Diversification of Tapioca Flour in the Making of Food Fiber Enriched Flakes (Dietary Fiber) of Coconut Flour

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Abstract

Research on diversification of tapioca flour in producing flakes enriched by dietary fiber from coconut residue flour has been conducted. Tapioca flour as a source of carbohydrate was obtained by extracting cassava (Manihot Esculenta Crantz) while coconut residue flour as a source of dietary fiber was prepared from VCO processing waste. The result of the experiment showed that cassava starch can be used in producing flakes and by the addition of coconut residue flour, it influents to the content of water, ash, protein, carbohydrate, fat, dietary fiber as well as mineral content. The mixture of 75% of tapioca flour and 25% of coconut residue flour (F2) was chosen as the most favorite product during organoleptic test (odor, taste, texture, color, chipness) with water content 3.30%, ash 1.77%, protein 2.44%, fat 14.48%, carbohydrate 78.22%.

Keywords
Brand Image, Green Marketing, Store Atmosphere, Purchase Decision.

1. Introduction

The existence of wheat flour has been very attached to the food processing industry. In Indonesia, the need for wheat flour is increasing every year so that Indonesia has to import about four million tons of wheat flour every year (Suntoro, 2005). One of the causes of this increased demand for flour is the increasing number of food products that use wheat flour as the main ingredient, such as in making cakes, bread, instant noodles, and other products. The increasing public need for the use of wheat flour will have an impact on wheat flour imports which will also increase.

One of the efforts to overcome this problem is the diversification of local flour in food production. The culture of consuming flour that has been developed needs to be followed up to reduce the dependence of the Indonesian nation on imported food. A local commodity that has the potential to replace wheat flour is tapioca flour which comes from cassava. Cassava as a raw material for making tapioca flour is a tuber that is cheap and easy to get with high carbohydrate content so that the tapioca flour produced can be used as a source of carbohydrates. This flour can be used as a raw material in making ready-to-eat products such as flakes.

Flakes is a product that is loved by many people because of the practicality of its presentation. Flakes are classified into types of ready-to-eat cereal foods that have been processed and engineered according to their type and shape (Felicia, 2006). The flakes to be made from tapioca flour must have adequate nutrition, therefore it is necessary to add other types of food ingredients that have high dietary fiber such as coconut dregs flour.

Coconut dregs, which have been used only as animal feed and sold at low prices, have a high dietary fiber content. The content of dietary fiber in coconut dregs flour is proven to play an important role in the prevention and control of various chronic diseases such as colon cancer, heart attacks, hypertension, stroke and diabetes mellitus, besides that it can also control overweight (obesity), increase mineral availability and prevent constipation. (constipation). This advantage can be used as the basis for the use of coconut dregs flour in making tapioca flour flakes as a source of food fiber. Expanding the use of coconut dregs from animal feed into food will be very profitable economically for coconut farmers and coconut-based food producers.

This study aims to determine the characteristics of tapioca flour and coconut dregs flour as raw materials for making flakes, knowing the composition of tapioca flour: the proper coconut dregs flour in making flakes through organoleptic tests, knowing the characteristics of processed products made from tapioca flour enriched with coconut dregs flour so that it has the potential as functional food that has high nutrition and dietary fiber.
2. Research Methods

2.1. Ingredients

The ingredients used to make flakes are tapioca flour, coconut dregs flour, sugar, salt, butter and hot water. The materials used for the analysis were 25% HCl, 1.25% HCl, 3% NaOH, 95% Ethanol, Hexane, Distilled Water, concentrated H2SO4, Selen Mixture, BCG-MM Indicator, H3BO3, Phosphate Buffer, α-Amylase, Protease, Amylogukosidase, Celite, Lanthanum Chloride, KCl, NaCl, Plate Count Agar (PCA), Lauryl Sulfate Tryptose (LST), Escherichia coli Broth (EC), Eosyn Methylene Blue Agar (EMBA), Dichloran Glucose (DG), and Egg Yolk Emulsion.

2.2. Equipment

Knives, mills, filter tools, collection buckets, pans, stoves, drying tables and flour machines, scales, bowls, pans, ovens, molds, dough rollers, spoons, mixers, serving containers, plastic spoons, weighing boxes, excicators, ovens, analytical balance, porcelain dish, kiln, digestion tube, digestor, kjeldahl flask, burette, erlenmeyer, volumetric pipette, filter paper, thimble, soxtec, fat reservoir, glass cup, funnel, electric bath, water bath, spray flask, watch glass, stirrer, glass plate, vacuum pump, thermometer, aluminum foil, reflux, Atomic Absorption Spectrophotometer, petri dish, screw cap tube, durham tube, and Colorflex device.

