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Abstract. This research examined the effect of flour making method using chemicals on the soaking process of taro tubers. Method 1 was done by soaking taro tubers in 500 ppm sodium metabisulfite solution. Method 2 was done by soaking in warm water at 40 ° C for 3 hours followed by immersing in 10% NaCl solution for 1 hour, Method 3 was done by immersing in a brine solution (1 teaspoon in 5 liters of water) for 20 minutes followed by soaking it again in a sodium metabisulfite solution (1 gram per 1 liter of water) for 20 minutes. In related to the proximate composition in taro flour, the result showed that the flour making that uses sodium metabisulfite ($Na_2S_2O_5$) soaking method produces the best protein and crude fiber content of 3.158% and 4.080%, respectively. The taro cookie making that uses flour that is immersed in sodium metabisulfite ($Na_2S_2O_5$) produces the best protein, crude fiber and energy content of 2.091%, 2.820% and 588.897% respectively. This is because the first method only uses one immersion process that is using sodium metabisulfite, while the second and third methods go through two immersion processes. It can be concluded that the flour making method using a soaking process with 500 ppm sodium metabisulfite solution can increase the benefit of using taro flour.

1. Introduction

Taro flour is a product of taro tubers which is processed through drying, refining and sieving. It contains good protein, fat and fiber. According to Perez et al. [1], the problem of taro flour when it is consumed is that it causes itching due to the calcium oxalate compounds. In addition, it can also cause irritation to the skin, mouth and digestive tract [2]. Taro flour contains saponin and it will become brown when it is heated. This happens to food containing carbohydrates where it will be carcinogen when it is cooked at temperatures above 120˚C [3]. From problems above, one way to reduce oxalate levels and make the taro floor safe to consume is by making the flour with a good method. Taro flour is made by going through several stages of the process such as slicing, soaking in a salt solution, steaming, drying, and milling which can reduce the oxalate level of the taro. Taro contains calcium oxalate which can cause itchy in the mouth, tongue and throat. Calcium oxalate crystals that are like thin needles can pierce and penetrate into the thin layers of skin, especially those in the lips, tongue and throat. Then, an irritant (possibly a type of protease) will appear and cause discomfort feeling such as itching or burning [4].

In the beginning, the taro skin was peeled and then cut into small pieces to make the process easier. The peeling process would potentially change the color of the taro to brown (browning) or black. To

avoid a browning reaction, peeled taro tubers must be pre-treated immediately. The pre-treatment could be by immersing it in sodium metabisulfite ($Na_2S_2O_5$). According to Slamet [5], the flour pre-treatment by soaking it in a solution of sodium metabisulfite ($Na_2S_2O_5$) produced a better color (brighter) because sulfites could inhibit the browning reaction catalyzed by phenolase enzyme and block the reaction of 5 furfural metal hydroxyl compounds forming from D-glucose that caused brown color. In addition to soaking in sodium metabisulfite ($Na_2S_2O_5$), heating at a certain temperature such as blanching could be an alternative treatment to reduce nutrient loss. This process aimed to preserve color and taste. The pretreatments used were blanching and immersion in sodium metabisulfite ($Na_2S_2O_5$) and NaCl with various concentrations and soaking time. Research on taro starch and taro flour in Indonesia is still limited, for example, research of Widowati et al. [6] on the effect of NaCl concentration and $NaCO_3$ concentration on the extraction and characterization of several taro varieties and research of Hartati and Prana [14] on the analysis of starch and crude fiber of several cultivars of taro *(Colocasia esculenta* L. Schott). Ocheme et al. [7] revealed that the proximate, functional, and pasting characteristics of the flour blends were determined by groundnut protein concentrate (GPC) in wheat flour. The addition of GPC enhanced protein, fat, ash, and crude fiber contents of the blends flour, while the moisture and carbohydrates decreased. Abera et al. [8] evaluated taro flour blended with wheat for bread preparation. They found that addition of taro flour at concentration of 20-50% improved ash, fiber, carbohydrate content, crude protein content of taro and wheat flour formulated bread. Proximate and some mineral analysis were carried out on taro cocoyam (*Colocasia esculenta*) tuber to determine its nutritive composition and mineral values [9]. The addition of taro flour to wheat at a ratio of 1:5 produced acceptable bread. Incorporation of taro flour to wheat would be an effective method of cost reduction [10]

