Utilization of purple sweet potato as a partial substitute glutinous rice flour in the *ombus-ombus* cake from North Tapanuli traditional food

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Abstract. *Ombus-ombus* is one of the traditional Batak Toba foods from North Tapanuli made from glutinous rice flour. The nutritional content of purple sweet potato is quite complete at affordable prices, which has the potential to be developed into processed food products based on local food and can reduce imports of Indonesian glutinous rice. The main objective of this research was to determine the best *ombus-ombus* cake formulation by using purple sweet potato as a partial substitute for glutinous rice flour. This research was conducted using a completely randomized design, consisted of two factors, factor I, the percentage substitute of purple sweet potato flour (P1 = 0%; P2 = 10%; P3 = 20%; P4 = 30%) and storage temperature condition (S1 = at room temperature and S2 = at freezing temperature) with three replications. The moisture content of *ombus-ombus* based on research was very significantly different (P <0.05) where the value was higher ranged 40-45%, and the organoleptic of colour, aroma, taste, texture were also very significantly different, almost the same value as previous research values and preferred by panelist than commercial products. The best formulation is 20% purple sweet potato flour and 80% glutinous rice flour with freezing storage.

1. Introduction

Indonesia is a country that has fertile land with a tropical climate with diverse natural resources. Judging from the potential of regional resources, Indonesia has the potential for food availableness as a source of carbohydrates which is quite large. *Ombus-ombus*, a traditional supported case of wet cake and has a short shelf storage so it is necessary to study / conduct research on proper storage to extend the shelf life of the product. *Ombus-ombus* is one of the original products from Siborongborong which has been around for years and is in great demand by visitors from various places. Normally this cake is distributed by cycling dealers and some are sold in restaurants. The name *ombus-ombus* itself is said to have originated from the custom of the Batak people when eating. Consumer birth to exhale (ombus) the breather into this cake which is usually served warm. Together with the lapet, another Batak typical cake, these *ombus-ombus* are usually served in special events of Batak communities. For many years now, the main ingredient used for *ombus-ombus* making is glutinous rice flour dough which is filled with sugar and coconut. *Ombus-ombus* cake has a cone shape wrapped in banana leaves and then is steamed.

One source of carbohydrates is a type of tubers such as sweet potato (*Ipomoea batatas* L). Based on field observations, initially the sweet potatoes that were mostly found were white, yellow and orange
flesh-coloured sweet potatoes. However, after the existence of sweet potatoes with a very attractive purple, utilization of purple sweet potatoes has a very good prospect because it is very attractive.

The carbohydrates found in purple sweet potatoes are complex carbohydrates with a low glycemic index classification, it is 44. If consumed, carbohydrate with less glycemic index will not increase blood sugar levels drastically [1]. Purple sweet potato is an ingredient that rich in anthocyanins, which have an antioxidant function. Antioxidants are compounds that can inhibit the oxidation process, so that they can prevent degenerative diseases such as aging, cancer, diabetes, and cataracts. In addition, anthocyanins in purple sweet potatoes also have the ability to be antimutagens, anti-carcinogenic, prevent liver dysfunction, antihypertensives, and lower blood sugar levels [2,3]. Process the purple sweet potato into flour is one way to use it.

This backs up the use of purple sweet potato flour as an alternative origin of carbohydrates which can be victimised as a substitute for wheat-based results and their derivatives that have added esteem for health. Processing of sweet potatoes into a food product such as donuts, biscuits and cakes, but it has a weakness, namely the product does not have a long shelf storage [4]. Given that the nutritional content of purple sweet potatoes is quite complete at affordable prices, it has the potential and it is expected to increase the function of purple sweet potato. Therefore, the aim of this search was to determine the use of purple ocarina as a limited substitute for glutinous rice flour in making ombus-ombus cakes.

2. Materials and methods
The substances victimised in this study were white glutinous rice flour, purple sweet potato flour, white sugar, grated coconut, and salt obtained from traditional markets in Medan. Other materials are water.

2.1. Research methods
It was conducted victimisationing a completely randomized design, with 2 factors, the percentage substitute of purple sweet potato flour (P1 = 0; P2 = 10%; P3 = 20%; P4 = 30%) and storage temperature condition (S1= at room temperature and S2= at freezing temperature) with three replications. At preliminary study, the ombus-ombus was also stored at chilled temperature, however, the cake was ruined before analysis was undertaken [5].

