Effect of blanching time and sodium metabisulphite concentration on the physicochemical properties of jackfruit seed flour (*Artocarpus heterophyllus*)

R A Lumban Gaol¹, M Nurminah¹,²* and R J Nainggolan¹

¹Department of Food Science and Technology, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia.
²Centre for Tubers and Roots Crop Study, Faculty of Agriculture, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia.

E-mail: *miminurminah@usu.ac.id

Abstract. This research aimed to determine the physicochemical characteristics of jackfruit seed flour and to develop the utilization of jackfruit seeds. The analysis was performed using a factorial complete randomized design consisting of two factors, blanching time (T1 = 5 minutes, T2 = 10 minutes, T3 = 10 minutes) and sodium metabisulphite concentration (K1 = 200 ppm, K2 = 400 ppm, K3 = 600 ppm ppm). The parameters analysed were moisture content, ash content, fat content, protein content and L value (brightness). The interaction between the two factors has a very significant influence on water content and L value; it has a significant effect on protein content; and not significant effect on ash content and fat content. Jackfruit seed flour with 5 minutes blanching time and 200 ppm sodium metabisulphite concentration produces the best and more acceptable quality of jackfruit seed flour.

1. Introduction

Jackfruit (*Artocarpus heterophyllus*) is very popular with the community and is consumed a lot throughout the year [1]. According to the Central Statistics Agency, in 2016 jackfruit production in Indonesia reached 654,914 thousand tons and in North Sumatra amounted to 10,253 thousand tons [2]. This causes the production of jackfruit seeds is relatively high, but its utilization is still minimal. Though jackfruit seeds are rich in nutritional content such as having a carbohydrate content of 36.7 g, protein 4.2 g, phosphorus 200 mg, calcium 33 mg, and iron 1.0 mg per 100 g and energy 165 kcal [3]. Jackfruit seeds are considered as waste which is only used by steaming, boiling or burning to be eaten by a small portion of the community. Jackfruit seeds as a food ingredient are indeed not popular in Indonesia, but if you get serious handling it can be used as a flour producer that is not inferior to other flour which will increase its economic value and usefulness. One of the obstacles encountered in making jackfruit seed flour is the sap on the seeds that need to be removed to maintain colour and maintain the nutritional content of the flour produced. In this study, one of the efforts to maintain the nutritional content and colour of jackfruit seed flour is blanching with a certain blanching time and soaking in sodium metabisulphite solution [4]. Jackfruit seed flour with different preliminary treatments will then be tested for its physicochemical properties and obtain the best jackfruit seed flour.
2. Methods
Jackfruit seeds obtained from the traditional market in Medan. Jackfruit seeds sorted and cleaned. Furthermore, seeds were steam blanched at a temperature of 85°C for 5 minutes, 10 minutes, and 15 minutes. Then jackfruit seeds were peeled and thinly sliced with a slicer with a thickness of 2-3 mm. Furthermore, seeds were soaked in a solution of sodium metabisulphite (with the concentration of K1 = 200 ppm, K2=400 ppm, and K3 = 600 ppm) for 4 hours at room temperature. Jackfruit seeds were drained and drawn into the pan and then put into the oven with a temperature of 50°C for 16 hours to dry. Furthermore, chips crushed with a hammer mill machine tools and seeds blender then sieved to 80 mesh sieve.

The analysed parameters consist of water content by oven method [4], ash content by ashing [5], fat content by soxhlet method [4], protein content by Kjeldahl methods [4] and the value of L (brightness) using chromameter Konica Minolta (type CR-400, Japan). Data analysis using a randomized design was analysed using SPSS version 22 for windows. The data report in all Tables is the average of triplicate observation subjected to one-way analysis of variance (ANOVA). The difference among the ranges of the properties was determinate using the method of Least Significant Difference (LSD) tests at a 95% confidence level (P<0.01). De Garmo was used in determining the best treatment method [6].

3. Result
3.1. Water content
Figure 1 indicates the water content of jackfruit flour with blanching time of 15 minutes and 600 ppm sodium metabisulphite concentration has the highest value. The second factor has a very significant effect (P <0.01) on the water content of jackfruit seed flour. This shows the longer the blanching time, the higher the air content. This is because when blanching for 15 minutes the water into the cell that causes the granules and swells but does not break the air increases so that the higher the water content the higher. [7] The higher concentration of sodium metabisulphite can damage the tissue in jackfruit seeds. Soaking in sodium is done through tissue cells in the material into holes so that it increases the drying process [8], this fast-drying process causes the water in the material to quickly evaporate [9]. The water content in this study is lower when compared to SNI for wheat flour (01-3751-1995), a maximum of 14.5%. Thus, the water content of jackfruit seeds produced has met the standard.

