



## Proximate, Minerals, and Vitamins in Chayote Flour

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### ABSTRACT

The composition of biomolecules on the squash is affected by the processing, so that the squash that have been processed into flour has a different composition, so that need for their exploration squash flour composition. This study was designed to evaluate composition of proximate, minerals and vitamins in squash flour. Analysis of proximate, vitamins and minerals using AOAC method. The percentage of ash content, carbohydrate, fat and protein respectively are ( $4.49 \pm 0.17$ ), ( $73.35 \pm 0.47$ ), ( $3.49 \pm 0.29$ ) and ( $15, 10 \pm 0.27$ ). The levels of vitamins star from the highest is a vitamin C ( $11.900 \pm 1.072$ ), vitamin A ( $0.038 \pm 0.002$ ) and vitamin E ( $0.015 \pm 0.00007$ ). While the mineral minerals content star from the highest is potassium ( $2311.90 \pm 309.15$ ), calcium ( $271.5 \pm 9.19$ ) and Sodium ( $21.69 \pm 8.53$ ). Chayote is suitable processed into flour that has the highest nutritional value of carbohydrates of 73.35 g/100 g, vitamin C of 11.9 mg/100 mg and potassium mineral of 23.11 g/100 g, so that the processing of squash flour is an innovation in the development of products made from it.



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### INTRODUCTION

Fruits and vegetables provide nutritional value for human needs. Consumption of fresh fruit and vegetables is highly recommended, for healthy, however most of the people are not able to maintain and supply the fruit and vegetables every day of the year. Chayote is a fleshy vegetable, perishable, that can be

grown throughout the tropics and in the world of squash have a high nutritional content (Vieira *et al.*, 2019). In many cases, fresh chayote has a shelf life only a few days so it is unsafe or unfit for eating. The water content in squash cause a short shelf-life so that necessary innovations to use it (Mishra and Das, 2015; Sangma *et al.*, 2019).

Chayote (*Sechium edule*) is a type of vegetable that is widely consumed, but the use of the squash so far been limited, it is only used as a vegetable. Squash contain vitamins A, B, C, and minerals (both macro and micro minerals). Chayote is possible to generate a various product to increase the consumption and utilization. Make chayote into a flour is an innovative product that can develop as an alternative food. Squash flour as a base material trending a healthy food products that can prevent the increase of glucose levels and blood pressure (Mirasol *et al.*, 2017; Sakung *et al.*, 2018). Chayote flour have antioxidant effects, anti-microbial, diuretics, antihypertensive, and hipocholesterol. This can occur because

the squash have a component of coenzyme nicotinamide adenine dinucleotide (NAD), which function in the process glycogenesis (glucose into glycogen) so that blood glucose levels controlled. The water of squash has a useful diuretic effect that makes urination smoothly. It is also be useful to prevent heart disease, stroke, and can increase the immune system by their content of vitamin B1, vitamin C and  $\beta$ -carotene (Coronel *et al.*, 2017).

The processing may affect the composition of biomolecules on the squash, therefore the squash have been processed into flour has a different composition so that need their exploration of composition. Utilization squash flour for clinical and epidemiological studies in the prevention of prevalence chronic diseases associated with the bioactive compounds in it. Implementation of the recovery in the form of chayote flour continued to investigate and identification of active biomolecules.

## MATERIALS AND METHODS

Analyze the proximate, vitamins and minerals done with a laboratory experiment research. The research was conducted from May to October in 2019 at Chemical education laboratory Faculty of Teacher Training and Education, Tadulako University for the manufacture of squash flour. Analysis of proximate and vitamins at Faculty of Science Research Laboratory Tadulako University and analysis of minerals at Central Sulawesi Provincial Health Laboratory.

Squash used in this study taken from "Perkebunan Rakyat" in Palolo sub district Sigi district adjacent to the city of Palu. Manufacture of squash flour through a process: Chayote washed using a flow water, than crushed into small pieces than dried it in oven for 2 x 24 hours (until dry), dried chayote milled and sieved using an electromagnetic sieve shaker with size of 80 mesh.

Determination of water content and ash content using method as described by AOAC (2016). An empty container is dried in constant weight with oven at 105 °C temperature, let it cool in a desiccator and weighed (W1). The sample powder (2.0 g) was weighed (W2) in the container and dried at 105 °C until reaches a constant weight. Cup containing the flour sample left to cool in the desiccator and weighed (W3). Furthermore, the water content was calculated using a formula,

% Water content or Ash Content =

$$\frac{w_2 - w_3}{w_2 - w_1} \times \frac{100}{1}$$

Fat and protein content of the chayote flour sam-

ples determined by soxhlet extraction method as described by AOAC (Association of Official Analytical and chemistry). Carbohydrate content of the chayote flour samples determined based on the difference of the total dry ingredients and adding percentages of protein, fat, ash and water by using the formula: Carbohydrate (%) = 100% - % (protein + fat + ash + water). Determination of Vitamin C with UV-VIS Spectrophotometry. Preparation standard solution of Vitamin C 100 ppm Determination of the maximum wavelength of 200-600 nm, using a calibration curve Testing standard solution at a concentration of 4 ppm, 8 ppm and 12 ppm, levels of vitamins in flour samples created a concentration of 1000 ppm and then assayed at the maximum wavelength.