2.2. Sweet potato flour preparation
The flour of purple sweet potato and glutinous rice flour were mixed with formulations according to the treatments, i.e., 0: 100, 10:90, 20:80, and 30:70. Then, 50 mL water added gradually to the mixture according to the treatment and kneaded until homogeneous. The filling ingredients: granulated sugar and grated coconut are prepared, and roasted for ± 5 minutes as stuffing ingredients. Banana leaves are prepared as a wrap for cooking. The dough is formed into a beat form by hand so the filling is added in the centre. Mixture was then shaped to resemble a cone (triangle) shape and put in a banana leaf. Finally, the food was set prepared as a wrap for cooking. The dough is formed into a round shape by hand and then the filling is added in the middle. The mixture was then shaped to resemble a cone (triangle) shape and put in a banana leaf. Finally, the food was set put it in the steaming pan and steam for 30 minutes at pee temperature of 99 °C. The ombus-ombus were stored at room temperature and freezing temperature before being analysed.

Preparation for make flour was made by washing the sweet potato beneath running water to dispatch the filth that pierces to the skin of the sweet potato. Then, it was peeled, sliced ± 2 cm in size and soaked in 3000 ppm sodium metabisulfite solution for 20 minutes. The sweet potato was washed with running water and then dried in a blower cabinet oven at 50 °C for 48 hours. After that, the dried sweet potato was mashed and sieved using an 80 mesh sieve and the finished flour is packed with polyethylene plastic. The moisture content of it flour based on the test results in the laboratory was 10.5%. Glutinous rice flour is obtained from a cake shop or using factory-produced glutinous rice flour and the moisture content of it flour was 9.9%.
2.3. Observation and data measurement methods

2.3.1. Moisture content. 5 g of sample that want analysed was put into an aluminium which had been dried for one hour at a temperature of 105 °C and its weight was known. The sample was heated at 105°C for three hours, then cooled in a desiccator cold and then weighed. Heating and cooling were repeated till a constant sample weight was obtained [6]. Moisture is weight of initial sample minus eight of final sample times 100%, and then divide initial sample weight.

2.3.2. Organoleptic test (colour, aroma, taste, texture). The organoleptic test on ombus-ombus cake produced from purple sweet potato flour was carried out by using the hedonic test. Samples are presented in plastic plates and have been coded, randomly tested by 30 untrained panellists. The range of scales is given 1 to 5 [7]. For the hedonic scale is very dislike (1), do not like (2), neutral (3), like (4), really like (5).

3. Results and discussion

Moisture content organoleptic analysis colour, aroma, taste, and texture of ombus-ombus cake according to analysis are presented in Table 1.

Table 1. The effect of substitute flour and storage on moisture content, organoleptic analysis colour, aroma, taste, and texture

| Treatment | Moisture content (%) | Colour | Aroma | Taste | Texture |
|-----------|----------------------|--------|-------|-------|---------|
| P1        | 41.4 cC              | 2.6 dD | 3.5 dD| 3.2 dD| 2.6 dD  |
| P2        | 41.6 cBC             | 3.8 cC | 3.7 cC| 3.6 cC| 3.0 cC  |
| P3        | 42.4 bB              | 4.6 aA | 4.1 aA| 4.5 aA| 3.2 aA  |
| P4        | 44.5 aA              | 4.1 bB | 4.1 abAB| 4.1 bB| 3.2 bB  |
| S1        | 42.4 bB              | 3.8    | 3.8   | 3.9   | 3.2     |
| S2        | 43.4 aA              | 3.7    | 3.8   | 3.9   | 3.2     |

Note: P1 = 0% purple sweet potato flour, P2 = 10% purple sweet potato flour, P3 = 20% purple sweet potato flour, P4 = 30% purple sweet potato flour, S1 = storage at room temperature, S2 = storage at freezing temperature for 7 days.