![Figure 1](image_url)

**Figure 1.** Interaction between the blanching time and the concentration of sodium metabisulphite with water content of jackfruit seed flour
3.2. Ash content
The interaction between the blanching time factor and the concentration of sodium metabisulphite has no significant effect (P > 0.05) on the value of the ash content of jackfruit seed flour. Figure 2 shows the ash content of jackfruit seed flour with immersion in sodium metabisulphite solution concentration of 600 ppm has the highest value. The concentration of sodium metabisulphite has a significant effect (P < 0.05) on the ash content of jackfruit seed flour. This is because sodium bisulphite contains minerals Na and S, which can bind mineral components in the material [10]. This is due to the sodium bisulphite that enters the pores of the material getting bigger so that it will increase the ash content of the jackfruit seed flour produced.

Blanching time does not significantly affect the ash content (P > 0.05), this is due to blanching time does not affect the content of inorganic substances present in the material, because some of the blanching materials equally evaporate water and there is no addition or reduction inorganic substances. [11] Ash is a chemical component found in food. The presence of ash in food ingredients can indicate that the food ingredients have minerals.

![Figure 2](image)

**Figure 2.** The relationship between blanching time with ash content of jackfruit seed flour

3.3. Fat content
The interaction between blanching time factor and sodium metabisulphite concentration had no significant effect (P > 0.05) on the value of the fat content of jackfruit seed flour. Figure 3 shows the fat content of jackfruit seed flour with a blanching time of 5 minutes has the highest value. Blanching time had a significant effect (P < 0.05) on the value of jackfruit seed fat content. In general, after processing food, there will be damage to the fat contained therein. The level of damage varies greatly depending on the temperature used and the length of processing time. The decrease in fat content is due to the blanching process which is getting longer, making fat will be oxidized especially in unsaturated fatty acids [12]. The blanching process causes better penetration of hot water in the material and fat contained in the water-soluble material blanching so that the fat content decreases. This change occurs due to the activity of the inactive lipase enzyme due to the blanching process after soaking, the soaking process will affect the softer texture so that heat penetration into jackfruit seeds will decrease [13].

The concentration of sodium bisulphite has a very significant effect (P <0.01) on the value of the fat content of jackfruit seed flour. Figure 4 shows the higher concentration of sodium bisulphite added, the lower the fat content of jackfruit seed flour. [14] Increasing the concentration of sodium metabisulphite will reduce fat content because the concentration of metabisulphite can accelerate drying. During the drying process, fat can be damaged due to heat. [15] The immersion process causes the breakdown of fat into fatty acids so that more fatty acids are volatile to the air when drying.
Figure 3. The relationship between blanching time with fat content of jackfruit seed flour

\[
\hat{y} = -0.0089t + 1.2631; r = 0.9854
\]

Figure 4. The relationship between sodium metabisulphite concentration with fat content of jackfruit seed flour

\[
\hat{y} = -0.0005N + 1.3569; r = 0.9991
\]

3.4. Protein content

Figure 5 indicates that the protein content of jackfruit seed flour with blanching time of 5 minutes and the concentration of sodium metabisulphite 200 ppm has the highest value. The interaction of the two factors had a very significant effect (P < 0.01) on the value of jackfruit seed protein content. This is because the longer the blanching time, the lower the protein content. Protein is a molecule that breaks down easily from heating. The heating process will make the protein undergo denaturation. Where protein denaturation occurs when the arrangement of spaces or polypeptide chains of a protein molecule changes. Denaturation makes the protein become damaged. The more denatured protein, the reduced levels of jackfruit seed protein will be reduced [16].

The higher the concentration of sodium bisulphite added, the lower the protein content [17]. Protein levels fall due to the release of protein structure bonds during immersion so that the protein component dissolves in water [18]. The decrease in protein content is caused by the diffusion of nitrogen substances that dissolve into the immersion water [19]. Soaking causes a decrease in protein levels based on the hydrophilic nature of the protein. This property arises from the presence of polar side
chains along the peptide chain, the carbonyl and amino groups. Protein molecules have several groups that contain unpaired N or O atoms. N atoms in the peptide chain are negatively charged so that they can attract H atoms from positively charged water [20].