2.3. Research Methods

The research includes two stages, namely the first stage of making the raw materials for making flakes, namely tapioca flour and tapioca flour and analyzing the characteristics of the flour produced. The second stage is making flakes from raw materials with a predetermined formula, testing organoleptics and analyzing the characteristics of the selected product.

2.3.1. Stage 1. Making Tapioca Flour and Coconut Dregs Flour

The cassava which will be processed into tapioca flour is peeled and cleaned of epidermis and dirt by washing it. The clean cassava is then milled, the result of the grinding is then filtered by adding water to separate the starch from the dregs. Then the starch is allowed to settle in the bucket for one night. The starch that has settled is dried in the sun to reduce the moisture content. The last step is to grind the starch and sift until the final result is flour.

Coconut dregs flour is obtained from residual VCO processing waste. Coconut waste is weighed as much as 1 kg, added with water with a ratio of 1: 8 then boiled and allowed to boil for 40 minutes. The result is then pressed to remove as much water as possible and then dried at a temperature of 50oC. After drying, the coconut pulp is ground and sieved with a 60 mesh sieve.

2.3.2. Stage 2. Making Flakes

Flakes are made by combining raw materials, namely tapioca flour and coconut dregs flour with various comparisons. The dough is added with 80 ml of warm water, 2 grams of salt, 10 grams of sugar and butter each. The dough is stirred until smooth then made a sheet to be wrapped in aluminum foil and steamed for 15 minutes. After that the dough is drained, milled and boxed. The final stage is baking in the oven for ± 8 minutes.

In making flakes the formula that is tried is:
- F1: 100% tapioca flour (standard)
- F2: 75% tapioca flour and 25% coconut dregs flour
- F3: 50% tapioca flour and 50% coconut dregs flour
- F4: 25% tapioca flour and 75% coconut dregs flour

2.4. Observation

1. Analysis of Tapioca Flour and Coconut Dregs Flour

Chemical and microbiological analyzes were carried out on the tapioca flour and coconut dregs flour. Chemical analysis for tapioca flour includes moisture content, ash, starch, degree of acid and degree of whiteness as well as metal contamination (Pb, Hg, Cd, As, Sn). Meanwhile, for coconut dregs flour, the analysis includes water content, ash, protein, fat, carbohydrate, dietary fiber and minerals (Na, K, Ca, Mg, Fe). Microbiological analysis included Total Plate Numbers (ALT), Escherichia coli, molds and Bacillus cereus.

2. Organoleptic Test

Organoleptic testing is done by rating test and ranking test. In the ranking test, panelists were asked to express their responses to the parameters of color, aroma, texture, taste and crunch. The hedonic scale used is 1-5 where the numbers 1 = very dislike, 2 = dislike, 3 = neutral, 4 = like and 5 = really like. The ranking test aims to determine the order of the samples according to differences in sensory quality levels. In this test the first order states the highest order. This test is needed to determine the most preferred formula for tapioca flour.
3. Analysis of flakes characteristics

The most preferred flakes products based on the organoleptic test will be tested for their chemical content through analysis of moisture, ash, protein, fat, carbohydrates, dietary fiber and minerals including Na, K, Ca, Mg, Fe).

3. Research Results And Discussion

From the results of testing the characteristics of raw materials in the form of tapioca flour and coconut dregs flour, the following results were obtained:

a) Observation of color parameters, tapioca flour and coconut dregs flour both have white color. This is because in the processing process, both the cassava and coconut that are used are free from the epidermis and have gone through the washing stages first. The aroma parameter shows that tapioca flour has a distinctive aroma of tapioca and coconut dregs flour has a distinctive aroma from coconut. Based on the observation of texture parameters, there is no difference between tapioca flour and coconut dregs flour due to the same grinding and sieving processes.

b) Tapioca flour experienced a drying reduction of 18.75%. This percentage is obtained from 40 kg of fresh cassava which is used to produce 7.5 kg of tapioca flour. The drying shrinkage value is low, this is because the cassava raw material used is of good quality so that cassava is suitable for processing into tapioca flour. Meanwhile, for coconut dregs flour, the final weight is 790 grams. This result was obtained from 1750 grams of remaining VCO coconut dregs with a drying loss of 45.14%.

c) Tapioca flour has a moisture content of 11.4%, ash 0.23%, acid degree 0.66 ml NaOH 1N / 100 g, whiteness 95.21%, starch 79.5% and Pb metal contamination of 0.042 mg / kg , Hg 0.0122 mg / kg, As 0.0054 mg / kg, cd 0.0221 mg / kg. The microbial test showed that tapioca flour had ALT content of 4.4 x 103 col / g, mold 40 cabbage / g, Escherichia coli <10 cabbage / g and Bacillus cereus <100 cabbage / g.

d) Coconut dregs flour has a water content of 4.85%, 0.61%, 16.98% protein, 42.27% fat, 43.55% carbohydrates, 33.02% food fiber and 85.61 ppm of Na mineral content. , K 336.23 ppm, Ca 267.38 ppm, Mg 1606.50 ppm, fe 75.10 ppm. Microbial tests on coconut dregs flour showed that tapioca flour had an ALT content of 5.5 x 103 col / g, mold <10 cabbage / g, Escherichia coli <3 cabbage / g and Bacillus cereus <100 cabbage / g.

