISTOGRAM OF PROTEIN CONTENT VALUES

Figure 8 shows the protein content of tortilla chips in the range of 5.11% – 15.07%. The highest protein content value was found in formula C (75% squid fortification) which was 15.07%, while the lowest protein content was found in the control formula (without squid) which was 5.11%. The protein content of tortilla chips in formula A is 8.18% and formula B is 13.32%.

Based on the results of Analysis of Variance (ANOVA) that the addition of squid to tortilla chips made from cassava and seaweed has a significant effect on the protein content of the product. The more fortification of squid, the value of the protein content of tortilla chips increased. The protein content in these tortilla chips is thought to come from the ingredients used in making tortilla chips, namely squid,

according to Okuzumi and Fujii (2000), squid contains a protein content of 15.3%. The results of the study by Vioni et al (2018) stated that the increase in protein levels in the cup cake was due to the squid ink having 11.74% protein, the higher the concentration of squid ink given, the higher the protein content.

Carbohydrate Level

Histogram of protein content analysis results on tortilla chips for each treatment can be seen in Figure 9.

FIGURE 9. HISTOGRAM OF CARBOHYDRATE CONTENT VALUES

Figure 9 shows the carbohydrate content of tortilla chips in the range of 53.04% – 72.87%. The highest carbohydrate content value is found in formula A (without squid) which is 72.87%, while the lowest carbohydrate content is found in formula C (75% squid fortification) which is 53.04%. The carbohydrate content of tortilla chips in formula A is 67.9% and formula B is 60.85%.

Based on the results of Analysis of Variance (ANOVA) that the addition of squid to tortilla chips made from cassava and seaweed has a significant effect on the carbohydrate content of the product. The more fortification of the squid, the lower the carbohydrate content of the tortilla chips. The high carbohydrate content in tortilla chips is thought to come from the starch content used in making tortilla chips, namely cassava, besides that there are also other ingredients such as rice flour and seaweed.

According to the results of research by Agusandi et al (2013), the lowest carbohydrate content of wet noodles was found in the control formula, namely without the addition of squid ink, the more the addition of squid ink the carbohydrate content decreased. The carbohydrates in wet noodles come from wheat flour. The results of Fathiarisa's research (2016) show that the carbohydrate content of commercial tortilla chip products is 62.11%. The difference is thought to be due to the addition of fish which contains more protein and fat. The high carbohydrate content in tortilla chips without the addition of fish (0%) is caused by the use of raw materials that use high amounts of cassava starch. The addition of mackerel to tortilla chips will reduce the carbohydrate content of the resulting product and increase the fat and protein content proportionally.

Selection of Selected Products

The results of Bayes' analysis showed that treatment C (75% squid fortification) was ranked first with a value of 2.37. Treatment B (50% squid fortification was ranked second with a value of 2.00. Then the third rank was treatment A (fortification of squid meat with a value of 1.63), thus tortilla chips in treatment C were the selected crackers judging from the hedonic and chemical quality values.

Conclusion

1. Different fortification of squid has an effect on the value of hedonic quality and proximate value of tortilla chips.

2. The result of Bayes analysis of the selected product was treatment C (75% squid fortification). The hedonic quality characteristics of the selected tortilla chips had the criteria of intact, neat, uneven thickness, dark brown color, slightly brittle dry texture, and less strong squid taste and aroma. The chemical characteristics of the selected tortilla chips contain 4.21% water content, 4.61% ash content, 23.09% fat content, 15.07% protein content, 53.04% carbohydrates and has a crispness of 1312.6 Force/g.

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