

Physicochemical, Microbiological and Sensory Properties of Dabai Cake

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Abstract: Dabai is one of the indigenous seasonal fruits that can be found in Sarawak. The nutrient-rich dabai has tremendous application in food product development including formulating dabai into cake mixture as its nutrients affect the quality of the cake produced. The aim of this study is to determine the physicochemical properties, microbiological and sensory characteristics of dabai cake. Physicochemical properties including proximate analyses as well as macro mineral analyses were conducted according to the standard methods. From the analyses, the moisture content ranges from $29.94 \pm 0.40\%$ to $33.49 \pm 0.50\%$, ash content $1.44 \pm 0.12\%$ to $1.49 \pm 0.02\%$, protein content $7.15 \pm 0.38\%$ to $9.28 \pm 0.29\%$, and fat content $14.67 \pm 0.76\%$ to $18.83 \pm 1.04\%$. In addition, it is also found that the amount of mineral including Na, K, Ca, Mg, Fe and Zn increased proportionally with dabai content in the formulation. Furthermore, the microbial loads of dabai cake were either none or too few to count throughout the duration of 35 days stored in chiller within 4°C to 9°C . In terms of general acceptability, the cake was that incorporated with 10 g of dabai is the most preferred with the mean score of 6.90. From this study, it is found that the production of dabai cake contains acceptable amount of nutrients with no significant differences of sensory attributes and can be stored up to 35 days in chiller.

Keywords: Dabai cake, indigenous fruit, physicochemical properties, microbiological, sensory analysis.

INTRODUCTION

White at its early stage of fruiting and purple when ripe, dabai (*Canarium odontophyllum Miq.*) is one of the indigenous seasonal fruits found in Sarawak. It is a well-known fruit to the local and usually consumed after being soaked in warm water for few minutes to soften it and mix with salt or soy sauce. Soaked dabai is also eaten with rice just like salad or as main ingredient in fried rice.

Studies of fresh dabai and dabai oil are well documented and available online [1,2,3]. In addition, there is a list of products developed based on dabai fruits. Current food products developed from dabai include: dabai paste, dabai crackers, pitted dabai, dabai crystal cake and dabai pizza. The Agriculture Research Centre, Semongok, Sarawak has developed the recipes for pizza, snack, maki (dried seaweed roll), pitted pickles, desserts and salad dressing based on dabai fruits [4].

Hence, there is a need to do research on dabai fruit to diversify the based products. Research findings on nutritional values, chemical and physical properties may contribute to the future development especially in food product processing. Dabai fruit has the potential to be a very good source of nutrients and minerals. It has been reported that the energy content of dabai is high which is

within the range from 149 to 339 kcal, while fat content is 26.2% and protein 3.8% [5,6]. Dabai also contains minerals such as potassium (810 mg), phosphorous (65 mg), calcium (200 mg) and magnesium (106 mg) [5,6]. Meanwhile Azlan *et al.*, [7] reported that two clones of dabai called Jamba and Sintu were identified. These clones have advanced characteristics and better physical properties [7]. Shakirin *et al.*, [8], found that the total phenolic content of dabai skin and flesh is 6.13 ± 0.74 mg GAE/g.

One of the potential dabai based products is dabai cake. Generally, cake is a mix of flour, sweetening agent, sugar, a binding agent, fats, flavours and leavening agents. Cake is a baked product which is usually sweet. According to Offia Olua and Edide, [9] the quality of fruit cake is mostly determined by the type of fruits and nuts content and taste. Since dabai has been reported to contain a lot of nutrients [1,3,5,6,7] there is a potential in adding dabai into cake mixture as its' nutrients may enhance the quality of the cake produced.

In addition, dabai cake may have a huge potential in the market since dabai is one of the famous fruit to the local in Sarawak. Thus, this study was conducted to determine the physical properties, microbiological and sensory characteristics of dabai cake produced.

MATERIALS AND METHODS

10 kg of matured dabai fruits were bought from Sibul Central market. The fruits were immediately delivered to Food Processing Laboratory in University College of Technology Sarawak (UCTS) Sibul. The fruits were stored at -20°C in freezer before further processing and analysis. Prior to analysis, the fruits were taken out of the freezer and thawed at room temperature.

