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Analysis of the Characteristics of Chemical Compounds in Palm Flour (Arenga pinnata) from the Poso District

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Abstract

Aren (Arenga pinnata) is a palm family with the potential to develop high economic value in tropical regions such as Indonesia. This study aims to determine the levels of each chemical compound contained in palm flour (protein, fat, carbohydrate, potassium, and calcium levels). Determination of protein, fat, and carbohydrate levels in this study using a UV - VIS spectrophotometry tool. Determination of potassium (K) and calcium (Ca) levels using a flame photometer. The results showed that the analysis of protein content obtained 1.5765 %, fat content obtained 1.465 %, and carbohydrate content obtained 55.88 %. The analysis of potassium content obtained 1.76 %, and calcium levels obtained 1.495 %. The results of this study are expected to be foodstuffs that can be processed into food to meet the needs of protein, carbohydrates, fat, potassium, and calcium in the body.

Keywords: Palm flour, chemical compound, UV - VIS spectrophotometry, flame photometer

Introduction

The aren palm tree has benefits for the living beings around it. The liquid produced by this plant is known as tuak, which tastes sweet and becomes the essential ingredient of alcohol and palm sugar (Ferita et al., 2015). Another by-product is sago, which can also be made into flour, but each palm tree produces a different amount of flour (Mahulette et al., 2021). The starch content of palm flour is approximately 26 %—37 %, with protein, carbohydrates, and fat associated with fatty acids that make excess weight.

Palm flour contains three compounds: calcium, phosphorus, iron, vitamin C, vitamin A, and potassium (Dghaim et al., 2021). In addition, starch/carbohydrate levels are produced, but the range of levels is 26 - 37 %. The starch content may depend on the biological characteristics of each palm tree where it grows (Legros et al., 2009). The compounds and elements examined in this paper significantly affect the human body. Therefore, it is recommended that products with a low glycemic index (GI) and glycemic load (BG) be consumed, as they have been shown to play a role in preventing and managing these diseases (Augustin et al., 2015).

Saputro et al. (2016) have used palm sugar as an alternative sweetener to process dark chocolates. Carbohydrates are found in many cereals (rice, wheat, corn, potatoes, and so on) and in grains that are widely distributed in nature (Hutagalung, 2004; Seal et al., 2021).

Potassium is an essential mineral the body requires to regulate body fluid balance, regulate muscle contraction, and maintain a healthy nervous system. As much as 95 % of potassium is in the intracellular fluid (Lanham-New et al., 2012). Foods that contain potassium are suitable for people with high blood pressure. Potassium needs are estimated at 2000 mg/day (Weaver, 2013; Staruschenko, 2018).

Calcium is the most abundant mineral in the body. Approximately 9 % of calcium is found in complex tissues, namely bones and teeth, and 1 % in blood and soft tissues (Hong et al., 2022). Without 1 % calcium, muscles will experience contraction disorders, blood will be challenging to clot, and nerve stimuli will be disturbed during delivery (Jomova et al., 2022). To fulfill the need for 1 % calcium, the body gets it from the food eaten or the bones because it cannot produce most minerals and vitamins.

The research, which will be described further in this paper, aims to determine the levels of fossil carbohydrates, protein, fat, calcium, and potassium in palm flour (Arenga primate) from Poleganyara village, East Pamona sub-district, Poso district, Central Sulawesi.

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Methods

This research was conducted at the Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, for the analysis of protein, fat, and carbohydrate levels using UV—Vis spectrophotometry and at the Soil Science Laboratory, Faculty of Agriculture, for the analysis of potassium and calcium levels using a flame photometer. The equipment used was a photometer, hot plate, 10 mL measuring pipette, 25 mL measuring flask, magnetic stirrer, soxhlet, and oven.

The tools used in making palm flour are a pan, grater, and sieve cloth.

Materials

The materials used are aren pith (part of the soft core of the aren stem), distilled water, an HNO3 p.a. solution, tissue, a 1 M NaOH solution, cotton wool, hexane, HClO4 p.a., LaCl3, and pure standard tartan for potassium and calcium.

Sample preparation

Samples of aren palm flour were obtained from Poleganyara Village, East Pamona District, Poso Regency. The palm trunks were peeled to remove the hard outer skin, the peeled palm trunks were finely grated while adding water so that they became palm pulp, the palm pulp was put into a filter cloth, then kneaded so that the starch escaped from the filter as a starch suspension, and the fiber was left on the filter cloth, this starch suspension was collected in a settling container for 12 hours. The starch will settle as a paste, and the liquid above the sediment will be discarded.

Proximate analysis

Proximate evaluation of moisture content using thermogravimetric method, ash content dry ashing method, and fat content soxhlet method. Protein analysis using UV - VIS spectrophotometer. Measurement of total carbohydrate content in a sample was calculated based on the calculation (in %): % carbohydrate = 100 % - % (protein + fat + ash + water).

Potassium and calcium analysis

Mineral content of food ingredients, the material must be deconstructed first by weighing as much as 0.25 grams of palm flour samples from Poleganyara village, East Pamona sub-district, Poso Regency that have been baked, in an Erlenmeyer that is already known by weight. Then, leave it overnight with 4 mL of HNO3 p.a. and 2 mL of HClO4 p.a. in the Erlenmeyer. The next day, the sample is heated at 100 ^{o}C until the yellow vapor runs out and the solution becomes clear, then the solution is filtered into a 25 mL volumetric flask. Then, set the volume of the solution to the mark of the volumetric flask and shake until the solution is homogeneous. Add 9 mL of 0.25 % $LaCl_3$ solution and shake with a vortex until homogeneous (10 X dilution). The next step is to measure the standard series of potassium and calcium solutions using a flame photometer.

