



## Macro and Micronutrients of Purple Sweet Potato Flour as Material Raw Complementary Feeding

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### ABSTRACT

Safe food is supported by the use of local natural ingredients for food making raw materials. Infants older than 6 months should be given complementary feeding (MP-ASI) for optimal growth. Complementary Feeding in the dominant market is made from wheat flour and tapioca flour, new innovations are needed as a substitute for flour or tapioca, in order to obtain products with high nutritional value. Sweet potato is one of the local confectionary commodities that is safe to be given to babies after 6 months of age. The purpose of the study was to determine the macro and micro nutritional levels of purple sweet potato flour as raw material for cakes for MP-ASI. The research method used was a laboratory experiment by analyzing the levels of macronutrients in purple sweet potato flour. The results of this study obtained an analysis of the macro and micro nutritional content of purple sweet potato flour, carbohydrate 80,02%, protein 6.05%, fat 0.76%, Iron (Fe) 6.7049 mg/kg and Zinc (Zn) 8.5595 mg/kg. The conclusion of this study is that based on the results of the analysis of macro and micro nutrients in purple sweet potato flour which is quite high, sweet potato flour can be used as a new innovation as a raw material for rising cakes to support MP-ASI.

## 1. Introduction

Complementary feeding (MP-ASI) are foods and drinks containing nutrients given to infants or children aged 6 - 24 months to meet nutritional needs other than breast milk. Factors affect milk quality among them are feed supplementation with other food resources which changes the macro and micro components [1,2]. Exclusive breastfeeding infant's feces contain more bifidobacteria, after 6 months, infant must get MP-ASI [3]. Adequate nutrition during complementary feeding is important for the growth, development and well-being of children. Other main energy and carbohydrate sources at 9 and 12 months of age were rice porridge, infant biscuits and fresh fruits, while fish, red meat and eggs were the other main protein and total fat sources. Breast-fed and mixed-fed infants had a more varied diet as compared to formula-fed infants. Formula-fed infants had consistently higher protein and lower total fat consumption compared to those who were breastfed [4].

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Baby biscuits on the market are dominantly made from wheat. As is known, wheat flour has a high gluten content. Gluten is the main protein in wheat flour which consists of gliadin (20 - 25%) and glutenin (35 - 40%) [5,6].

According to Fennema [8], about 30% of gluten amino acids are hydrophobic and these amino acids can cause proteins to aggregate through hydrophobic interactions and bind fats and other non-polar substances. Gluten has the ability to bind trapped gas, which if consumed in excess will cause infants to experience gluten intolerance, which is one of the risk factors for diarrhoea in infants [7,8].

The modification of *kue bangkit* as traditional cakes for functional complementary feeding was carried out by substituting the inulin of sweet potato (*Ipomoea Batatas*). Research on the use of tubers has been carried out, one of which is by exploring and utilizing bioactive components and their functional values. Natural antioxidants can protect the human body from free radicals and inhibit chronic diseases including inulin found in sweet potatoes (*Ipomoea Batatas*) [9,10]. Purple sweet potato is a potential prebiotic food ingredient because of high amount of carbohydrates that can be fermented in the body [11,12].

Furthermore, another research Putri and Muliani [13] reported that modified red sweet potato flour contains 19.75% resistant starch with total dietary fibre (TDF) of 44.64% [13]. According to Vatanasuchart [14], there are advantages to products high in resistant starch, which can reduce constipation and flatulence because resistant starch is able to maintain water content in faeces. The addition of other ingredients is necessary to increase the nutritional content of the rise cake and add flavour.

Sweet potatoes vary in size, shape, skin colour, flesh colour depending on the variety. The nutritional content of sweet potatoes is quantitatively influenced by variety, location, and growing season. In addition to containing complete nutrition, sweet potatoes also have a variety of tuber flesh colours, such as white, yellow, orange, red, purple white tinge, and purple. The purpose of this study was to determine the macro and micronutrient content of purple sweet potato flour as a raw material for MP-ASI *kue bangkit*, traditional Malay food [15,16].

## 2. Methodology

The analysis of the nutritional content of sweet potato flour and selected products was carried out at the Centre for Product Development and Industrial Standardization (BPPSI) of Pekanbaru. The equipment used in making sweet potato flour and *kue bangkit* are sweet potato, grater, baking sheet, spoon, gas stove, blender. After that purple sweet potato flour was then analyzed carbohydrate levels using the by differences method, protein with using the kjeldahl-micro method, fat using by soxhlet. The materials of making purple sweet potato flour presented in Figure 1.



Fig. 1. Materials of making purple sweet potato flour

### 3. Results

#### 3.1 Procedure of Sweet Potato Flour Making

The making of sweet potato flour was conducted in several stages. The first stage was weighing each sweet potato variety, cleaning the skin, and further cutting the sweet potatoes using a cutting machine. The second stage is washing the sweet potatoes until it was clean. Furthermore, the sweet potatoes were grated in the form of chips and dried using direct UV light for 5-6 hours. Last, the dried sweet potatoes were blended and sieved using a sieve. The result of making purple sweet potato flour is presented in Figure 2.