Sample Preparation

Dabai fruits were soaked in the lukewarm water for about 15-20 minutes at 50°C to soften the flesh and skin. The seed was removed, the flesh and skin were placed in a bowl and then put aside. The ingredients used for baking dabai cake were salted butter, fine sugar, eggs, vanilla essence, self-rising flour and full cream milk.

In the beginning, butter and sugar were beaten until fluffy by using a mixer. Eggs and vanilla essence were then added and mixed well. Next, the self-rising flour and full cream milk were added. Finally, the dabai flesh and skin were added to the mixture and mixed well. The formulation of each ingredients and the quantity of dabai flesh and skin are shown in Table 1. The homogenous mixtures were poured into cake mould and baked in an oven for 30 minutes at 180°C (top) and 160°C (bottom). The oven was preheated at the same top and bottom temperature for 10 minutes prior to baking. The cake was cooled to room temperature and then stored in chiller between 4°C - 8°C for further analysis

Table 1: Formulation of dabai cake

Ingredients	Level of incorporation				
	Control	Formula 1	Formula 2	Formula 3	Formula 4
Salted butter (g)	75	70	65	60	55
Fine sugar (g)	95	95	95	95	95
Fresh eggs (g)	100	100	100	100	100
Vanilla essence (g)	1	1	1	1	1
Self-rising flour (g)	200	200	200	200	200
Full cream milk (g)	110	110	110	110	110
Dabai flesh and skin (g)	0	5	10	15	20

Physicochemical analysis

Determination of macronutrient compositions including moisture, protein, fat, ash and carbohydrate of dabai cake were conducted according to the methods of AOAC (2016). All samples were analysed in triplicates and the results were expressed as g/100 g of fresh samples.

Moisture content was determined using the direct drying method [10]. Approximately 5.00±0.10 g of homogenised samples were prepared in triplicates. The samples were dried overnight in an air-oven (Memmert, Germany) set at 103°C. The moisture content is calculated by using Eq. 1.

$$\%moisture = \frac{Initial\ Weight - Final\ Weight}{Initial\ Weight} \quad (Eq. 1)$$

Protein content of dabai cake was determined according to the principle of Kjeldahl method [10] on a mechanised and automated Kjeltex instrument (Foss, China). Homogenised sample 2.00±0.10 g was digested with 15 ml concentrated sulphuric acid (H₂SO₄) using electrically heated aluminium block digester. The digested sample was diluted and made alkaline with 50 ml 40% sodium hydroxide (NaOH). This was followed by rapid steam distillation of ammonia from the diluted digest into 25 ml 4% boric acid for manual titration with 0.1 N hydrochloric acid (HCl). A conversion factor of 6.25 was used to convert the measured nitrogen content to protein content.

Crude fat content was determined by solvent extraction method [10]. A 2.00±0.10 g of homogenised sample was extracted with 120 ml petroleum ether on a Soxhlet apparatus for approximately 80 minutes. The process starts with boiling the sample for 20 minutes, then rinsing for 40 minutes, solvent recovery for 10 minutes and finally drying process took 10 minutes. Petroleum ether was removed by evaporation and the residue of lipid was weighed.

Dry ashing method [10] was applied to determine the ash content of the dabai cake. Approximately 2.00±0.10 g of homogenised sample was placed evenly on the ashing crucible. The weight of the ashing crucible was recorded. They were then placed inside the muffle furnace (Nabertherm, Germany) set at 550°C for 24 hours or until greyish ash was obtained. After cooling, the weights of the ashing crucible were recorded. The resulting ash was digested for determination of minerals composition in dabai cake.

Determination of available carbohydrate [10] in the sample was calculated by difference method in which by subtracting the sum of above values from 100.

Microbiological Analysis

Yeast and moulds test method was adopted and modified from Offia Olua and Edide, [9]. The tests were conducted for 36 days to determine the presence of microbes in the dabai cake stored in a chiller. The media for yeast and moulds tests were Dichloran Rose Bengal Chloramphenicol (DRBC) agar. Yeast and moulds tests

for dabai cake were analysed for five weeks. 25 g of a homogenate sample was aseptically mixed with 9 ml of 0.1% sterilized peptone water in a test tube. The mixture was diluted serially to the sixth diluents (10⁶). The inoculum was aseptically spreaded on DRBC agar and incubated at 30°C for 5 days. The number of colonies of each plate was counted with the aid of colony counter.

