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Proximate Analysis on Chayote (Sechium edule (Jacq.) Swartz) Sticks

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ABSTRACT

Chayote is one type of commodity vegetable in Indonesia. It is known chayote has a high content of nutrients. The nutritional content in chayote can be efficacious as an antioxidant, antipyretic, and anti-inflammatory, can reduce cholesterol levels, and hypertension. Processing of chayote into flour is so that it can be stored longer and can be processed into various snacks as desired. This study aims to determine the proximate levels of chayote sticks. The sample is crushed, then analyzed for protein content using a biuret reagent. Determination of protein levels using UV-Vis spectrophotometer at a wavelength of 549 nm and using a standard solution of bovine serum albumin as a comparison. Analysis of carbohydrate content using anthrone reagent. Determination of carbohydrate levels using UV-Vis spectrophotometer at a wavelength of 360 nm and using a standard solution of glucose as a comparison. Analysis of fat content using the soxhlation method. Determination of fat content using the soxhlet tool with N-hexane as a solvent in sample extraction. Analysis of water content using gravimetric method. Determination of water content using an oven tool. Analysis of ash content using gravimetric method.. The results of this study showed proximate levels in chayote sticks were that an average protein content of 10.157%, an average carbohydrate content of 49.873%, an average fat content of 32.688%, an average water content of 0.42%, and an average ash content of of 2.174%.

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Analisis Proksimat Pada Stik Labu Siam (Sechium Edule (Jacq.) Swartz)

ABSTRAK

Labu siam merupakan salah satu jenis sayuran komoditi yang ada di Indonesia. Diketahui labu siam mempunyai kandungan nutrisi yang tinggi. Kandungan gizi pada labu siam dapat berkhasiat sebagai antioksidan, antipiretik, anti radang, dapat menurunkan kadar kolesterol, dan hipertensi. Pengolahan labu siam menjadi tepung bertujuan agar dapat disimpan lebih lama dan dapat diolah menjadi berbagai makanan ringan sesuai keinginan. Penelitian ini bertujuan untuk mengetahui kadar proksimat batang labu siam. Sampel digerus, kemudian dianalisis kandungan proteinnya menggunakan pereaksi biuret. Penentuan kadar protein menggunakan spektrofotometer UV-Vis pada panjang gelombang 549 nm dan menggunakan larutan standar albumin serum sapi sebagai pembanding. Analisis kandungan karbohidrat menggunakan pereaksi anthrone. Penentuan kadar karbohidrat menggunakan spektrofotometer UV-Vis pada panjang gelombang 360 nm dan menggunakan larutan standar glukosa sebagai pembanding. Analisa kadar lemak menggunakan metode soxhletation. Penentuan kadar lemak menggunakan alat soxhlet dengan pelarut N-heksana dalam ekstraksi sampel. Analisis kadar air menggunakan metode gravimetri. Penentuan kadar air menggunakan alat oven. Analisis kadar abu menggunakan metode gravimetri. Penentuan kadar abu menggunakan kiln. Hasil penelitian menunjukkan kadar proksimat pada batang labu siam adalah rata-rata kadar protein 10,157%, rata-rata kadar karbohidrat 49,873%, rata-rata kadar lemak 32,688%, rata-rata kadar air 0,42%, dan rata-rata kadar abu. sebesar 2,174%.

Kata Kunci:
Labu Siam, Proksimat, Stik, Karbohidrat, Protein, Lemak, Kadar Air

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Introduction

Indonesia is a tropical country that easily grows various types of vegetables, one of which is chayote. In Central Sulawesi, in 2017 the production of chayote based on data from the central statistics agency reached 3998 tons (Ruswindi, Sakung, & Baculu, 2020; Sulteng, 2017). Chayote is one type of vegetable that contains various nutrients such as carbohydrates, fiber, protein, fat, minerals, phenolic compounds, and antioxidant activity (Anggraini, 2019). There are micro and macro minerals in chayote that can maintain body functions, such as zinc which can nourish the skin and reduce acne (Kurniawan, Khasanah, & Sulistiyana, 2018).

The high content of protein and potassium in chayote is very good to be used as one of the non-pharmacological management methods for hypertensive patients. Consumption of chayote can lower high pressure (Christiana, Anggraini, & Daeli, 2021). Giving chayote juice can increase cholesterol production in the elderly. The content of vegetable fiber in chayote can reduce cholesterol absorption (Meihartati, 2020). Chayote also contains alkaloids, saponins, cardenolin, and flavonoids that are efficacious as antipyretic and anti-inflammatory (Murwati & Ambarwati, 2021).

