A Comparative Study on Nutritional Value of Purple Sweet Potatoes from West Java and Central Java, Indonesia

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Abstract. This study aimed to compare the nutritional value of two local cultivars of purple sweet potatoes from West Java and Central Java Indonesia. The proximate analysis was conducted to investigating the percentage of protein, carbohydrate, ash, water, total fat, total energy and energy from fat. Amino acid analysis was conducted using Ultra Performance Liquid Chromatography except the tryptophan by High Performance Liquid Chromatography. West Java cultivar were relatively higher content of carbohydrate, ash, total fat and total energy than Central Java cultivar. West Java cultivar relatively higher protein and amino acid content. The three highest amino acids in Central Java cultivar were aspartate 2550.2 mg/kg, glutamic acid 1711.9 mg/kg and leucine 1127.8 mg/kg. Meanwhile, the three highest from West Java cultivar were aspartate 1214.8 mg/kg, glutamic acid 1177.8 mg/kg, and phenylalanine 667.9 mg/kg. Methionine was detected as the lowest amino acid in Central Java cultivar and were not detected in West Java cultivar. We assumed that Central Java cultivar have better protein and amino acid content than West Java cultivar. Further study is required to explore the nutrition benefit of both cultivars.

1. Introduction
Sweet potatoes (Ipomoea batatas (L) Lam) is an important crop particularly in South East Asia region including Indonesia. Since it can be harvested all around the year, sweet potatoes are considered into food security crop as well as included into the seven largest important crop in the world [1][2].

Sweet potatoes have potential nutritional value depending on the content of its bioactive compounds which are correlate to the flesh color [3]. The purple fleshed color of sweet potatoes were well established containing anthocyanin, a secondary metabolite that responsible to color pigment range from red to purplish-blue [4][5]. Anthocyanin from purple sweet potatoes (PSP) were numerous studied as health properties against several health condition, for instance obesity, inflammation [6], hyperglycemia
oxidative stress [8], cancer [9] etc. Therefore, PSP were included to be proposed as functional food and ingredients of nutraceutical to attenuate those major health problem and maintain physiological function in order to promote the human wellness [1][10][11].

Nutraceutical is defined as dietary supplements from plant chemical compound that delivered as concentrate of medicinal form and has beneficial on health [12]. Nutraceutical plays an important role in future therapeutic perspectives and a new era of research sector projects in collaboration between medicine, health and food industries [10]. The development of nutraceutical is requiring many important steps and should be properly standardized, including botanical source, growth condition, identity test of compounds, preparation steps and final production. In a hence, exploration of the nutritional value of plant candidate grown in different areas is very necessary [13].

Our previous work was demonstrated the difference profiles of nutritional value particularly amino acids from two phenotypes of PSP in East Java region [14]. In this current study we were expanding the exploration on others cultivar from different provinces at the Java island i.e. West Java and Central Java, Indonesia.

2. Methods
2.1 Proximate analysis
Fresh tuber roots of purple sweet potatoes (*Ipomoea batatas*) were harvested from local farm at Tegal village, Bogor, West Java, Indonesia and Windusari village, Magelang, Central Java, Indonesia, at four months planting age. The percentage of water was conducted by following manner, the 1-2g of fresh sample was heated at 105°C, afterwards cooled in desiccator for 3 hours. Fat content was identified by Soxhlet method. The sample was extracted with hexane in a Soxhlet for 3 hours then evaporated at 105°C. Protein was measured with Kjeldahl method [15]. The percentage of ash was measured after heated the 2-3g sample in 550°C until the greyish ash completely emerged. The percentage of carbohydrate was calculated by the following equation: 100% - (% ash + % water + % protein + % fat) [16][17][18].

2.2 Amino acid analysis
Ultra-Performance Liquid Chromatography method was carried out to identify the threonine (Thr), histidine (His), cystine (Cys), methionine (Met) glycine (Gly), lysine (Lys), valine (Val), alanine (Ala), arginine (Arg), serine (Ser), glutamic acid (Glu), aspartic acid (Asp), phenylalanine (Phe), isoleucin (Iso), leucine (Leu), proline (Pro) and thyrosine (Tyr). We were used the column of AccQ.Tag Ultra C18 (2.1mm x 100mm, 1.7μm particle, Waters) at 49°C with flow rate was 0.5ml/minutes. The wavelength of 260nm was used for analysis using PDA detector. Totally, 1μl was injected into the UPLC system[14].The High-Performance Liquid Chromatography was used to analyse the tryptophan (Trp) according to the AOAC official method. The column condition was Lichrospher RP-18 (250mm x 4.0mm, 5μm particles, Merck), 1.5 ml/minutes of flow rate, ambient temperature and 280nm wavelength of PDA detector [14][19].