Sensory Evaluation

Sensory evaluation of the cake samples was conducted within 6 hours of production in the food processing laboratory of Food Technology Programme, School of Engineering and Technology, UCTS, using a total of 40 untrained panelists among UCTS staff and students. The 9-point hedonic scale was used where 1 represented dislike extremely and 9 like extremely.

RESULTS AND DISCUSSION

Physicochemical properties

The physicochemical properties of the studied dabai cake are shown in Table 2. Formula 4 has the highest moisture content of 33.49 g/100 g compared to other formulations while control has the lowest moisture content of 29.94 g/100 g. Raw dabai is reported to have moisture content 45.72 – 73.45 g/100 g [2]. The high moisture content in dabai was attributed to the high amounts of dabai fruit added to the cake. In addition, moisture content may be affected by crude fiber in raw dabai. According to Boon and Hong [6], the crude fiber of raw dabai is 4.3 g/100 g. Hence, it can be reported that higher dabai content contributes to higher moisture content in dabai cake.

Formula 4 showed the highest ash content with 1.49 g/100 g while the lowest ash content was detected in control formula with 1.44 g/100 g. Ash content of dabai fruit is within the range of 1.67 – 4.35 g/100 g [2][6]. Ash content is a measure of total amount of minerals present in the food such as calcium, magnesium, potassium and phosphorus. As raw dabai is reported to have acceptable amount of nutrients and minerals [5][6], it is expected that addition of dabai will influence the ash content. Thus, from this study, it was found that higher amounts of dabai added to the cake subsequently increased the ash content.

Protein content of dabai cake was detected highest in formula 3 which is 9.28 g/100 g, followed with formula 4 (9.22 g/100 g), formula 2 (8.62 g/100 g), formula 1 (7.53 g/100 g) and the lowest is control (7.15 g/100 g). Previous studies reported that protein content in raw dabai is within the range from 2.93 to 12.37 g/100 g

[2][6]. Since the protein analysed in this study is crude or total protein, therefore the protein assay results may also be influenced by the protein coming from the eggs and milk added to the recipe.

Fat content showed control has the highest mean score of 18.83 g/100 g, followed with formula 1 (18 g/100 g), formula 2 which is 17 g/100 g while formula 4 has the lowest mean score of 14.67 g/100 g. In the formulation, as the amount of dabai is increased, the amount of butter is reduced accordingly. Thus, this contributed to lower fat content of dabai cake. Butter may contain higher fat compared to dabai fruit. Previous studies conducted by Chua *et al.* [2] and Azrina *et al.* [11] reported that lipid content in dabai pulp is 6.46 – 27.66 g/100 g or 22.37% respectively. Thus, a small amount of dabai is enough to give sufficient amount of lipid or fat needed in the cake formulation. Therefore, dabai may be a good alternative to reduce the amount of butter used as formulated in this study.

The total carbohydrate content calculation depends on the content of moisture, ash, protein and fat in the dabai cake. It is not significantly difference between all formulations. Table 3 showed nutrient content of dabai cake. The amount of Na, K, Ca, Mg, Fe and Zn increased after adding dabai into the formulation. This result is also in agreement with the ash content measured earlier in this study.

Microbiological properties

Most fresh baked products usually have a few days of shelf life at ambient temperature. One of the major losses in the bakery industry is cause by the microbial growth. Microbial spoilage in cakes happens due to fungal growth, which can be seen on the surface of the cake [12]. Based on the analysis conducted in this study, it was found that the number of colony was either none or too few to count (lower than 30). Hence, from this study, it was found that dabai cake can be stored without spoilage at least for 35 days in the chiller within 4°C - 8°C.

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Table 2: Physicochemical properties of dabai cake

Formula	(g/100 g) Moisture	(g/100 g) Ash	(g/100 g) Protein	(g/100 g) Fat	(g/100 g) Carbohydrate
Control	29.94 ± 0.40 ^a	1.44 ± 0.12 ^{ab}	7.15 ± 0.38 ^a	18.83 ± 1.04 ^b	48.65 ± 1.40 ^a
Formula 1	31.08 ± 0.19 ^{ab}	1.45 ± 0.29 ^{abc}	7.53 ± 1.11 ^a	18.00 ± 0.87 ^b	48.27 ± 0.84 ^a
Formula 2	31.72 ± 0.83 ^{bc}	1.47 ± 0.01 ^{bc}	8.62 ± 0.63 ^{ab}	17.00 ± 1.5 ^{ab}	48.43 ± 1.70 ^a
Formula 3	32.65 ± 0.16 ^{cd}	1.41 ± 0.01 ^a	9.28 ± 0.29 ^b	16.33 ± 0.29 ^{ab}	48.12 ± 0.30 ^a
Formula 4	33.49 ± 0.50 ^d	1.49 ± 0.02 ^c	9.22 ± 0.29 ^b	14.67 ± 0.76 ^a	48.87 ± 1.17 ^a