Chayote is one of the potential results of plantations being quite abundant, but the lack of creativity in the processing of the community makes the chayote is only limited to processed into ordinary vegetable dishes. It takes creative innovation to create new products from processed chayote to add selling value (Ilhmadi et al., 2022). In addition to being used as a vegetable side dish, chayote can also be processed into snacks (Annabel, Sugandhi, Goeltom, & Pramono, 2021). Given the shelf life of chayote can only last about 7 days when put in the refrigerator, it is necessary the diversify and development of chayote products (Idris & Triastuti, 2021)

The processing of chayote into flour is based on its high nutritional value of chayote carbohydrates, proteins, and fats, respectively by 73.35 g/100 g, 3.49 g/100 g, and 15.10 g/100 g. The processing of chayote into flour will result in food product development innovation (J. M. Sakung, 2020).

Chayote flour processing can be an alternative to developing chayote-based products as a food source. Variations of chayote processing are carried out so as not to cause boredom (Suryani, 2019). Based on research conducted by (J. Sakung, Nuryanti, Afadil, Pulukadang, & Maryam, 2021), the results of proximate analysis of biscuits formulation of chayote and mung beans using pre-experimental research. Biscuit samples were divided into five formulations based on the ratio of chayote flour and mung bean flour (%) in g/100 g. Sample F1 (100: 0), F2 (75: 25), F3 (50: 50), F4 (25: 75) & F5 (0: 100). The results obtained showed the lowest water value of water content in F5 (2.118%). The lowest ash content values are found at F5 (1.42%). The highest value of carbohydrate content at F5 (59.88%). The highest fat content values are in F1 (32.64%). The highest protein content is found in F5 (12.25%. This indicates the quality of biscuit products made from chayote flour, and mung beans flour, and both formulations are in the category of good with acceptable indicators for human consumption because it has a high nutritional value macronutrient.

Sticks are one type of snack that is very popular with children and adults but sticks made from wheat flour have only a little nutritional content, this needs the addition of other ingredients to add nutritional value (Fajari, 2017). The emergence of innovation in making sticks with the addition of commodity foods that are still rarely used, such as pumpkin as an effort to diversify foods products that provide new flavors and have beneficial nutritional value. There are many kinds of sticks commonly sold in the market such as sweet potato sticks, potato sticks, taro sticks, and cheese sticks (Sari & Ninsix, 2017).

Chemical characteristics (water content, ash, fat, protein, and carbohydrates) sticks with experimental variations of mackerel ingredients, namely mackerel meat, mackerel bones and whole mackerel. The results showed that mackerel meat sticks have the value of water content, ash content, fat content, protein content, and carbohydrate content, respectively, namely 2.80%, 2.48%, 28.16%, 12.30%, and 54.30%. Mackerel bone steak in a row 2.60%, 5.52%, 36.11%, 8.52%, and 47.23%. Whole mackerel sticks in a row 2.72%, 3.07%, 31.24%, 9.88%, and 53.09% (Siswanti & Agnesia, 2017).

Research conducted by (Fernanda, Widanti, & Kurniawati, 2017) the characteristics of vegetarian sticks with the substitution of plantain flour and tempeh as a source of protein, using a complete randomized design (CRD) with two factors, namely plantain flour content (10, 20, and 30%) and tempeh content (10, 20, 30, and 40%) 12 combinations and each treatment performed twice repetition. The highest protein content of 13.40% was obtained from the treatment of tempeh content of 40% and banana flour content of 30%. The lowest water content in the vegetarian sticks is 2.21% resulting from the treatment of tempeh content of 10% and 30% banana flour content. The lowest ash content of 1.59% was produced from the treatment of tempeh content of 10% and plantain flour content of 10%. While

the laboratory tests carried out (Noflidaputri & Lestari, 2022) in the research, 100 grams of moringa leaf flour sticks contain 9.69% protein, 43.5% carbohydrates, 23.5% total fat.