From Table 1 in the moisture content column, it can be seen that the 0% substitution of flour was not significantly different from the 10% substitution flour but very significantly different with 20% substitution and 30% substitution of flour. The 10% substitution of flour was not significantly different from the substitution of 20% flour, but very significantly different from the 30% substitution of flour. The substitution of 20% flour was significantly different from the 30% substitution of flour. Storage at room temperature differs markedly from freezing temperature storage.

The substitution of flour was also affected the colour of ombus-ombus. At 0% substitution flour was very significantly different with 10% substitution, 20% substitution, and 30% substitution of flour. At 10% substitution flour was very significantly different with 20% substitution and 30% substitution of flour. The substitution of 20% flour was significantly different from the substitution of 30% flour. The aroma of 0% substitution of flour was very significantly different with 10% substitution, 20% substitution, and 30% substitution of flour. The substitution of 10% flour was very significantly different with 20% substitution and 30% substitution of flour. The substitution of 20% flour was very significantly different from the substitution of 30% flour. The substitution of 20% flour was not significantly different from the substitution of 30% flour.

The substitution of flour was also affected the taste of ombus-ombus. 0% flour was very significantly different with 10% substitution, 20% substitution, and 30% substitution of flour. The 10% substitution of flour was very significantly different with 20% substitution and 30% substitution of flour. The substitution of 20% flour was very significantly different from the substitution of 30% flour. The texture of 0% substitution of flour was very significant with 10%, 20%, and 30% substitution of flour. The 10%
substitution of flour was very significantly different with 20% substitution and 30% substitution of flour. The substitution treatment of 20% flour was very significantly different from that of 30% flour. The 10% substitution of flour was very significantly different with 20% substitution and 30% substitution of flour. The substitution treatment of 20% flour was very significantly different from that of 30% flour. The 10% substitution of flour was very significantly different from the substitution of 30% flour.

3.1. Moisture content

Based on the analysis, the substitute of purple sweet potato flour and glutinous rice gave a very significant effect on moisture content. Table 1 shows that the highest moisture content was found in ombus-ombus treatment percentage substitute 30% purple sweet potato flour (44.5%), the lowest moisture content found in ombus-ombus treatment percentage substitute 0% purple sweet potatoes flour (41.4%). According to the National Standards Agency (SNI 01-4309-1996) [8], the maximum moisture content of cake is 40%. The moisture content of ombus-ombus cake still measures up to the current standards.

Moisture content is one parameter that is quite important in flour products because it is related to quality, safe moisture content for flour-like products, which is less than 12% [9]. The difference in moisture cognitive operation is caused by the use of different adds up to of rice flour, where purple sweet potato flour has a higher come of moisture than glutinous rice flour. In the observations made, the purple sweet potato flour made had a moisture content of 10.5% and glutinous rice flour content of 9.8%. The differences in moisture content of the raw materials might affect the resulted product. The difference in the esteem of moisture content with storage does not allow lot dissimilar values, This is in accordance with former search conducted by [10] who examined the shelf animation of purple sweet potato klepon with very cold, which is supported on the results of the psychoanalysis on the seventh day of the level esteem pee has not changed lot. Ombus-ombus cake has the identical type of cake and identical constitution so that the klepon can be a comparison.

In addition, storage temperature also had a significant core (P<0.05) on the moisture cognitive operation of the ombus-ombus cake produced. The highest moisture cognitive operation was found in ombus-ombus cake stored at freezing (43.4%) and the lowest water content was found in ombus-ombus cake stored at room storage (42.4%). The results obtained are not much dissimilar from the research conducted by [11] on the manufacture of dodol victimisationing purple sweet potato and glutinous rice, where the more purple sweet potato flour is added, the dodol moisture content also increases because purple sweet potato flour has the higher moisture content than glutinous rice flour.

In this study, the low effect between storage temperature and moisture content in ombus-ombus cakes because of storage conditions for the ombus-ombus cake are tightly closed so there is no migration of water vapor the environment to the material [12].