3. Results and Discussion
The proximate analysis was revealed that purple sweet potatoes from West Java cultivar has higher percentage of total fat and carbohydrate as well as the energy from fat. Whereas the percentage of water and protein content was higher in Central Java cultivar. Table 1 was detailed the macronutrient content between those two cultivars.
Amino acids analysis was demonstrated that Central Java PSP relatively higher amino acids content than West Java except the tryptophan. The amino acid of aspartate was the highest level in both cultivars. The lowest level of amino acid was cystine in storage roots of Central Java PSP, conversely cystine was not detected in West Java PSP. The difference of amino acids level between those cultivars was shown in Table 2.

Table 1. The proximate composition differences of purple sweet potatoes from West Java and Central Java cultivars

| Component of Macronutrients | Level (%)       | West Java | Central Java |
|-----------------------------|----------------|-----------|--------------|
| Protein (%)                 |                | 1.05      | 1.81         |
| Ash (%)                     |                | 0.59      | 0.53         |
| Energy from fat (Kcal/100g) |                | 10.89     | 4.46         |
| Total fat (%)               |                | 1.21      | 0.50         |
| Water (%)                   |                | 57.77     | 65.81        |
| Total energy (Kcal/100g)    |                | 172.61    | 137.14       |
| Carbohydrate (%)            |                | 39.39     | 31.36        |

In compare to previous studies, our finding was demonstrated a higher level of protein and lower carbohydrate than Malaysian cultivar [20]. Our cultivars were higher content of protein, carbohydrate and lower level of water than Nigeria cultivar [21]. Another earlier study by Hossain, using purple sweet potatoes from Bangladesh was revealed the higher carbohydrate, protein, ash and lower water in compare to our current results [22]. Proximate composition of plants are related to several factor, such as soil fertilizer [23], humidity [24], harvesting season [25] and the color fleshed differences [26].

Table 2 The amino acid differences between West Java and Central Java cultivars

| Amino acids     | Level (mg/kg) | West Java | Central Java |
|-----------------|---------------|-----------|--------------|
| L-Serine        | 435.3         | 797.4     |
| L-Glutamic acid | 1177.8        | 1711.9    |
| L-Phenylalanine | 667.9         | 774.2     |
| L-Isoleucine    | 442.1         | 721.7     |
| L-Valine        | 612.2         | 1117.8    |
| L-Alanine       | 529.9         | 881.2     |
| L-Arginine      | 428.6         | 422.2     |
| Glycine         | 529.5         | 677.6     |
| L-Lysine        | 437.2         | 712.7     |
| L-Aspartate     | 1214.8        | 2550.2    |
| L-Leucine       | 622.9         | 1127.8    |
| L-Tyrosine      | 187.9         | 288.9     |
| L-Proline       | 362.5         | 533.7     |
| L-Threonine     | 527.4         | 917.4     |
| L-Histidine     | 189.7         | 261.1     |
| L-Cystine       | n.d           | 17.9      |
| L-Methionine    | 32.6          | 57.6      |
| L-Tryptophan    | 530.3         | 191.2     |

*n.d=not detected
The amino acid of Glu and Asp were the two highest amino acid in both cultivars. This correlated with a previous amino acid analysis using purple sweet potatoes planted in Kawi Mountain, East Java Indonesia. However, the West Java and Central Java cultivars were detected to have amino acids of Gly, His, Met, Trp and Ser which were not found in the East Java cultivar [14]. The genetic engineering, different phenotype of tuber fleshed color, geographical region of planting and nitrogen fertilizer were assumed as related factor associated with the amino acid composition [27][14][28]. Amino acids have several beneficial properties for plant, for instance as secondary metabolites precursor, plant immunity against biological pathogen, and plant resistance to abiotic stressor. The amino acid catabolism is required for plant growth and development, especially cellular energy to response the external stressor [29][30].

Purple sweet potatoes has been established as health benefit food in various animal models studies, i.e dyslipidemia, hyperglycemia and obesity [31][32][33]. In a hence, this study supported the nutrient database for the usage of our local cultivar purple sweet potatoes for human nutrition requirements.

4. Conclusion
Our recent study was revealed the potential candidate of nutrition from purple sweet potatoes of West Java and Central Java cultivar, both cultivars were assumed as excellent source of energy and amino acids compound.

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