The results of the analysis were compared with (Badan Standardisasi Nasional, 2011) and (Badan Standardisasi Nasional, 2009). Based on these results, tapioca flour and coconut dregs flour have good sanitation, food safety and quality which is indicated by the fulfillment of the SNI quality requirements which can then be used later for making flakes.

3.1. Physical Characteristics of Tapioca Flakes Enriched with Coconut Dregs Flakes

The characteristics of tapioca flakes enriched with coconut dregs can be seen in Figure 1.
Table 1. Physical characteristics of tapioca flour flakes enriched with coconut dregs flour

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Brownish</td>
</tr>
<tr>
<td>Texture</td>
<td>Hard</td>
</tr>
<tr>
<td>Aroma</td>
<td>Tapioca flour</td>
</tr>
</tbody>
</table>

Table 2. Tukey Flakes test results

<table>
<thead>
<tr>
<th>Formulations</th>
<th>Average</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>2.00</td>
<td>2</td>
</tr>
<tr>
<td>F2</td>
<td>1.65</td>
<td>1</td>
</tr>
<tr>
<td>F3</td>
<td>2.84</td>
<td>3</td>
</tr>
<tr>
<td>F4</td>
<td>3.52</td>
<td>4</td>
</tr>
</tbody>
</table>

3.1.1. Organoleptic Test

Table 3. Flakes Hedonic Test Results

<table>
<thead>
<tr>
<th>No.</th>
<th>Treatment</th>
<th>Color</th>
<th>Aroma</th>
<th>Taste</th>
<th>Texture</th>
<th>Crunchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F1</td>
<td>3.65a</td>
<td>3.29a</td>
<td>3.87a</td>
<td>3.23a</td>
<td>3.97ab</td>
</tr>
<tr>
<td>2</td>
<td>F2</td>
<td>3.90a</td>
<td>3.68a</td>
<td>4.19a</td>
<td>3.77a</td>
<td>4.42a</td>
</tr>
<tr>
<td>3</td>
<td>F3</td>
<td>3.68a</td>
<td>3.39a</td>
<td>3.10b</td>
<td>3.61a</td>
<td>3.39bc</td>
</tr>
<tr>
<td>4</td>
<td>F4</td>
<td>3.55a</td>
<td>3.55a</td>
<td>2.71b</td>
<td>3.35a</td>
<td>2.77c</td>
</tr>
</tbody>
</table>

Based on the organoleptic test, for the parameters of color, aroma and texture, the addition of coconut dregs flour did not have a significant difference. As with the taste and crunchiness parameters, the addition makes a real difference in some formulas. Flakes products with formula F2 with a composition of 75% tapioca flour and 25% coconut dregs flour were the products selected by the panelists based on the highest value based on the rating test and ranking test.

3.2. Characteristics of Flakes F2

Table 4. Characteristics of Flakes F2

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>F1 (standard)</td>
</tr>
<tr>
<td>1</td>
<td>Water</td>
<td>%</td>
<td>1.37</td>
</tr>
<tr>
<td>2</td>
<td>Ash</td>
<td>%</td>
<td>0.88</td>
</tr>
<tr>
<td>3</td>
<td>Protein</td>
<td>%</td>
<td>1.06</td>
</tr>
<tr>
<td>4</td>
<td>Fat</td>
<td>%</td>
<td>2.06</td>
</tr>
<tr>
<td>5</td>
<td>Carbohydrate</td>
<td>%</td>
<td>94.13</td>
</tr>
<tr>
<td>6</td>
<td>Food Fiber</td>
<td>%</td>
<td>1.32</td>
</tr>
<tr>
<td>7</td>
<td>Na</td>
<td>ppm</td>
<td>66.6</td>
</tr>
<tr>
<td>8</td>
<td>K</td>
<td>ppm</td>
<td>544.6</td>
</tr>
<tr>
<td>9</td>
<td>Ca</td>
<td>ppm</td>
<td>221.25</td>
</tr>
<tr>
<td>10</td>
<td>Mg</td>
<td>ppm</td>
<td>64.2</td>
</tr>
<tr>
<td>11</td>
<td>Fe</td>
<td>ppm</td>
<td>29.25</td>
</tr>
</tbody>
</table>

Based on these results, it can be seen that the addition of coconut dregs flour will have an effect on moisture, ash, protein, fat, carbohydrate, dietary fiber and mineral content including Na, K, Mg, Ca, and Fe.
3.2.1. Water content

It is important to determine the water content in food ingredients to determine the shelf life of the material. In addition, water has an effect on the appearance, texture and taste of food. The results of the analysis of moisture content, F2 flakes have a moisture content of 3.30%. The high water content in F2 flakes can be caused by the moisture content in tapioca flour which is more than 10%.