Fig. 2. Procedure of sweet potato flour

Sweet potato flour is a semi-finished product that must be reprocessed into food products which is cakes [17]. Sweet potatoes are rich in nutritional value and have bioactive compounds that are beneficial for health, as well as potential to be processed into various food products with a proportion of flour usage of 10 - 100 percent. This effort contributes greatly in supporting the food diversification program because it can reduce imports of flour, improve the image, added value of local food products, and increase farmers' income through increasing sweet potato production [18]. The results of the analysis of macro and micro nutrients content can be seen in Table 1.

**Table 1**

The results of the analysis of the macro and micro nutrients content of purple sweet potato flour

No	Parameter	Results
1	Carbohydrate	83,02%
2	Protein	6.05%
3	Crude Fat	0.76%
4	Iron (Fe)	6.7049 mg/kg
5	Zinc (Zn)	8.5595 mg/kg

Carbohydrates are polyhydroxy aldehydes or polyhydroxy ketones covering the condensate of the polymers formed. The name of the carbohydrate is used in these compounds, considering the empirical formula is  $C_nH_{2n}O_n$  or  $C_n(H_2O)_n$  namely carbon that undergoes hydration. Carbohydrates are the main source of energy for the entire world's population. A number of carbohydrate group produces dietary fiber which is useful for digestion. Beside that carbohydrates also have an important role in determining the characteristics of the material food, such as taste, color, texture, and others. Meanwhile, in the body carbohydrates are useful for preventing ketosis, the body's protein breakdown excess, loss of minerals, and is useful for helping fat metabolism and protein [19].

The results showed that there were differences in the carbohydrate content of purple sweet potatoes flour by sun dried. This is caused by carbohydrate components can undergo changes caused by hydrolysis of starch from the activity of the amylase enzyme, the formation of a sour smell and musty smell from carbohydrates due to the activities of microorganisms, as well as the browning reaction [19].

Protein molecules are composed of 12 to 18 kinds of amino acids that are interconnected. Protein is needed by the body to perform its function as a building substance for the growth and maintenance of body tissues, to regulate the continuity of processes in the body and to ensure the optimization of children's brain function [20].

Based on the AKG in 2019, the need for protein in infants aged 6-11 months is 15g [21], this shows that in consuming 100 grams of purple sweet potato flour has fulfilled 6.05% of protein needs in infants 6-11 months, although it shows that it still does not meet the standard protein needs but we can fulfil it by adding food ingredients that can support protein such as the use of eggs in making *kue bangkit* as MP-ASI.

Fat is an important food substance for the health of the human body, fat is a more effective source of energy compared to carbohydrates and protein [22]. Based on the AKG 2019, the fat requirement for infants 6 - 11 months is 35g [21]. Consuming 100 grams of purple sweet potato flour can fulfil about 0.76% of the fat requirement in infants 6 - 11 months. This shows that it still does not meet the standard fat needs, but we can fulfil it by adding food ingredients that contain fat such as coconut milk in making *kue bangkit*.

Infants need iron for their rapid growth. Iron deficiency in infancy can impair growth and cause delays in motor and mental function. Based on the AKG 2019, the need for iron (Fe) in children aged

6 - 11 months is 11mg [21]. By consuming 100 grams of sweet potato flour, it can fulfil about 6.7% of iron needs in infants 6 - 11 months. Zinc is an important mineral in the growth of children. Zinc plays a role in the synthesis of protein, Adnosine Dinucleoside (DNA), and Adenosine Ribonucleoside (RNA) and plays a role in the operation of enzymes in the body. Thus, when zinc deficiency occurs, cell division, growth and tissue repair can be inhibited.

Based on the AKG 2019, the zinc (Zn) requirement in children aged 6 - 11 months is 3 mg [21]. By consuming 100 grams of sweet potato flour, it can meet about 8.5% of the zinc requirement in infants 6 - 11 months. This shows that it meets the standard zinc requirement for infants aged 6 - 11 months. That way, sweet potato flour is very suitable to be used as an innovative raw material in making *kue bangkit* as complementary food as shown in Figure 3.



**Fig. 3.** Purple sweet potato flour's material raw of MP-ASI *kue bangkit*

#### 4. Conclusions

Based on the results of the analysis of macro and micro nutrients in purple sweet potato flour, the results of the analysis of macro and micro nutrients were carbohydrate 80.02%, 6.05% protein, 0.76% fat, 6.7049 mg/kg Iron (Fe) and 8.5595 mg/kg zinc (Zn). This shows that purple sweet potato flour can be used as the latest innovation as a raw material for *kue bangkit* to reduce the use of flour in supporting the manufacture of Complementary Feeding (MP-ASI).

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