As one of the taro products, the flour has the potential to become a raw material for the food industry. Taro flour can be produced by the process of peeling, washing, slicing the tubers, then drying and grinding. After taro flour is produced, the knowledge about the organoleptic characteristics of taro flour is needed to find out information about the taro flour itself. To increase the selling value to the community, it is necessary to have different taro tubers process. One of the processed forms is cookies. In the process of taro tubers become cookies, in addition to the flour becoming the main ingredients, it also adds to shelf life of the taro tubers. Taro tubers themselves have a sufficient amount of water, which causes them to be easily damaged and cannot last long if they are not processed immediately.

Every 100 grams, taro flour has 3.9% of protein, 2.01% of fat, 9.4% of water, and 2.70% of fiber, 2.24% of ash [11]. Taro flour is good as cookies ingredient because it can replace wheat flour 100%, which means it can replace the function of the whole wheat flour. The cookies have a light and fragile texture, and are able to form a structure that can retain the shape of cookies [12]

The purpose of this study was to determine the results of the preliminary treatment using 3 methods, i.e. by immersing in sodium metabisulfite ($Na_2S_2O_5$), soaking in warm water and 10% NaCl solution for 1 hour, and soaking NaCl and sodium metabisulfite solution for 20 minutes. The chemical parameters observed were the level of moisture, ash, fat, protein, carbohydrate, energy and crude fiber.

2. Research Method

2.1 Tools and Materials

The main ingredient used in this study was taro tuber. It can be found in Gunungpati District area, Semarang, Central Java. Meanwhile, the reagents used were sodium metabisulfite ($Na_2S_2O_5$), 10% NaCl, Aquades. The tools used in this study were: knives, basins, tuber chopper, cabinet drying, flour sieving, Erlenmeyer, measuring flask, beaker glass, measuring cup, thermometer, stirrer, pH indicator and Scanning Electronic Microscope (SEM).

2.2 Method

Sample code 1 went through the process of peeled, washed, roasted, washed, soaked with sodium metabisulfite solution, dried, grinded, sieved, and packed. Sample code 2 went through the process of peeling and slicing the tubers for 5 mm thick, washing them with water, soaking them in warm water at 40 ° C for 3 hours, soaking them in 10% NaCl solution for 1 hour, washing them with water again, drying, grinding and sieving, and packing. Sample code 3 went through the process of peeling, washing, slicing, soaking deep the taro slices in brine solution (1 tsp in 5 liters of water) for 20 minutes; soaking them again in a solution of sodium metabisulfite (1 gram per 1 liter of water) for 20 minutes, washing them again under running water and draining them; drying, milling and sieving, and packing.

From these treatments, each will be analysed for the flour characteristics. The analysis of the characteristics includes the analysis of water, protein and crude fiber. Cookies made from the 3 types of flour will be analysed for its characteristics. It includes the analysis of water, ash, fat, protein, carbohydrate, crude fiber and energy. The characteristics of taro flour will be compared with the characteristics of taro flour as a result of research from Therik et al. [11] and taro flour cookies then will be compared with the content of wheat flour cookies (SNI 01-2973-1992)

3. Result and Discussion

3.1 Taro Flour Characteristic

The analysis of taro flour characteristics includes the aspect of water, protein and crude fiber as given in Table 1.

Table 1. Taro Flour Characteristic

Chemical Parameter	Soaking in natrium metabisulfite ($Na_2S_2O_5$)	Soaking in warm water and 10% NaCl solution for 1 hour	Soaking in NaCl dan natrium metabisulfite solution for 20 minutes	Comparison [11]
Water content (%)	6.316	6.307	3.765	9.4
Protein content (%)	3.158	2.729	2.239	3.9
Fiber content (%)	4.080	2.691	2.783	2.7

3.2 Water content in taro flour

Table 1 shows that the three samples of flour have a lower water content compared to the comparison taro flour [11]. Taro flour which has the lowest water content is the one which is soaked in NaCl and sodium metabisulfite solution. This is due to the immersion in 2 different solutions. The immersion in NaCl solution results in lower water content in taro flour. This might be because the NaCl solution which is hygroscopic causes an osmosis process which will absorb and remove water from the taro tubers. In accordance with the opinion of Witono [13], salt has a high osmotic pressure (hypertonic) so that it can draw water out of the material. Meanwhile, Natrium metabisulfite, which is acidic and salty, also has high osmotic nature like NaCl.