Determination of Vitamin A (HPLC method). Preparation standard solution of vitamin A using retinol palmitate at concentration of 1.2; 2.5 and 6.2 ppm.

Determination of Vitamin E (HPLC method). Preparation standard solution of the vitamin E; pipette 0.0328 mL was added at 50 mL flask squeeze with ethanol. Then created a series satandar vitamin E at a concentration of 1.2 ppm, 6.2 ppm and 8.8 ppm. After that weighed  $\pm$  1.25 g into a flask and calibrated with THF: ethanol 1: 1. The mixture is filtered with filter paper, and then enter it into the vial and injected into the HPLC.

**Table 1: Proximate compositions of chayote flour**

Parameter	Units	Chayote Flour
Water	%	3,58 $\pm$ 0,26a
Ash	%	4,49 $\pm$ 0,17
Carbohydrate	%	73,35 $\pm$ 0,47
Fat	%	3,49 $\pm$ 0,29
Protein	%	15,10 $\pm$ 0,27

<sup>a</sup>Mean  $\pm$  SD for twice replication

**Table 2: Levels of vitamins and minerals in chayote flour**

Parameter	Units	Chayote Flour
Vitamin A	%	0,038 $\pm$ 0,002a
Vitamin C	%	11,900 $\pm$ 1,072
Vitamin E	%	0,015 $\pm$ 0,00007
Sodium (Na)	%	21,69 $\pm$ 8,53
Calcium (Ca)	%	271,5 $\pm$ 9,19
Potassium (K)	%	2.311,90 $\pm$ 309,15

<sup>a</sup>Mean  $\pm$  SD for twice replication

Determination of mineral parameters. Taken 1 mL the sample solution has been prepared, diluted with

distilled water in a 50 mL volumetric flask until mark boundaries. Potassium, calcium and sodium in the sample solution is determined with measuring the absorbance by atomic absorption spectrophotometer. Potassium was measured at a wavelength of 766.5 nm, calcium at a wavelength of 285.2 nm and sodium at a wavelength of 589 nm.

## RESULTS AND DISCUSSION

### The proximate composition of chayote flour

The proximate analysis of chayote flour is presented in Table 1. The results indicate chayote flour has a moisture content that is included in the range of 7-11%, this means that the flour can be stored for a long term. The results of ash content, carbohydrate, fat and protein in units percent respectively are  $(4.49 \pm 0.17)$ ,  $(73.35 \pm 0.47)$ ,  $(3.49 \pm 0.29)$  and  $(15.10 \pm 0.27)$ .

### The Vitamin and mineral composition of chayote flour

Table 2 showed the vitamin levels sorted from the highest is vitamin C ( $11.900 \pm 1.072$ ), vitamin A ( $0.038 \pm 0.002$ ) and vitamin E ( $0.015 \pm 0.00007$ ). While the highest mineral content is potassium ( $2311.90 \pm 309.15$ ), calcium ( $271.5 \pm 9.19$ ) and sodium ( $21.69 \pm 8.53$ ).

The results of the composition 100 grams of chayote flour indicates the various components of the moisture, ash, carbohydrates, fats and proteins. The highest content in the flour respectively are carbohydrates (73.35%), protein (15.10%), ash (4.49%), water (3.58%) and the lowest is a fat 3.49%. The content of nutrients in the chayote flour have a significant contribution in metabolism process and refresh the body. As a result, if consumed at 100 grams per day, it may significantly contribute more than 56.7% of carbohydrates for daily need in children (4-9 years) and more than 45.4% of carbohydrates for daily need of adults.

Based on Table 1 described, the carbohydrate content of chayote flour produced was 73.35 g/100 g of, it exceeded the minimum requirement of SNI (70 g/100 g of material). Fat levels in this study was 3.49 g/100 g, it is below the minimum fat content requirements in SNI (9.5 g/100 g of material). Fat is an essential nutrient for maintaining the health of the human body. While the protein content of 15.10 g/100g, it exceed the minimum requirement of SNI (9 g/100 g of material). The protein levels meets the standard requirements and is an extremely important nutrient, because it is most closely connected with the processes of life (Tarina and Hutabarat, 2019).