The addition of local food commodities such as moringa flour in the manufacture of sticks had previously been carried out by SMEs located in Kabonena Village, Ulujadi District, Palu City. Moringa is known to be one of the foods that contain high nutrients, the addition of moringa flour certainly makes stick snacks nutritious and good for consumption. One of the students of the Chemistry Education Study Program of Tadulako University accompanied by a biochemistry lecturer has made a visit to SMEs that produce sticks in Kabonena village in order to survey the location of making sticks that will be used as research samples, based on the results of the visit, information was obtained that the development of sticks with new variants in the form of adding other local commodity food ingredients is needed to give a new taste to the sticks and of course will also make the nutritional value different (Annisa, 2022).

Stick is a product that can be used as a snack that provides nutritional content and is certainly healthy for the body. Sticks can be consumed by all ages, besides the shelf life of sticks is also quite long and the price is affordable. Therefore, it is necessary to conduct research on food processing through the manufacture of sticks with the addition of chayote flour to determine the approximate value contained therein.

Method

The equipment used in this study is a knife, blender, sieve 70 mesh, mortar and pestle, analytical balance KERN 572, erlenmeyer 250 mL, erlenmeyer 80 mL, separating funnel, spatula, dropper, bottle, measuring cup, measuring flask, orbital shaker GS30 speed 50-250rpm, measuring pipette, test tube, fume hood, water bath, soxhlet, fat flask, evaporator BUCHI, oven memmert Un 55, tweezers, desiccators, cuvettes, UV-Vis spectrophotometers CECIL ce 2041 single beam, porcelain dishes, ashing dishes 30 mL, Analytical Balances PW 254, and furnace nabertherm. The main ingredients used in making chayote sticks in this study are chayote flour, starch, wheat flour, eggs, milkfish, masako (flavoring), garlic, baking soda, and sugar. The materials used in the sample analysis are chayote sticks, aquades, HCl, Na_2CO_3 crystal, biuret reagent, protein standard solution (bovine serum albumin), anthrone reagent, glucose standard solution, fat-free cotton, N-Hexane solvent, tissue, filter paper, and aluminum foil.

Data Collection Techniques

Procedure for making chayote sticks

Weigh the raw materials used in accordance with the specified, pure as much as 400 grams of milkfish meat without thorns using a blender until the texture is smooth and soft, add as much as 150 grams of sugar, 350 grams off egg white, 75 grams of chopped garlic into a blender until smooth and mixed evenly, then add baking soda to taste (two tips of a teaspoon) and 1 sachet of masako (flavor tapper), then add spices to the container (baking dish). Then add 2 handfuls of flour, 124 grams of chayote flour into the mixture and add starch to taste (± 500 grams). Then the dough is kneaded with enough flour until smooth. Then grind the dough that has been smooth until flat, after that grind back the dough that has been flattened to form an elongated stick the size of a finger. Next the wet sticks are fried until crisp for ± 10 minutes. After that test the proximate levels contained in the chayote sticks.

Sample Preparation of Chayote Sticks

Sample preparation conducted in this study is smoothing the chayote sticks. Samples that have been finely prepared in the analysis of the proximate value.

Proximate analysis on chayote sticks

Protein Content (Spectrophotometers Method with Reagent Biuret)

The sample was weighed using an analytical balance of 0.119 grams samples for treatment 1 and 0.118 grams for treatment 2 into each erlenmeyer 250 mL, then added as much as 20 mL of aquades and NaOH 1 normal as much as 5 mL, then homogenized using a shaker for 2 hours. After that, filtered into a bottle and its filtrate pipetted as much as 0.1 mL into a 25 ml flask, then diluted with aquades to the limit mark of the flask. The dilution results are taken as much as 1 mL using a pipette into a test tube, then added as much as 1 mL of biuret reagent and homogenized. Then the homogeneous sample was kept for 10 minutes, then its absorption was measured at a wavelength of 549 nm, and then analyzed for protein levels.

Carbohydrate Content (Spectrophotometers Method with Reagent Anthrone)

A total of 0.504 grams of samples for treatment 1 and 0.540 grams for treatment 2 were introduced into each erlenmeyer 250 mL. Added 3 mL of aquades into each erlenmeyer containing the sample and then homogenized. The homogeneous sample solution is placed in a water bath for 3 hours. After it is cooled, then added Na2CO3 crystals until not foaming and filtered into the bottle. After that, the filtrate is pipetted as much as 1 mL into each flask then added aquades to the limit mark of the flask and shaken. Dilution results pipet as much as 1 mL into each test tube, then added as much as 3 mL of anthrone reagent and homogenized in the fume hood. Then put in a water bath with a temperature of 100ºC for 10 minutes. Then the sample is cooled and transferred into a cuvette to read its absorbance using a UV-Vis spectrophotometer at a wavelength of 630 nm, and then analyzed for carbohydrate levels.