3.3 Protein content in taro flour

Table 1 shows that the three samples still have lower protein content comparing to the comparison taro flour. One sample that has protein content close to the comparison taro flour is the one immersed in sodium metabisulfite ($Na_2S_2O_5$), which was 3.158%. This happened due to the short period of the sodium metabisulfite soaking. The longer the soaking time of sodium metabisulfite, the lower the protein content. Since the sodium metabisulfite solution is acidic because the pH is <3, then the longer it is soaked it will cause protein damage. This is supported by Indraswati [14] which stated that proteins can be damaged due to the influence of heat, reactions with acids or bases. In addition,

proteins undergo degradation which is the breakdown of complex molecules into simpler ones due to the influence of acids or bases.

3.4 Fiber content in taro flour

The fiber level of the taro flour resulted from the research is higher than the comparison taro flour, especially in samples soaked in sodium metabisulfite ($Na_2S_2O_5$). This shows that the high concentration of sodium bisulfite can ignite the reaction of the lignin substance so that it can affect the fiber level of the taro flour produced. This difference is due to the components of crude fiber, especially lignin, which is resistant to degradation, both chemically and enzymatically. This is supported by Muljohardjo and Rahayu [15] who stated that lignin is a very strong compound against chemical and enzymatic reactions so that it is not easily degraded.

3.5 Taro Flour Cookies Characteristics

The analysis of taro clour characteristics includes the analysis of water content, ash and fat.

Table 2. Taro Flour Cookies Characteristics (Water, Ash, Fat, Protein)

Chemical Parameter	Soaking in natrium metabisulfite ($Na_2S_2O_5$)	Soaking in warm water and 10% NaCl solution for 1 hour	Soaking in NaCl dan natrium metabisulfite solution for 20 minutes	Comparison*
Water level (%)	1.206	1,918	1,526	Max 5
Ash level (%)	2.224	1,799	1,946	Max 1,5
Fat level (%)	40.523	39,419	40,146	Min 9,5
Protein level (%)	2.091	1,888	2,031	Min 5

* SNI 01-2973-1992.

Table 3. Taro Flour Cookies Characteristics (Carbohydrate, Crude Fiber, Energy)

Chemical Parameter	Soaking in natrium metabisulfite ($Na_2S_2O_5$)	Soaking in warm water and 10% NaCl solution for 1 hour	Soaking in NaCl dan natrium metabisulfite solution for 20 minutes	Comparison*
Carbohydrate level (%)	53,956	54,976	54,352	Min 7
Crude Fiber level (%)	2,820	2,720	2,819	Max 0,5
Energy level (%)	588,897	582,225	586,843	Min 400

* SNI 01-2973-1992.

3.6 Water level in taro flour cookies

Water in food material will affect its appearance, texture and taste. The amount of water will determine the stability and durability of cookies [16]. Overall, the amount of water in taro flour cookies still meets the requirements set by the Indonesian National Standard (SNI), which is less than 5%

The initial water level of fresh taro tubers is 63.1% [17]. After made into flour and being treated with NaCl solution immersion, the mean value of water level in taro flour ranged from 1.206% - 1.526% (Table 3.2). The longer the immersion in NaCl solution, the lower the water level of taro flour. This is potentially due to the hygroscopic NaCl solution in which causes an osmosis process that will

absorb and remove water from the taro tubers. It is in accordance with the opinion of Witono [13] that salt has a high osmotic pressure (hypertonic) so that it can draw water out of the material.

3.7 Ash level in taro flour cookies

The higher the taro flour contents in the cookies the higher the ash content. This is because the mineral of Ca, F, and Fe in taro flour are higher than the minerals in wheat flour [16]. This happens because the sodium bisulfite that enters the pores of the material is getting bigger so that it will increase the ash level in the taro flour produced. Eskin et al. [18] stated that sodium bisulfite salt and ash are minerals, thus they can increase the ash level in the taro flour.