3.2.2. Ash content

Ash content is the inorganic residue from the ashing process which indicates the mineral content in food ingredients. The ash content of the F2 flakes was 1.77%, which indicated that the addition of coconut dregs flour would have an effect on the mineral content of the flakes because the coconut dregs itself had a high enough mineral content.

3.2.3. Protein

Protein functions to form new tissue and maintain existing tissue as well as a substance that regulates the body's metabolic processes. Based on the analysis results, it can be seen that F2 flakes have a protein content of 2.44% because the coconut dregs flour used has a higher protein content than wheat flour, which is 16.98%.

3.2.4. Fat

Fat is a more effective source of energy for the body and one gram of fat can produce 9 Kcal of energy. The fat content in the selected flakes (F2) was 14.48%. This level is much greater than the standard (F1), which is 2.06%. This is because the coconut dregs flour used has a higher fat content than tapioca flour, which is 42.27%.

3.2.5. Carbohydrate

Carbohydrates also have an important role in determining the characteristics of food ingredients, such as color, taste, aroma, and texture (Winarno, 20014). The carbohydrate content of the selected flakes (F2) was 78.22%. This content is the highest content compared to other proximate analyzes. In this study, carbohydrate content was determined by difference, namely by adding up the levels of protein, fat, ash, water and then subtracting 100%.

3.2.6. Food Fiber

According to (Tensiska, 2008) the value of food fiber is higher than crude fiber because it still contains components that are missing in the determination of crude fiber, such as about 50% cellulose and 85% hemicellulose. In principle, the determination of dietary fiber content is enzymatic gravimetry. Flakes F2 has a dietary fiber content of 12.14%. The Food Standards Agency recommends that products claiming to be a source of fiber should contain 3 grams of fiber per 100 g. The resulting F2 flakes product has a very high food fiber content exceeding the fiber source requirements, so that the flakes product can be used as a source of food fiber in the production of functional food.

3.2.7. Mineral

The selected flakes (F2) have a higher mineral content than the standard flakes (F1). The selected flakes (F2) contained K content of 663.03 ppm, 98.5 ppm of Na, 36.22 ppm of Fe, 268.9 ppm of Ca and 80.54 ppm of Mg. The mineral content of standard flakes (F1) is K of 544.6 ppm, Na 66.6 ppm, Fe 29.25 ppm, Ca 221.25 ppm and Mg of 64.2 ppm. The high levels of minerals in F2 flakes can provide benefits for our bodies, namely maintaining intra and extracellular osmotic pressure, maintaining bone health, preventing insomnia and anemia.

4. Conclusions and Suggestion

4.1. Conclusions

From the results of the research conducted, it can be concluded:

1. Tapioca flour has the characteristics of water content of 11.4%, ash 0.23%, acid degree 0.66 ml NaOH 1N / 100 gram, 95.21% white degree, and Pb metal contamination of 0.042 mg / kg, Hg 0, 0122 mg / kg, As 0.0054 mg / kg, Cd 0.0221 mg / kg, and Sn 0.123 mg / kg. Based on these results, it can be seen that the tapioca flour produced has a good quality characterized by the characteristics that meet the SNI standard for tapioca flour 3451: 2011

2. Coconut dregs flour has a Water Content of 4.85%, Ash 0.61%, Fat 42.27%, Protein 16.98%, Carbohydrates 43.55%, Food Fiber 33.02%, mineral K content of 336.03 ppm, Na 85.61 ppm, Ca 267.38 ppm, Mg 1606.50 ppm, and Fe 75.10 ppm.

3. Tapioka flakes enriched with coconut dregs flour with F2 treatment (75% tapioca flour : coconut dregs flour 25%) is an appropriate formulation in the process of making flakes based on the organoleptic test.
4. Based on the results of the analysis, the formula F2 flakes has a water content of 3.30%, ash 1.77%, 2.44% protein, 14.48% fat, 78.22% carbohydrates, 12.14% food fiber and mineral Na of 98, 5 ppm, K 663.03%, 268.9 ppm, Ca 268.9 ppm, Mg 80.54% and 36.22 ppm of Fe content. Based on the results of the analysis, the product flakes high nutritional content as well as food and has the potential to be functional food.

4.2. Suggestion

Further research is needed regarding the storage and packaging process if the tapioca flour-based flakes enriched with coconut dregs flour are to be marketed.

References