Results and Discussion

Proximate analysis

The results of the proximate analysis of palm flour are shown in **Table 1.** The content of carbohydrates, fat, and protein, with the average value of each analysis, is as follows: carbohydrates (55.88 g / 100 g), fat (1.465 g / 100g), protein (1.57 g / 100 g), ash (0.394 g / 100 g), and water (40.68 g / 100 g).

Table 1. Palm flour composition

Parameters	Results (g / 100 gr)
carbs	55.88 ± 0.24
fat	1.465 ± 0.33
protein	1.57 ± 0.69

Potassium and calcium analysis

The results of the analysis of potassium and calcium content are shown in **Table 2.** The potassium and calcium content with the average value of each analysis is potassium (1.76 g / 100 g) and calcium (1.495 g / 100 g).

Table 2: Mineral composition of palm flour

Parameters	Results (g / 100 gr)
potassium	1.76 ± 0.36
calsium	1.495 ± 0.24

Moisture content and ash content

The thermogravimetric method of moisture content test was carried out by heating in an oven for 3 hours with a temperature of 105 ^{o}C. These results show that the moisture content of palm flour is very high at 40.68 %. A level higher than 14.5 % is a suitable medium for the growth of fungi, bacteria, and insects that can damage flour during storage. The ash content results obtained in the gravimetric palm flour sample amounted to 0.394 % (Aryani et al., 2018).

Protein content

The protein test aims to determine the content of macromolecules using spectrophotometric methods for protein analysis. The Lowry method measures Protein levels using a UV—VIS spectrophotometer. Protein concentration is calculated based on Optical Density (OD) or absorbance at a specific wavelength to determine the amount of protein in the solution (Hasan, 2010).

The spectrophotometric method was repeated twice using a UV - VIS spectrophotometer. The protein content in this study was 1.57 g / 100 g of material, which is above the minimum SNI requirements (0.6 g / 100 g). This protein level shows that protein meets the

standard needs and is an essential nutrient because it is most closely related to life (Tarina et al., 2019).

Fat content

Fat and oil are found in almost all types of food, each with a different amount of fat content. Therefore, it is essential to analyze the fat content of a food ingredient to calculate its calories. Fats and oils are part of the lipids group, organic compounds with one characteristic: they are insoluble in water but soluble in ether, benzene, chloroform, and others (Li, 2022).

Determining the weight of fat in the sample used the calculation of the difference between the weight of the beaker containing fat and the empty beaker so that the fat content in palm flour is 1.465 g / 100 g of material, above the minimum fat content requirement in SNI (1.1 g / 100 g of material). Fat is an important food substance that maintains the health of the human body. In the body, fat functions mainly as an energy reserve in the form of fat tissue. Fat and oil are found in all foodstuffs with different contents. The function of fat in food is to provide a savory taste and crispy quality (especially fried foods), as well as tender properties (soft) in baked cakes (Colla et al., 2018).

According to Kurek-Górecka et al. (2013), compounds with bioactivity as antioxidants are phenol group compounds with hydroxy groups substituted in the benzene ring in the ortho and para positions against -OH and -OR groups. These compounds can inhibit free radicals by donating protons and forming stable radicals. Stable radicals form due to free electrons stabilized by electron delocalization with resonance in the aromatic ring.

Carbohydrate content is done by difference, which is the result of subtraction from 100 % with water content, ash content, protein content and fat content so that the carbohydrate content depends on the reduction factor, so the lower the nutrient content such as ash, water, protein and fat, the higher the carbohydrate content, on the contrary, the higher the nutrient content such as ash, water, protein and fat, the lower the carbohydrate content.

Based on the results of the analysis, the carbohydrate content of palm flour is 55.88 % of the results obtained, below the minimum requirements of SNI (70 g / 100 g material). The lower the harvest age, the lower the carbohydrate content. The sampling location affects the carbohydrate content in the palm pith, where each area has its characteristics and differences in water conditions and nutrients in the soil, which significantly affect mineral content. Plant roots absorb nutrients in the soil. Plant roots absorb nutrients in the soil. Plant roots are directly related to colloidal particles in the soil, and each colloidal particle is coated by a layer containing dissolved minerals; these dissolved minerals will be distributed throughout the plant body so that minerals in the soil are also in the plant body (Ma et al., 2022).

Carbohydrate content

Carbohydrate content is determined by difference, resulting from subtracting 100 % water, ash, protein, and fat content. Thus, the carbohydrate content depends on the reduction factor. The lower the nutrient content, such as ash, water, protein, and fat, the higher the carbohydrate content; on the contrary, the higher the nutrient content, the lower the carbohydrate content.

The carbohydrate content in palm flour is 55.88 %. The results obtained for carbohydrate content are below the minimum requirements of SNI (70 g / 100 g ingredients). The carbohydrate content in palm flour is 55.88 %. The results obtained for carbohydrate content are below the minimum requirements of SNI (70 g / 100 g ingredients).

Potassium and calcium content

The calculation of calcium (Ca) content in palm flour using a flame photometer is 1.495%. In contrast, the source of information on the nutritional value of the Indonesian Ministry of Health for calcium content is 91 mg / 100 g. This result shows that there is an antagonism between potassium and calcium. Increasing the concentration of Ca in the soil will reduce the concentration of K. The higher the potassium content obtained, the lower the calcium content. (Hijriani, 2009).

Conclusions

Based on the results obtained, the water content in palm flour was 40.68 %, and the ash content was 0.394 %. The average protein content in palm flour is 1.57 %, the fat content is 1.46 %, and the carbohydrate content is 55.88 %. The average potassium content in palm flour is 1.76 %, and the calcium content is 1.495 %.

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