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Utilization Of White-Meat, Red-Meat And Super Red Dragon Fruit (*Hylocereus sp*) Skin Waste As An Alternative Food Source

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Abstract. Dragon fruit skin, waste material (dragon fruit waste), will have a profitable sale value if it can be used as a food raw material. Dragon fruit skin waste contains relatively high dietary fiber so it can be used as a food raw material. This study aims to utilize dragon fruit skin waste for the manufacture of dragon fruit skin flour as an alternative food source. Some tests are made on white-meat dragon fruit skin, red-meat dragon fruit skin and super red dragon fruit skin. The preliminary study is the soaking of the three types of dragon fruit skin in two solutions, namely 0.1% sodium citrate and 0.1% sodium metabisulfite to prevent the browning effect on flour. Dragon fruit skin flour from the soaking with both solutions is then characterized physically, including its texture, color, flavor and rendement. The best physical characterization is followed by chemical characterization, including the contents of water, ash, protein, fat, carbohydrate, dietary fiber, minerals (Fe, Na, K, Ca and P), and also microbiological characterization of Escherichia coli, molds and Bacillus cereus. The chemical and microbiological characterization shows that the red-meat dragon fruit skin flour has better results than the white-meat and super red dragon fruit skin flour does. The red-meat dragon fruit skin flour contains 8.80% water, 0.20% ash, 2.35% fat, 7.69%, protein, 68,29% carbohydrate and 28,72% dietary fiber as well as 4.40 mg K, 8.76 mg Na , 0.65 mg Fe , 10.20 mg Ca and 32.58 mg P.

Keywords: Waste, Dragon Fruit Skin, Dragon Fruit Skin Powder, Alternative Food Source

I. INTRODUCTION

Dragon fruit (Hylocereus sp) is a fruit crop newly cultivated in Indonesia starting in 2000 and much-liked by people because it has many benefits as well as a relatively high nutritional value. According to Faridah (2013), dragon fruit skin weighs 30-35% of the fruit and often is just disposed of as waste. Dragon fruit skin waste contains relatively high nutrients, especially vitamins and minerals so that it can be used as food raw materials. Besides, it can also increase nutritional contents when processed into food. The nutritional content of dragon fruit skin is quite complete, including carbohydrate, fat, protein, calcium, phosphorus, iron, vitamin B, vitamin C and water (Munadjim, 1988).

The chemical analysis shows that the composition of red dragon fruit skin contains 72.1% carbohydrate (Saneto, 2012). As the dragon fruit skin contains carbohydrates, the dragon fruit skin can be processed into flour. This flour can replace or reduce the amount of flour commonly used in the manufacture of foodstuffs (Kalahi, 2014). Based on the above backgrounds, as a form of efforts to exploit the skin of dragon fruit that has not been maximized and the lack of public knowledge about the benefits of dragon fruit skin, it is necessary to do researches to improve the economic value of the three types of dragon fruit skin of white-meat, red-meat and super red dragon fruit (*Hylocereus sp*) because of their high carbohydrate and mineral contents. Furthermore, these three types of dragon fruit skin will be made into flour and physically characterized, including rendement, texture, color and aroma. To prevent the browning effect on the flour, the dragon fruit skin will be soaked in sodium citrate and 0.1% sodium metabisulfite solutions.

The best result of physical characterization is then continued with chemical and microbiological characterization, which will be used as reference material for flour to be processed into various snack foods. It is expected that the addition of dragon fruit skin flour can improve the nutritional content of snack products, especially their mineral content. So people who consider snacks as merely snacks can satiate their stomachs as well as increase their nutritional intake.

II. RESEARCH METHODS

Preliminary Research

The preliminary study aims to determine the physical characteristics of three kinds of dragon fruit skin flour each of which is soaked in a solution of sodium citrate and 0.1% sodium metabisulfite.

Advanced Research

At this stage, there is the chemical and microbiological characterization of the dragon fruit skin

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flour resulted from the best physical characterization. From this further research it is expected to get dragon fruit skin flour with the best characteristics which can then be used as a reference in making various snack products.