Fat Content (Soxhlation Method)

A total of 5.325 grams samples for treatment 1 and 5.091 for treatment 2 were inserted into each thimble made of filter paper, next the top is closed using fat-free cotton and the tip of the thimble is folder tightly, after it is interested into each soxhlet tube. The lower end of the soxhlet tube is connected to each drained fat flask and its weight is known. The upper part of the soxhlet extractor is connected to the return cooler that has been assembled above the water bath. Next, the solvent is poured n-hexane ± times the volume of the tube and flowed through the return coolant. Extraction is carried out until the missing color of the sample issued on the soxhlet tube. Fat flask containing fat extract is then evaporated and then dried in the oven at a temperature of 105ºC to evaporate the remaining solvent that is still mixed with fat. Furthermore, the fat obtained is cooled in a desiccator and then weighed to determine its weight.

Water Content (Gravimetry Method with Oven)

Water content testing is done by gravimetric method. Each ash dish is dried in the oven for 1 hour, then cooled in a desiccator for 15 minutes and then weighed to determine the weight of the empty dish. A total of 3.0277 grams of samples for treatment 1 and 3.0401 grams of samples for treatment 2 were inserted into a porcelain cup, then weighed to determine the weight of the cup and the initial sample (before heating). Furthermore, the dish that has been containing the sample in the oven at a temperature of 105ºC for 30 minutes, then cooled in a desiccator for 15 minutes. Then the cup containing the heated sample is weighed to determine its weight after heating. The treatment of heating, cooling, and weighing the sample is repeated until obtaining a constant weight ((Muliasari et al., 2019).

Ash Content (Gravimetry Method with Kiln)

Ash content testing was conducted using gravimetric methods. Each clean ash dish preheats in the oven for 30 minutes at 105ºC, then refrigerated ± 5 minutes and then weighs. Sample weights as much as 3.187 grams for treatment 1 and 3.204 grams for treatment 2 were inserted into each ash bowl, then ashed in the furnace for 3 hours or until ash was obtained at a temperature of 600ºC. After washing, the saucer containing the ash sample is weighed to determine the weight of the ash obtained (Muliasari et al., 2019).

Data Analysis

Protein Content

Determination of protein levels using equation

Protein Content (%) = (((Concentration BSA (mg/L))/1000) × Vol (L))/(Weight of Sample (g)) ×100%

Description:

BSA = Bovine Serum Albumin
Vol = Volume (Yenrina, 2015).

Carbohydrate Content

Determination of carbohydrate levels also uses the same linear regression line equation Y = aX + b as in the determination of protein.

Weight of glucose in the sample = Glucose C. × Vol.S × DF

Description:

Glucose C. = Glucose Concentration (mg/L)
Vol.S = Volume of Sample (L)
DF = Dilution Factor (Melego et al, 2019).

Carbohydrate Content (%) = (Glucose Weight (g) × CCF)/(Weight of Sample (g))×100%
(Yenrina, 2015).

Description:

CCF (Carbohydrate Conversion Factor) = 0.9

Fat Content

Determination of fat content can be calculated using the formula:
Fat Content (%) = ((B - C))/A × 100%
(Yenrina, 2015).
Description:

A = Sample Weight (grams)
B = Flask weight & Fat Weight (grams)
C = Empty Fat Flask Weight (grams)

Water content

Determination of water content can be calculated using the formula:
Water Content (%) = (Initial Weight -Final Weight)/(Weight of Sample) ×100%
Description:

Initial Weight = Sample before heating
Final Weight = Sample after heating Yenrina, 2015).

Ash Content

Determination of as content can be calculated using the formula:
Ash Content (%) = (C - A)/(B - A) ×100%
Description:

A = Empty cup Weight (grams)
B = Cup Weight + Initial Weight of Sample (grams)
C = Cup Weight + Ash Weight (grams) (Muliasari et al., 2019).