Mean values in the same column not followed by the same letter are significantly different ($p \leq 0.05$)

Table 3: Nutrient content of dabai cake

Formula	(mg/100 g) Na	(mg/100 g) K	(mg/100 g) Ca	(mg/100 g) Mg	(mg/100 g) Fe	(mg/100 g) Zn
Control	292.1 ± 2.47 ^a	129.4 ± 0.7 ^a	46.6 ± 1.08 ^a	16.67 ± 0.81 ^a	2.73 ± 0.32 ^a	0.05 ± 0.02 ^a
Formula 1	428.5 ± 5.85 ^c	159.9 ± 13.1 ^b	51.07 ± 2.15 ^a	18.1 ± 0.8 ^a	2.57 ± 0.31 ^a	0.12 ± 0.06 ^{a,b}
Formula 2	319.72 ± 10.72 ^b	149.07 ± 7.05 ^{ab}	54.33 ± 8.31 ^a	19.1 ± 1.28 ^a	2.77 ± 0.4 ^a	0.07 ± 0.02 ^{a,b}
Formula 3	313.5 ± 5.81 ^{ab}	167.97 ± 17.34 ^b	55.27 ± 7.33 ^a	20.7 ± 2.4 ^a	3.13 ± 0.49 ^a	0.17 ± 0.03 ^{bc}
Formula 4	405.87 ± 16.07 ^c	160.93 ± 5.51 ^b	52.57 ± 2.90 ^a	20.87 ± 3.3 ^a	2.43 ± 0.26 ^a	0.26 ± 0.06 ^c

Mean values in the same column not followed by the same letter are significantly different ($p \leq 0.05$)

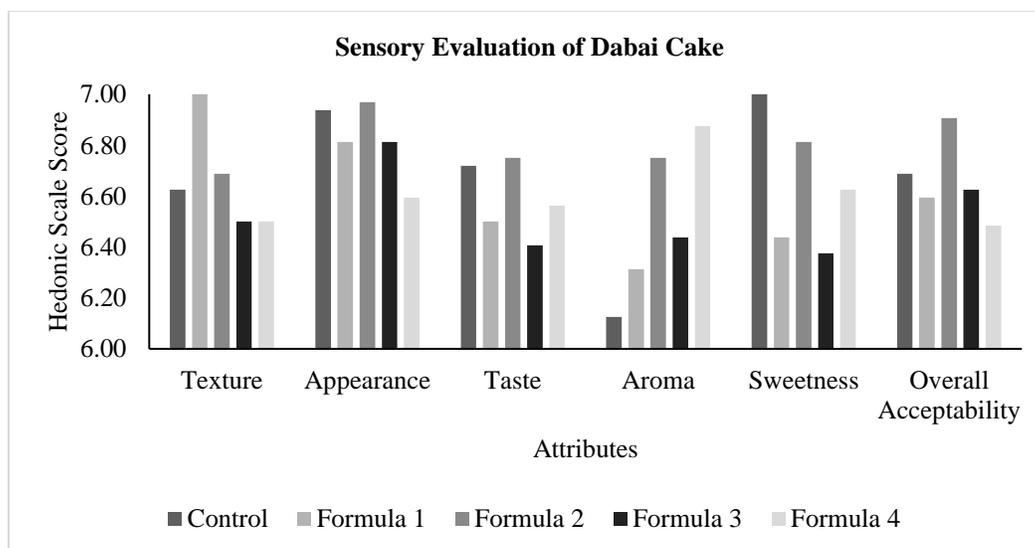


Figure 1: Sensory evaluation of dabai cake

Sensory properties

In sensory analysis, five attributes were evaluated including texture, appearance, taste, aroma and sweetness. The findings were shown in Figure 1. In terms of texture, the panelists preferred formula 1 while for appearance and taste they liked formula 2. In terms of aroma formula 4 has highest score while for sweetness, control showed highest score and followed by formula 2. For overall acceptability, formula 2 showed the highest score among other formulation and control. In formula 2, 10 g of dabai were added into the cake formulation. Hence, it can be concluded that panelists preferred formula 2 compared to other formula.