Observation Parameter

The observation parameter in this research is the observation of physical characteristics of dragon fruit skin flour with organoleptic tests. Chemical characteristic of dragon fruit skin flour are determined by proximate test through water content analysis (SNI 01-2891-1992), ash content analysis (SNI 01-2891-1992), protein content analysis (SNI 01-2891-1992), fat content analysis (SNI 01-2891-1992), carbohydrate analysis (AOAC, 2005), dietary fiber analysis (Asp, Johnson, Hallmer & Sijestrin, 1983), Ca (AOAC, 2005), Na (AOAC, 2005), K (AOAC, 2005), Fe (AOAC, 2005) and P (AOAC, 2005), and microbiological analysis of *Escherichia coli*, molds, and *Bacillus cereus*.

III. RESULTS AND DISCUSSION

Rendement

The results of the determination of the rendement of each type of dragon fruit skin flour soaked with both sodium citrate and 0.1% sodium metabisulfite 0.1% can be seen in Table 1.

Table 1. Rendement Results of Dragon Fruit Skin Flour.

No	Sample	Rendement (%)
1	White-Meat Dragon Fruit Skin Flour	10.00
2	Red-Meat Dragon Fruit Skin Flour	10.00
3	Super RedDragon Fruit Skin Flour	10. 00

Based on the results in Table 1, the rendement value of the three types of dragon fruit skin flour is the same that is 10%. This may be due to the drying and grinding process for separating the starch liquid and endosperm debris containing some of non-starch components such as dietary fiber, protein and fat resulting in heavy loss of weight during the flour production. The longer the drying time and the higher the drying temperature applied to the food, the more water will evaporate, this results in lower moisture content and reduced weight, and also lower rendement (Desrosier, 2008).

Physical Characteristics of Dragon Fruit Skin Flour

Physical characteristics of white-meat, red-meat and super red dragon fruit skin flour soaked in 0.1% sodium citrate solution can be seen in Table 2.

Table 2. Physical Characteristics of White-Meat, Red-Meat and Super Red Dragon Fruit Flour

No	Parameter	White-Meat Dragon Fruit Flour	Red-Meat Dragon Fruit Flour	Super Red Dragon Fruit Flour
1	Form	Powder	Powder	Powder
2	Aroma	A little smelly	Normal	Normal
3	Color	Reddish Brown	Reddish Brown	Reddish Brown

The physical characteristics of white-meat, red-meat and super red dragon fruit skin flour soaked in a 0.1% sodium metabisulfite solution can be seen in Table 3.

Table 3. The Physical Characteristics of White-Meat, Red-Meat and Super Red Dragon Fruit Skin Flour

No	Parameter	White-Meat Dragon Fruit Flour	Red-Meat Dragon Fruit Flour	Super Red Dragon Fruit Flour
1	Form	Powder	Powder	Powder
2	Aroma	Normal	Normal	Normal
3	Color	Reddish Brown	Reddish Brown	Reddish Brown

Physical characteristics of the three kinds of dragon fruit skin flour have no significant difference, but white-meat dragon fruit skin soaked in sodium citrate smells a little. The brown color of the dragon fruit flour is the effect of the *browning* reaction.

The soaking of dragon fruit skin using 0.1% sodium citrate or 0.1% sodium metabisulfite which serve to reduce dark color of flour but cannot make the color of flour white due to the browning reaction so that the dragon fruit flour produced has a dark color. The texture of the three types of dragon fruit skin flour produced has no difference, because they all go through the same process of sieving and with the same mesh size, which is 80 mesh. From the results of physical characterization it can be concluded that the best results are shown by the dragon fruit skin flour soaked in 0.1% sodium metabisulfite which will be followed by chemical and microbiological characterization.

Figure 1. Dragon Fruit Skin Flour

Chemical Characteristics of Dragon Fruit Skin Flour

The chemical characteristics of white-meat, red-meat and super red dragon fruit skin flour can be seen in Table 4.