Result

The results obtained in this study are proximate value data, namely protein, carbohydrates, fat, water, and ash contained in chayote (Sechium edule (Jacq.) Swartz) sticks. The sample used in this study is chayote purchased from vegetable stalls in Tondo village, Mantikulore District, Palu City. Chayote peeled and washed thoroughly. Then the chayote is cut into rather thin slices. Next, the chayote slices in the oven to dry and then removed and cooled at room temperature. After that, the dried chayote slices are blended and sifted into flour. Chayote flour is processed into sticks made in Small and Medium Enterprise (SME) Kabonena Village, Ulujadu District, Palu City.

Table 1 Chemical Composition on Chayote Sticks

Parameters	Chayote Sticks (Mean ± Standard Deviation)%
Carbohydrates	49.873±0.132
Fat	32.689±0.550
Protein	10.157±0.118
Water	0.42±0.028
Ash	2.174±0.239

Discussion

Carbohydrate Content Analysis

Based on the results of research conducted, obtained carbohydrate levels in samples of chayote sticks: treatment 1 by 49.967% or equivalent 0.25183368 grams and in treatment 2 by 49.780% or equivalent 0.268812 grams. Based on the results of the analysis of the both samples, the average value of the protein content is 49.873%. In accordance with has been by Sakung et al., 2020, 100 grams of chayote flour contains fairly high carbohydrate which is equal to 73.35 grams. When compared with the addition of other foods such as tofu pulp as much as 75% which only contains carbohydrate by 1.147% (Deglas, 2017), chayote sticks are much higher in carbohydrate content.

Protein Content Analysis

Based on the results of research conducted, obtained protein levels in samples of chayote sticks treated 1 by 10.241% or equivalent to 0.01218679 grams and in treatment 2 by 10.074% or equivalent to 0.01188732 grams. Based on the results of the analysis of the both samples, the average value of the

protein content is 10.157%. According to Sakung et al., 2020, 100 grams of chayote flour contains a fairly high protein which is equal to 15.10 grams. When compared with the addition of other foods such as tofu pulp as much as 75% which only contains protein by 5.50% (Deglas, 2017), chayote sticks are much higher in protein content.

Fat Content Analysis

Based on the results of research conducted, obtained fat levels in samples of chayote sticks treatment 1 by 32.300% or equivalent 1.719975 grams and in treatment 2 by 33.078% or equivalent 1.68400098 grams. Based on the results of the analysis of the both samples, the average value of the protein content is 32.688%. In accordance with has been by Sakung et al., 2020, 100 grams of chayote flour contains fairly high carbohydrate which is equal to 3.49 grams. While the extrudate snacks quality requirements are based on Indonesian National Standard 2886 according to the National Standardization Agency in 2000, which has a fat content with a maximum frying process of 38% (b/b) (BSN, 2000). This means that the fat content in chayote sticks is quite high, but still within the standard.

Water Content Analysis

Based on the results of research conducted, obtained water levels in samples of chayote sticks treatment 1 by 0.40% and in treatment 2 by 0.44%. Based on the results of the analysis of the both samples, the average value of the water content is 0.42%. While the extrudate snacks quality requirements are based on Indonesian National Standard 2886 according to the National Standardization Agency in 2000, which has a water content maximum of 4% (b/b) (BSN, 2000). The water content in chayote sticks relatively low, this is because there is a release of water due to the frying process making sticks.

Ash Content Analysis

Based on the results of research conducted, obtained ash levels in samples of chayote sticks treatment 1 by 2.344% and in treatment 2 by 2.005%. Based on the results of the analysis of the both samples, the average value of the water content is 2.174%. While the extrudate snacks quality requirements are based on Indonesian National Standard which has an ash content maximum of 0.1% (b/b)(BSN, 2000). The ash content obtained in the analysis of chayote sticks exceeds the maximum standard because in addition to chayote flour which is known to contain many minerals such as potassium, calcium, and sodium, the addition of other ingredients in the process of making these sticks can also affect the high and low levels of ash content in a food product, the better quality of the food product, because the low ash content indicates that nutritional content of the food product is higher.

Conclusion

Based on the results of research that has been done, obtained the content of chayote sticks, the average protein of 10.157%, carbohydrates an average of 49.873%, fat an average of 32.688%, water an average of 0.42%, and ash an average of 2.174%. it can be concluded that the addition of chayote flour in the manufacture of sticks can increase the nutritional value of the sticks. with the better nutritional content in food is certainly good and safe for consumption.

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