The initial ash content of fresh taro tubers is 1.00%, which increases after being immersed in NaCl solution. This is potentially due to the immersion in the NaCl solution which causes the accumulation of sodium and chloride minerals in the treatment sample, therefore the longer the soaking process, the more minerals that enter the tubers and cause the ash level of the taro flour to increase. Desniar and Wijatur [19] stated that salt contains minerals such as sodium and chloride. In addition, there is an osmosis process where the hygroscopic NaCl solution will absorb and remove water from the taro tubers and then some of the solids in the NaCl solution will enter the tubers through the diffusion process.

3.8 Fat level in taro flour cookies

The fat in cookies functions as a flavoring and texture softener. Generally, the higher the fat levels in food, the better the taste. The presence of this fat is very important which results in the SNI to require a minimum value of fat in cookies of 9.5%. The fat level test in taro flour cookies results in a range between 39.419 - 40.523%

The fat content of all cookie formulations has greater fat content than required. The fat level in cookies mostly comes from the addition of egg yolks and margarine which reaches 45%

3.9 Protein level in taro flour cookies

Protein is a very important nutritional element, thus it is required in almost all food products. In the metabolic system, protein functions as a building block for the body. For cookies, the minimum protein required by SNI is 5% [16]. Taro cookies are not a good protein source because they have a lower protein level compared to the requirement by SNI. In order to fulfill the body's need for protein, a combination or addition of other foods is needed when consuming taro cookies.

3.10 Carbohydrate level in taro flour cookies

Carbohydrate is the main source of calories for almost all people in the world, especially those in developing countries. Although the number of calories produced by 1 gram of carbohydrate is only 4 kcal, it is a source of calories that is affordable and easy to obtain. Carbohydrate also has an important role in determining the characteristics of food ingredients, such as color, texture, and others [16]. Calculation of the carbohydrate content in taro cookies is done using the by difference method. The types of carbohydrate compounds measured are starch, sugar, fiber, and oligosaccharides [16]. The measurement results for taro flour cookies ranged from 53,956 - 54,976% which means that it is higher than the SNI limit, which is 7% at the minimum. It occurs because the carbohydrate content of fresh taro tubers is 34.2%, thus it greatly affects the protein content in taro flour cookies.

3.11 Crude fiber level in taro flour cookies

The crude fiber content of taro tubers before being treated is 1.5%, in which after being made into cookies ranged from 2.72 - 2.82% (Table 3). In the cookies making process, there is te baking process which results in the water content to be more and more evaporated so that the crude fiber will be more concentrated. It is in accordance with the opinion Dianty **[**20**]** which stated that the baking/drying

process has increased the fiber content of the produced product compared to when it is still in the form of flour, which is 2.691%. In addition, the higher the temperature and heating time, the higher the crude fiber level. Based on the observation, the crude fiber content of taro flour cookies produced from all treatments has met the SNI requirements for crude cookies of a maximum of 0.5%. These taro flour cookies can be used as alternative cookies which are rich in fiber.

3.12 Energy level in taro flour cookies

The energy value of taro cookies can be calculated using the energy value obtained in chemical analysis. The chemical analysis results that contribute to the calculation of energy values are carbohydrate, protein and fat analysis. The biggest source of energy in taro cookies comes from the high carbohydrate and fat. One gram of fat provides 9 kcal/gram, while carbohydrate and protein only produce 4 kcal/gram.

4. Conclusion

The result of the proximate composition in taro flour shows that the flouring process using the method of soaking in sodium metabisulfite ($Na_2S_2O_5$) produces the best protein and crude fiber content of 3.158% and 4.080%, respectively. The result of the proximate composition in taro flour cookies that uses the method of immersing in sodium metabisulfite ($Na_2S_2O_5$) produces the best protein, crude fiber and energy content of 2.091%, 2.820% and 588.897% respectively. This is because this method only goes through one immersion process that is using sodium metabisulfite. Meanwhile, the second and third methods go through two immersion processes. It can be concluded that the flouring method using soaking process with 500 ppm sodium metabisulfite solution can increase the benefits of taro flour.

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