Borneo Journal of Sciences & Technology, Volume (1), Issue (2), Pages: 74-77
DOI: https://doi.org/10.35370/bjost.2019.1.2-11
e-ISSN: 2672-7439

Submitted: 10th April 2019 Accepted: 30th April 2019 Published: 31st July 2019

Physicochemical Characteristics and Proximate Analysis of Fruit Jam from *Baccaurea angulata* Peel

Suzy Rini Gindi, Koh Chen Chung, Sebastian Chua Phin Lun and Hii Siew Ling
School of Engineering and Technology, University College of Technology Sarawak, No. 1, Jalan Universiti, 96000 Sibu, Sarawak, Malaysia.

Abstract: The purpose of this study was to develop a food product from the peel of an under utilised native fruit, *Baccaurea angulata*, known locally as Belimbing Hutan. The peel of *Baccaurea angulata* fruit makes up more than 60 % of the fruit and is a significant source of food waste having potential to be explored. As such, the present study was the first to explore the feasibility of producing a food product from the peel. Using conventional jam making technology, the peel of *Baccaurea angulata* was used as the principal ingredient besides sugar and pectin to develop a jam product. The physicochemical properties and nutritional composition of the jam were determined by the Association of Analytical Chemists (AOAC) official methods of analyses with slight modifications as written in methods section. The nutrition composition included moisture content, protein, fat and ash. Carbohydrate was calculated by subtracting the sum of protein, fat, moisture, ash and crude fibre from 100%. Vitamin C was determined by Iodometric titration. Physicochemical properties such as pH, total soluble solid (TSS) and titratable acidity (TA) were also determined. The jam product has an acidic pH which is 2.82. The other results of the study indicated that jam produced from *Baccaurea angulata* had similar properties as other well-known fruit jams. The results showed that *Baccaurea angulata* jam was rich in carbohydrate (69.85 %) and supplied 279.84 kcal of energy.

Keywords: *Baccaurea angulata,* Jam, Sarawak, Physicochemical, Proximate analysis.

INTRODUCTION

The state of Sarawak is well known for its rich biodiversity. However, many of its plant resources are under utilised especially the *Baccaurea* genus. This genus has 100 species but only 3 species can be found in Sarawak and they are seasonal fruit. This research focused on *Baccaurea angulata* skin or peel. The fruit berry (30.72%) is consumed by the indigenous people as parts of their daily diets but the peel that makes up to 69.28 % of its weight was discarded [1]. This is considered a significant fruit waste if the peel is not fully utilized. Furthermore, agro-waste is a big challenges to nationwide and fully utilized of fruits waste is among the main goal in food and agriculture industries [2]. The *Baccaurea angulata* peel is succulent and sour having attractive colours ranging from pink to purple. The riped fruit is lighter in colour than the unriped fruit. At present, there is no research conducted on converting the peel to become a food product. Most of the previous research of *Baccaurea angulata* concentrated on its bioactive compounds, nutritional composition, health effects and drying methods of its whole fruits.

Jam is a popular confectionery to preserve fruits especially seasonal fruit so that it can be enjoyed all year round [3]. According to the Malaysian Food Act and Regulations 1985, fruit jam must contain at least 35% of fruit; this means that a large amount of *Baccaurea angulata* peel can be utilised to reduce wastage [4]. In this research, the jam was a mixture of *Baccaurea angulata* peel, water, sugar and pectin without any additives such as colouring or artificial flavour. The three main ingredients, namely *Baccaurea angulata* peel, sugar and pectin, the variables were manipulated in jam formulation. Pectin from apple was used as thickener and gelling agent [5].

The best formulation was selected by a sensory panel and was then subjected to proximate and physicochemical analyses. All the proximate analyses employed in this study followed the AOAC methods: moisture content, crude protein, crude fibre, total ash, fat and carbohydrate [6]. The physicochemical analysis is a system to determine the physical properties and composition of each materials in food products. These include pH, total soluble solid (TSS), acidity, amino acid etc. The physicochemical was used to determine

Corresponding Author: Suzy Rini, Affiliation: University College of Technology Sarawak, 084-367 506, e-mail: suzy@ucts.edu.my

and/or evaluate the quality control, product development and food regulation requirements.

MATERIALS AND METHODS

Sample Collection

Fresh *Baccaurea angulata* fruits were bought from local wet market around Sibu, Sarikei and Kanowit as this fruit can be easily found in the central region of Sarawak. The fruit was sold at its commercial ripening stage. These fruit will be kept in frozen state at -20^{o}C to preserve the quality before use [1].