3.2. Physical characteristics

3.2.1. Hedonic colour. Highest colour hedonic value is found in the percentage substitute 20% purple sweet potato flour (4.6%) and the lowest colour hedonic value found in treatment percentage substitute 0% purple sweet potato flour and 100% glutinous rice flour (2.6%). In other rows, the percentage backup 20% flour was preferred by the panellists. Use of purple sweet potato flour in the product increased the panellists’ preference for ombus-ombus cake might be caused by the purple colour of the sweet potato, indicating higher amount of anthocyanin. Anthocyanin is a pigment producing reddish colour. The anthocyanins were located in the liquid of sweet potato cells and are easily dissolve in water [13]. Anthocyanin in purple sweet potatoes have constituent components, namely mono or diacetyl 3-(2-glucosil) glucosyl-5-glucosyl peonidin cyanidin derivatives [14]. The storage had an insignificant difference (P> 0.05).
3.2.2. *Hedonic aroma.* The highest aroma value was found ombus-ombus made of percentage substitute 20% purple sweet potato flour (4.2%) and the lowest hedonic value of aroma was found in ombus-ombus with percentage substitute 100% glutinous rice flour (3.5%). Amongst all treated ombus-ombus, the substitution of 20% had the highest acceptance in terms of the aroma. Aroma is a measure of acceptance of a product which can be accepted if the product has specific characteristics [15]. The constituents that cause the aroma of the material are volatile compounds [16]. The influence of the main character on the fragrance of the purple sweet potato itself was not too strong. The storage had no significant core (P> 0.05) on the hedonic esteem of the ombus-ombus cake aroma.

3.2.3. *Hedonic taste.* Table 1 presents the taste results, panellist favourite ombus-ombus with only 20% of purple sweet potato flour substitution. As the taste is the most important for food product, it seemed that the proper formulation for the ombus-ombus was 20% of sweet potato flour and 80% of glutinous rice flour. In addition, purple sweet potatoes contain sugar (10-22.4%) which produces sweet taste in ombus-ombus cakes. The main sugars from the starch breakdown, glucose, sucrose, and fructose, are very influential in the formation of flavours. Fructose generally gives a sweeter taste than glucose and sucrose [17]. Moreover, storage condition had no importantly dissimilar (P> 0.05) on hedonic value of ombus-ombus cake taste.

3.2.4. *Hedonic texture.* In terms of texture ombus-ombus made of percentage substitute 20% purple sweet potato flour treatment had the highest texture value. This happens because its addition to glutinous rice flour makes the texture softer because the water-holding capacity decreases with the use of partial substitute flour for glutinous rice flour. Glutinous rice starch has the ability to bind water because of its high amylopectin levels [18]. According to [19] glutinous rice flour which is added water and heated will cause the starch to absorb water and form a thick paste. When adding glutinous rice flour, the texture of the product will be softer and will affect the stimulation of the taste buds. In contrast, storage condition gave no importantly dissimilar effect (P> 0.05) on the hedonic esteem of the ombus-ombus cake taste.

4. **Conclusions**

Based on the research, it can be concluded that the best formulation is ombus-ombus cake with a 20% substitution formulation of purple sweet potato flour either the product was stored at room temperature and freezing temperature. Besides the moisture content, organoleptic values for the ombus-ombus supported the finding that substitution of 20% sweet potato flour resulted in best cake in this study. The finding can suggest the possibility of sweet potato for food diversification in making ombus-ombus.

**References**

[1] Izzati F, Aritosang E Y and Siagian A 2015 Analisis indeks glikemik (IG) pada nasi campuran antara beras (Oriza sp) dengan ubi jalar orange (Ipomoea batatas L) [Analysis of the glycemic index (GI) of mixed rice (Oriza sp.) and orange sweet potato (Ipomoea batatas L)] *Gizi, Kesehatan Reproduksi* 13 pp 1–13

[2] Setiawan M, Putra S T, Sargowo D 2019 Efficacy of purple sweet potato (Ipomoea batatas) extract to prevent the aortic wall thickness of white male rats atherosclerosis model *Medicinal Plants-International Journal of Phytomedicines and Related Industries* 11 1 pp 55–59

[3] Oktaviono Y H, Al-Farabi M J, Suastika L O S, Hartono F, Dirgantara Y, Sandra F 2019 Preliminary study: Purple sweet potato extract seems to be superior to increase the migration of impaired endothelial progenitor cells compared to L-ascorbic acid *Sci. Pharm.* 87 16 pp 1–9

[4] Wahyu S P 2016 Pemanfaatan tepung ubi ungu dalam pembuatan katengong likubiu dan kue moci mobilu [The use of purple sweet potato flour in making katengong likubiu and moci mobilu cake] *Proyek Akhir [Final Project]* (Yogyakarta: Program Studi Teknik Boga Fakultas Teknik UNY [Department of Food Engineering Faculty of Engineering UNY]).