Figure 5. Interaction between the blanching time and the concentration of sodium metabisulphite with protein content of jackfruit seed flour

3.5. Value L
Figure 6 indicates that the value of L (brightness) of jackfruit seed flour with blanching time of 5 minutes and the concentration of sodium metabisulphite 600 ppm has the highest value. The interaction of the two factors had a very significant effect (P<0.01) on the L value of jackfruit seed flour. This is because the longer the blanching time, the lower the L value. Long heating time will cause discolouration and quality loss [16]. The higher the concentration of sodium metabisulphite, the brighter the flour produced. The soaking process can eliminate protein levels which can cause brownish colour when drying or heating. Immersion also results in late non-enzymatic browning (Maillard) [21]. Soaking in sodium metabisulphite solution can prevent non-enzymatic browning reaction because the sulphite group in sodium metabisulphite binds to the carbonyl group in sugar in flour which prevents the formation of melanoidin-causing compounds in brown so that better colours include higher brightness. Sulphites can inhibit the browning reaction which is catalyzed by the phenolase enzyme and can block the reaction of the formation of furfural metal hydroxyl compounds from D-glucose which causes a brown colour.
Figure 6. Interaction between the blanching time and the concentration of sodium metabisulphite with L value of jackfruit seed flour

4. Conclusions
Jackfruit seed flour with blanching time of 5 minutes and the concentration of 200 ppm sodium metabisulphite produces wheat flour and quality more than acceptable.

References
[1] Suprapti L 2004 Chips, Dry Sweets and Jackfruit Syrup (Yogyakarta: Canisius Publisher)
[2] Central Statistics Agency 2017 Production of Fruits by Type of Plant (Jakarta: Central Statistics Agency)
[3] The Indonesian Ministry of Health 2005 List of Food Composition (Jakarta: Bhratara Karya Aksara)
[4] Widowati S and Damardjati D S 2001 Exploring Local Food Resources and the Role of Food Technology in the Framework of National Food Security Food Magazine No. 36 / X / January 2001 p Bulog Research and Development Center 36 pp 3-11
[5] AOAC 1995 Official Methods of Analysis of AOAC International (Washington DC: Association of Official Analytical Chemist)
[6] Sudarmadji S, Haryono B and Suhardi 1997 Prosedur Analisa untuk Bahan Makanan dan Pertanian (Analysis Procedures for Food and Agriculture Materials) (Yogyakarta: Liberty)
[7] De Garmo E P, Sullivan W G and Canada J R 1984 Engineering Economy Seventh Edition (New York: Macmillan Pub. Co.)
[8] Whistler R L, BeMiller J N and Eugene F P 1984 Starch Chemistry and Technology 2nd ed (London: Academic Press)
[9] Herudiyanto M, Sumanti D M and Ahadlyah R N 2007 Effect of concentration and soaking time in sodium metabisulphite (Na$_2$S$_2$O$_5$) solution on the characteristics of Sumenep variety of shallots (Allium ascalonicum L) J Tech Agr 1 p 04
[10] Desti D K, Amanto, Sigit B and Aji M D R 2012 Effect of preliminary treatment and drying temperature on physical, chemical, and sensory properties of jackfruit seed flour (Artocarpus heterophyllus) J Food Tech 1 p 04
[11] Eskin N A M, Henderson H M and Townsend R J 1971 Biochemistry of Foods (London: Academic Press)
[12] Yulianti S, Ratman and Sofaria 2015 The effect of boiling time of jackfruit seeds (Artocarpus heterophyllus lamk) on carbohydrate, protein, and fat content J Che Sci 4 p 211
[13] Rani, Hertiini, Zulfahmi, Yatim R and Widodo 2011 Optimization of Soybean Powder Manufacturing Process National Seminar on Science and Technology-IV, Department of
Agriculture Technology, Lampung State Polytechnic, Rajabasa Bandar Lampung

[14] Kusumawati D D, Bambang S A and Dimas A J M 2012 Effect of preliminary treatment and drying temperature on the physical, chemical, and sensory properties of jackfruit seed flour (*Artocarpus heterophyllus*) *J Food Tech* **1** p 46

[15] Putri, Widya D R, Elok Z and Sholahudin N 2004 Extraction of natural suji leaf dyes, the study of the effects of blanching and extraction types *J Agri Tech* **4** p 18

[16] Winarno F G 2002 *Food and Nutrition Chemistry* (Jakarta: Gramedia Pustaka Utama)

[17] Anglemler A E and Montgomery M W 1976 *Amino Acids Peptides and Protein* (New York: Mercil Decker Inc.)

[18] Prasetyo S and Monica F 2004 Effect of treatment on the blanching process and the concentration of sodium bicarbonate on the quality of soy milk *Proceedings of the National Seminar on Chemical and Process Engineering* ISSN: 1411 - 4216

[19] Ertas N 2011 The Effects of Aqueous Processing on Some Physical and Nutritional Properties of Common Bean (Phaseolus vulgaris L.) *Int J Health and Nutri* **2** p 25

[20] Damodaran S and Kinsella J E 1982 Effects of Conglycinin on Thermal Aggregation of Glycinin *J Agric Food Chem*

[21] deMan J M 1997 *Food Chemistry* (Bandung: Bandung Institute of Technology)