Jam Preparation

Sorting was carried out to separate rotten and badly damaged fruits. Then, the whole fruit was washed thoroughly with distilled water to remove dirts. The fruit was cut into two to separate the pulp from the peel. The peel was blended into puree and the pulp was kept for other uses. The puree was then processed into jam according to the Food and Agriculture Organization's guidelines with slight modifications with no addition of citric acid; and also alternation of pectin and sugar methods [7]. The best formulation was based on the optimal acceptability from the sensory evaluation generated by D-Optimal of Mixture Design of Design Expert Version 10 software. First, 49.5% puree were boiled and stirred continuously. Then, 49.5 % sugar was added followed by 1.0 % of pectin alternately until completed. The mixture was kept boiling and stirred until its total soluble solid reached more than 65 %. The resulting jam was poured into sterile bottles by using the hot filling method. According to hot filing method, jam must be heated to 90-95^{o}C for 15-30 seconds. Then, the bottle is capped, and it is turned on its side or upside down followed by rapid cooling of the bottle.

Proximate Analysis

Proximate analysis was conducted on the most well-accepted jam formulation. The moisture content was determined by drying two grams of samples in the oven heated to 105^{o}C until constant weight. Loss on drying was taken as moisture content [8]. Ash was estimated using dry ashing method where two grams of sample was incinerated in a muffle oven at 550^{o}C for 12 hours [8]. Crude protein content was determined by Kjeldahl method (AOAC, 2005). The digestion was performed using digester machine (FOSS Labtec Line) and distillation by distillation machine (FOSS Kjeltec 8100). Soxhlet method was used to determine fat content [8]. Fat content was determined by extracting two grams of ground sample with petroleum ether in a soxhlet extractor. Crude fibre was determined by successive treatment with sulphuric acid and sodium hydroxide. The residue remaining after this treatment was dried and weighed and taken to be the weight of crude fibre [8]. Carbohydrates was calculated following Menezes *et al*. (2004) method [9]. The energy content was calculated by adding the calories from protein, carbohydrate and fat [10]. Finally, redox titration was carried out to determine vitamin C [10]. All analyses were performed in triplicates.

Physicochemical Analysis

The pH value of the jam was determined by pH meter (Sartorius, Model PB-10) on 10 mL of sample at 20^{o}C. Handheld refractometer was used to determine the total soluble solids (TSS) of jam (ATAGO, Model Master-T). Titratable acidity (TA) was determined by titration with 0.1M sodium hydroxide. Few drops of phenolphthalein indicator were added to 10mL of sample in a conical flask. Titratable acidity was determined after the pink colour of solution persisted for at least 30 seconds. All determination was performed in triplicates.

RESULTS AND DISCUSSION

Proximate Analysis

Baccaurea angulata is a seasonal fruit producing approximately 60 % of fruit waste. As shown in Table 1, the moisture of the jam was lower (29.89%) compared to the strawberry jam in the market (31.23 %). This was in consonance with the result of Norhazni *et al.,* [11] reporting that the moisture content of the peel of *Baccaurea angulata* was 11.37%, the indicator of the jam shelf life [12]. Lower moisture content of the jam was preferable as this gave the product a longer shelf life [12].

The protein and fat contents were 0.11 % and 0%, respectively as the main ingredient of the jam. The fruit peel, was low in protein and fat. The amount of ash content was also very low (0.15%). Low amount of ash indicated a low level of minerals content [13].

On the contrary, carbohydrate (69.85%) with an energy value (279.84 kcal) is high. This could be due to the high amounts of sugar (more than 40%) as well as the fruit peel used in the formulation.

The content of vitamin C (8.06mg/g) in *Baccaurea angulata* peel jam was higher than the strawberry jam. The result is in tandem with a previous study by Ahmed *et al.,* [1] that reported a high content of vitamin C in fresh peel of *Baccaurea angulata*. The decrease of vitamin C content was caused by the cooking process (vitamin C leached into the water) during jam production [12].

Table 1. Proximate composition and vitamin C of *Baccaurea angulata* peel jam

Nutrition Composition	*Strawberry Jam (Nurhazni et al., 2013)*	*Baccaurea angulata peel jam*
Moisture (%)	31.23	29.89
Ash (%)	0.23	0.15
Protein (%)	0.41	0.11
Fat (%)	0.03	0.0
Carbohydrate (%)	67.65	69.85
Energy value (kcal)	273.89	279.84
Vitamin C (mg/g)	3.28	8.06

Physicochemical Analysis

Physicochemical analysis covering the pH value and the titratable acidity (TA) is an important measure of the acidity of a product. The value of TA in *Baccaurea angulata* peel jam is 0.07g/L. Normally pH value for fruit or peel jam is acidic, ranging between 2.5 – 3.3 [14, 15]. The *Baccaurea angulata* jam possessed a pH of 2.82. This acidic condition gave the jam a longer shelf life [16]. The correct pH range was also crucial for gel formation and flavour enhancement [12].