CONCLUSION

Findings from this study revealed the nutritional properties contained in dabai cake. It includes protein, fat, energy and minerals such as potassium, magnesium and calcium. In terms of proximate analysis, it is found that the amounts of dabai added to the formulation influenced significantly the nutrient content of dabai cake. There were no significant differences ($p>0.05$) between all the formulations based on the sensory attributes. In terms of the mineral contents, sodium, potassium and zinc content were significantly difference ($p\leq 0.05$) between all formulations while no significant differences ($p>0.05$) of calcium, magnesium and iron content in the formulations. In this study, it has been found that dabai cake could be kept for at least 35 days in a chiller ($4^{\circ}\text{C} - 8^{\circ}\text{C}$).

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REFERENCES

- [1] Azlan, A., K. N. Prasad, H. E. Khoo, N. Abdul-Aziz, A. Mohamad, A. Ismail and Z. Amom, 2010. Comparison of fatty acids, vitamin E and physicochemical properties of *Canarium odontophyllum* Miq. (dabai), olive and palm oils. *J. Food Compos. Anal.* 23(8): 772–776.
- [2] Chua, H. P., D. Nicholas and M. N. A. Yahya, 2015. Physical properties and nutritional values of dabai fruit (*Canarium odontophyllum*) of different genotypes. *J. Trop. Agric. and Fd. Sc.*, 43(1): 1–10.
- [3] Shakirin, F. H. K. N. Prasad, A. Ismail, L. C. Yuen and A. Azlan, 2010. Antioxidant capacity of underutilized Malaysian *Canarium odontophyllum* (dabai) Miq. *Fruit. J. Food Compos. Anal.* 23(8): 777–781.
- [4] Berita, 2008. Commercialising dabai as Sarawak's specialty fruit. [Online] Available at: <<http://www.ehoza.com/v4/forum/health-delicacy-english/32052-commercialising-dabai-sarawaks-specialty-fruit.html>> [Accessed 19 May 2018].
- [5] Chua, H.P. and Nicholas, D. (2016). Dabai – Specialty fruit of Sarawak. *Scientia MARDI* 8: 10 Available at https://www.scribd.com/document/327857829/Scientia-MARDI-Vol-008-September-2016?campaign=SkimbitLtd&ad_group=725X1342Xc1129ea045f6574fb3a21c7de1aa82dc&keyword=660149026&source=hp_affiliate&medium=affiliate [Accessed 21/1/2019]
- [6] Boon Hoe, V. and Hong Siong, K., 1999. The nutritional value of indigenous fruits and vegetables in Sarawak. *Asia Pac. J. Clin. Nutr.*, 8(1): 24–31.
- [7] Azlan, A., N. N. M. Nasir, Z. Amom, and A. Ismail, 2009. Physical properties of skin, flesh, and kernel of *Canarium odontophyllum* fruit. *J Food Agric Environ.* 7(3–4): 55–57.
- [8] Shakirin, F.H, A., Azrina, I. Amin, and C. Y. Lau, 2009. Nutritional composition of *Canarium odontophyllum* Miq. *Proceedings of 11th Asean Food Conference 2009*. Brunei, Oct 21–23.
- [9] Offia Olua, B. I., and Edide, R. O. 2013. Chemical, Microbial and Sensory Properties of Candied-Pineapple and Cherry Cakes. *Nigerian Food Journal.* 31(1): 33–39.
- [10] AOAC., 2016. *Official Methods of Analysis*. 20th Edn. Association Official Analytical Chemists. USA: AOAC International.
- [11] Azrina, A., I. Amin, and I. Muhammad, 2007. Proximate composition and characterization of fat in *Canarium odontophyllum*. *Proceedings 10th Asean Food Conference 2007: Food for mankind – Contribution of science and technology*. Kuala Lumpur, Aug. 21 – 23.
- [12] Saranraj, P. and Geetha, M., 2012. Microbial spoilage of bakery products and its control by preservatives. *Int. J. Pharma. Bio. Archieves*, 3(1): 38–48.