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Table 4. The Chemical Characteristics of White-Meat, Red-Meat and Super Red Dragon Fruit Skin Flour

No	Para-meter	Unit	Dragon Fruit Skin Flour			SNI
			White-Meat	Red Meat	Super Red	
1	Water	%	7.72	8.80	5.29	Max 14.5
2	Ash	%	0.15	0.20	0.68	Max 0.7
3	Fat	%	2.10	2.35	2.26	
4	Protein	%	7.28	7.69	7.90	Min. 7.0
5	Carbo-hydrate	%	60.10	68.29	65.35	
6	Dietary Fiber	%	26.62	28.72	28.69	
7	K	mg	3.38	4.40	5.26	
8	Na	mg	6.98	8.76	8.90	
9	Fe	mg	0.55	0.65	0.70	
10	Ca	mg	7.56	10.20	10.35	
11	P	mg	36.20	32.58	32.40	
12	*E. Coli*	APM/g	$<1.0x10^1$	$<1.0x10^1$	$<1.0x10^1$	Max. 10
13	Molds	colony/g	$<1.0x10^1$	$<1.0x10^1$	$<1.0x10^1$	Max. $1x10^4$
14	*B.Cereus*	colony/g	$<1.0x10^1$	$<1.0x10^1$	$<1.0x10^1$	Max. $1x10^4$

Water Content

Based on the observation, the water content of the three types of flour is lower than the water content of wheat flour for foodstuffs required by SNI 01-3751-2006 which is a maximum of 14.5%. Water content of dragon fruit skin flour is influenced by several factors during the drying process, including the temperature and the duration of drying and water content of the dragon fruit skin before being processed. The low water content of the dragon fruit skin flour provides benefits during storage. The resulting flour will have a longer shelf life (Nisviaty, 2006).

Ash Content

From the observation of ash content, the three types of dragon fruit skin flour have ash contents according to ash content of wheat flour for foodstuff as required by SNI 01-3751-1995 which is maximal 0,7%. High ash content of foodstuff indicates a high mineral content of the ingredients (Winarno, 2004).

Fat Content

White-meat dragon fruit skin flour has the lowest fat content, which is 2.10% while the red-meat and super red dragon fruit skin flour are 2.35% and 2.26%.

Protein Content

The three types of dragon fruit skin flour have protein contents in accordance with the requirements of SNI wheat flour 01-3751-2006 that is at least 7.0%.

Carbohydrate Content

The carbohydrate content of the three kinds of flour of flour is lower compared with that of wheat flour that is 77.30% (Directorate of Nutrition Department of Health RI, 1993).

Dietary Food Content

Dietary fiber contents of white-meat, red-meat and super red dragon fruit skin flour are 26,62%, 28.72% and 28.69% respectively. *The Food Standards Agency* recommends that products claiming to be a source of dietary fiber should contain 3 grams of fiber per 100 g. The three types of dragon fruit skin flour produced in this study have dietary fiber contents that exceed the requirement of dietary fiber source, so that the three types of dragon fruit skin flour can be used as a source of dietary fiber in the production of functional food.

Potassium

Super red dragon fruit skin flour has the highest potassium concentration compared white-meat and red meat dragon fruit skin flour, that is 5.26 mg.

Sodium

Super red dragon fruit skin flour also has the highest concentration of sodium compared to white-meat and red meat dragon fruit skin flour, that is 8.90 mg.

Calcium

Super red dragon fruit skin flour has the highest concentration of calcium compared to white-meat and red-meat dragon skin flour, that is 10.35 mg.

Phosphor

White-meat dragon fruit skin flour has a higher concentration of phosphorus than red and super red dragon fruit skin flour, that is 36.20 mg.

Based on the physicochemical characteristics of the three types of dragon fruit skin, it can be concluded that the dragon fruit skin can be used as food sources of dietary fiber and minerals.

IV. CONCLUSION

1. Red-meat dragon fruit skin flour has better chemical characteristics than white-meat and super red dragon fruit skin flour does. Red-meat dragon fruit skin flour contains 8.80% water, 0.20% ash, 2.35% fat, 7.69% protein, 68.29% carbohydrate and 28.72% dietary fiber and 4.40 mg K, 8.76 mg Na, 0.65 mg Fe, 10.20 mg Ca and 32.58 mg P.
2. Based on the results of physical, chemical and microbiology characteristics, it can be concluded that the dragon fruit skin can be used as alternative food sources because it is rich in carbohydrates and dietary fiber, and minerals.

Recommendations

1. Need to do further research on the utilization of dragon fruit skin flour optimally to diversify healthy food products.
2. Need to do further research on shelf life of the dragon fruit skin flour.

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3. Need to do further research to determine the content of vitamins and antioxidants in dragon fruit skin powder.

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