The highest vitamin levels on chayote flour is vitamin C of 11.9 g/100 g sample, this indicates the flour can satisfy if the body has vitamin deficiency. The vulnerable groups to vitamin deficiency include pregnant women, nursing mothers and children, because their need for vitamin supplement is relatively higher and susceptibility to vitamin deficiencies is also common; thus, it is necessary to have healthy food alternatives in the form of chayote products. Vitamin C cannot be synthesized in the body (essential vitamins) and can be obtained from flour primarily based from fruit and vegetables (Almohanna et al., 2019).

Chayote flour was found to have a higher mineral content namely potassium, calcium and sodium are 2311.90%, 271.5% and 21.69% respectively. High levels of potassium in the chayote flour imaged a cost-effective strategy in reducing cardiovascular disease of adults. Chayote flour contains potassium that is an equivalent of 23.11 g/100 g flour. Adult body needs potassium amounted to 4700 g/day. Based on the data chayote flour meets the daily needs of potassium is 693.3 mg/day, if you eat chayote flour as much as 30 g/day (Choi et al., 2019).

Calcium is the second highest of mineral of chayote flour, it is appropriate recommendations for the adult's intake of 1000 (800-1500) mg daily. A higher calcium needed by pregnant women, nursing mothers and prevent the incidence of tumors. Results of the study revealed that three-quarters of Americans lack of calcium, with an average intake only of 500-600 mg in daily food. National Institutes of Health (NIH) recommends 1200 to 1500 mg/day of calcium for adolescents and young adults, it is by consuming 100 g/day of flour chayote can meet the calcium needs of 271.5 mg/day (Bartl and Bartl, 2019).

## CONCLUSIONS

Chayote can be processed into flour that has the highest nutritional value of carbohydrates of 73.35 g/100 g, vitamin C of 11.9 mg/100 mg and potassium of 23.11 g/100 g, so that the processing of chayote into flour is an innovation in the development of squash products.

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## REFERENCES

- Almohanna, H. M., Ahmed, A. A., Tsatalis, J. P., Tosti, A. 2019. The Role of Vitamins and Minerals in Hair Loss: A Review. *Dermatology and Therapy*, 9(1):51-70.
- Bartl, R., Bartl, C. 2019. The Osteoporosis Manual: Prevention, Diagnosis and Management. *Springer International Publishing*. ISBN: 978-3-030-00731-7.
- Choi, M. K., Kim, N. Y., Lee, Y. K., Heo, Y. R., Hyun, T., Oh, S. Y., Lyu, E. S. 2019. Contribution of food groups to sodium and potassium intakes by their ratio in Korean adults. *Progress in Nutrition*, 21(2):285-293.
- Coronel, O. A. D. A., León-García, E., Vela-Gutiérrez, G., Medina, J. D., García-Varela, C., García, R., S, H. 2017. Chayote (*Sechium edule* (Jacq.) Swartz). *Fruit and Vegetable Phytochemicals*, pages 979-992.
- Mirasol, R., Soetedjo, N., Thai, A. C., Ahmad, A., Tan, K. C., Deerochanawong, C., Mohamed, M., Saraswati, M., Sethi, B. K., Shah, S. 2017. A Consensus of Key Opinion Leaders on the Management of Pre-diabetes in the Asia-Pacific Region. *Journal of the ASEAN Federation of Endocrine Societies*, 32(1):6-12.
- Mishra, L., Das, P. 2015. Nutritional Evaluation of Squash (*Sechium Edule*) Germplasms Collected from Garo Hills of Meghalaya - North East India. *International Journal of Agriculture, Environment and Biotechnology*, 8:971-975.
- Sakung, J. M., Sirajuddin, S., Zulkifli, A., Rahman, S. A., Palutturi, S. 2018. The Effect of Chayote (*Sechium Edule*) on Blood Glucose Level of High School Teachers of Pre-Diabetes. *Indian Journal of Public Health Research & Development*, 9(5):245-245.
- Sangma, C., Kumar, V., Suri, S., Gat, Y., Kaushal, M., Kumar, A. 2019. Preservation and evaluation of spiced chayote juice using hurdle technology. *Brazilian Journal of Food Technology*, 22.
- Tarina, D. D. Y., Hutabarat, S. M. D. 2019. Implementation of Labeling Standards for Food Packaging Products in Indonesia. *International Journal of Multicultural and Multireligious Understanding*, 6:1-20.
- Vieira, E. F., Pinho, O., Ferreira, I. M., Delerue-Matos, C. 2019. Chayote (*Sechium edule*): A review of nutritional composition, bioactivities and potential applications. *Food Chemistry*, 275:557-568.