The total soluble solid (TSS) content is a measure of the amount of material that is soluble in water and the reading will be in degree Brix [17]. According to the Malaysian Food Act 1983 and Regulations 1985, the TSS of fruit jam must be more than 65^{o}Brix [4]. If lower than this value, the shelf life of the fruit jams would be significantly reduced. The TSS of *Baccaurea angulata* peel jam was 75^{o}Brix which conformed to the act.

Table 2. Proximate composition and vitamin C of *Baccaurea angulata* peel jam

Parameters	*Result*
pH	2.82
Total soluble solid (^{o}Brix)	75
Titratable acidity (g/L)	0.07

CONCLUSION

This research demonstrated the potential of utilising *Baccaurea angulata* for jam manufacture. The moisture content, ash, protein, fat, carbohydrate and energy content were 29.89%, 0.15%, 0.11%, 0%, 69.85% and 279.84 kcal, respectively. The pH, total soluble solids and titratable acidity were 2.82, 75 °Brix and 0.07 g/L, respectively. Although proximate analysis of *Baccaurea angulata* jam did not differ much from that of strawberry jam, it was found to have fairly high amount of Vitamin C which is beneficial to humans as it is one of the important dietary antioxidants for the prevention of oxidative damage.

ACKNOWLEDGMENT

We thank the Centre for research and development department of University College of Technology for grant us a funding to finance this research and also School of Engineering and Technology for its facilities.

REFERENCES

[1] I. A. Ahmed *et al.*, "In vitro antioxidant properties of underutilized Baccaurea angulata fruit," *IJAAEE*, vol. 1, no. 1, pp. 144-50, 2014.

[2] A. Souad, P. Jamal, and K. Olorunnisola, "Effective jam preparations from watermelon waste," 2012.

[3] C. Muresan, A. Pop, S. Muste, S. Scrob, and A. Rat, "Study concerning the quality of jam products based on banana and ginger," *Journal of Agroalimentary Processes and Technologies*, vol. 20, no. 4, pp. 408-411, 2014.

[4] F. Act, "Laws of Malaysia: Food Act and Regulations," ed: Kuala Lumpur: MDC Publishers Printers, 1983.

[5] A. L. Branen, P. M. Davidson, S. Salminen, and J. Thorngate, *Food additives*. CRC Press, 2001.

[6] H. Greenfield and D. A. Southgate, *Food composition data: production, management, and use*. Food & Agriculture Org., 2003.

[7] G. Paltrinieri, F. Figuerola, and L. Rojas, "Technical manual on small-scale processing of fruits and vegetables," 1997.

[8] W. Horwitz, *Official methods of analysis*. Association of Official Analytical Chemists Washington, DC, 1975.

[9] E. W. Menezes, A. T. de Melo, G. H. Lima, and F. M. Lajolo, "Measurement of carbohydrate components and their impact on energy value of foods," *Journal of Food Composition and Analysis*, vol. 17, no. 3-4, pp. 331-338, 2004.

[10] C. S. James, *Analytical chemistry of foods*. Springer Science & Business Media, 2013.

[11] N. M. Nor, K. ANuAr MD iSA, and M. K. AYoB, "Proximate composition and antioxidant activity of dried belimbing dayak (Baccaurea angulata) fruits," *Sains Malaysiana*, vol. 42, no. 2, pp. 129-134, 2013.

[12] P. J. Fellows, *Food processing technology: principles and practice*. Elsevier, 2009.

[13] M. M. Naeem *et al.*, "The nutritional composition of fruit jams in the Malaysian market," *Journal of the Saudi Society of Agricultural Sciences,* vol. 16, no. 1, pp. 89-96, 2017.

[14] M. A. Abdualrahman, "Physico-chemical characteristics of different types of mango (mangifera indica l.) fruits grown in drafur regions and its use in jam processing," *Science International,* vol. 1, no. 5, pp. 144-147, 2013.

[15] O. Ashaye and T. Adeleke, "Quality attributes of stored Roselle jam," *International Food Research Journal,* vol. 16, no. 3, pp. 363-371, 2009.

[16] E. A. Zottola, "Encyclopedia of food science and nutrition," 2003. Elsevier Science Ltd.

[17] S. Azam-Ali, "Fruit Preserves-Jams, Jellies and Marmalades," 2007.