[5] Bangun M K 1991 *Rancangan Percobaan [Experimental Design]* (Medan: Fakultas Pertanian [Faculty of Agriculture] Universitas Sumatera Utara)
[6] AOAC 1995 *Official Methods of Analysis* (Washington D.C: The Association of Official Analitycal Chemists)

[7] Soekarto S T 1985 *Penilaian Organoleptik untuk Industri Pangan dan Hasil Pertanian* [Organoleptic Assessment for Food and Agricultural Products Industry] (Jakarta: Bharatara Karya Aksara)

[8] Badan Standarisasi Nasional [BSN- National Standarization] 1996 Kue Basah [Cake’s Wet] SNI: 01-4309-1996 (Jakarta, Indonesia: Badan Standarisasi Nasional Indonesia [BSN- National Standarization of Indonesia])

[9] Winarno F G 2004 *Kimia Pangan dan Gizi* [Food Chemistry and Nutrition] (Jakarta: PT Gramedia Pustaka Utama)

[10] Cendekia D, Pujiono A S and Muladi A 2019 *Analisis daya simpan produk klepon ubi jalar beku* [Analysis of the shelf life of frozen sweet potato klepon products] *Jurnal Analisis Farmasi* 4 2 pp 73–6

[11] Riska 2016 *Pembuatan dodol dengan variasi konsentrasi gula dan perbandingan tepung jalar ungu dengan tepung ketan [Making dodol with various sugar concentrations and the ratio of purple sweet potato flour to glutinous rice flour]* *Bachelor thesis* (Banda Aceh: Fakultas Pertanian [Faculty of Agriculture] Universitas Syah Kuala)

[12] Solihin, Muhtarudin and Sutrisna R 2015 *Pengaruh lama penyimpanan terhadap kadar air kualitas fisik dan sebaran jamur wafer limbah sayuran dan umbi-umbian [The effect of storage time on water content of physical quality and distribution of wafer fungi of vegetable and tuber waste]* *Jurnal Ilmiah Peternakan Terpadu* 3 2 pp 48–54

[13] Anjani E P, Oktarlina R Z and Morfi C W 2018 *Zat antosianin pada ubi jalar ungu terhadap diabetes melitus* [Anthocyanin substances in purple sweet potatoes against diabetes mellitus] *Majority* 7 2 pp 257–62

[14] Suda I, Oki T, Masuda M, Kobayashi M, Nishiba Y and Furuta S 2003 *Physiological functionality of purple-fleshed sweet potatoes containing anthocyanins and their utilization in foods* *JARQ* 37 3 pp 167–73

[15] Rampengan V, Pontoh J and Sembel D T 1985 *Dasar-dasar Pengawasan Mutu Pangan* [Basic Food Quality Supervision] (Ujung Pandang: Badan Kerjasama Perguruan Tinggi Negeri Indonesia [Indonesian National College Cooperation Agency])

[16] Dumas J A, Ortiz C E and Soler S 2012 *Tastes and volatiles of tropicaltype sweet potatoes* *J.Agric.Univ. P. R.* 96 3 pp 183–90

[17] Zhang Z, Wheatley C C and Corke H 2002 *Biochemical changes during storage of sweet potato roots differing in dry matter content* *Postharvest Biology and Technology* 24 pp 317–25

[18] Larasati D 2016 *Perbandingan tepung beras ketan putih (Ci Asem) dengan tepung beras ketan hitam (setail) dan konsentrasi murbei (Morus nigra L.) terhadap karakteristik opak ketan hitam [Comparison of white glutinous rice flour (Ci Asem) with black glutinous rice flour (Setail) and concentration of mulberry (Morus Nigra L.) on the characteristics of black glutinous rice opaque]* *Bachelor thesis* (Bandung: Program Studi Teknologi Pangan [Food Technology Study Program Pasundan University])

[19] Haryadi 2006 *Teknologi Pengolahan Beras* [Rice Processing Technology] (Yoyakarta: Gadjah Mada University Press)