Nutritional Content Characteristics of Dolichos lablab L. Accessions in Effort to Investigate Functional Food Source

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Abstract. D. lablab L. is a species of bean that is categorized as local food with its perceived potential as alternative food source rich in nutritional content. This current comparative research aimed at investigating the influences of accessions upon nutritional content of D. lablab found in Malang, Probolinggo, Madura, and West Nusa Tenggara (WNT). A proximate analysis was administered to investigate water, ash, lipid, protein, and amylose contents in each of D. lablab accessions. One-way MANOVA test was chosen for data analysis in this current research. The interval of water content ranged from 8.95 to 19.35%. Additionally, the intervals of ash, lipid, protein, and amylose contents respectively signified 3.40-4.11%, 0.33-0.75%, 20.06-24.22%, and 11.89-14.93%. Meanwhile, in terms of dry weight, they respectively varied at the following intervals of 4.11-4.90%, 0.37-0.90%, 22.91-27.21%, and 13.10-17.04%. The result of analysis indicated that the differences set in the accessions significantly influenced the nutritional content of the investigated D. lablab. In short, conservation on any D. lablab accessions in Indonesia is in urgent need of implementation due to high nutritional contents of the plant.

Keywords: alternative food source, D. lablab, nutritional content

INTRODUCTION

Indonesia belongs to group of countries with relatively low consumption level of nutritional content [1]–[4], to be particular protein. The low protein consumption is due to people’s inability to consume meat and some other animal-sourced foods with high protein content [5], [6]. In addition, people’s unfamiliarity with alternative protein food source is also perceived as the triggering factor of the aforesaid condition. Notwithstanding, Indonesia is known as a country with diversity in its local food sources; some of which belong to species of bean (legumes) [7], [8] which are considered to be high protein food source [9]. As a matter of fact, there are various kinds of local legumes commonly found in Indonesia; one of which is Dolichos lablab.

Dolichos lablab (L.) is a species of bean that has been undergoing a series of domestications so as to result in high species variation [10]. This sort of legume is also known as komak bean, lablab bean, Dolichos bean, Hyacinth bean, Indian bean, Egyptian bean, and some other local names [10], [11]. This legume is originated from Africa and has been spread out over the world [10]. One of countries that has been home for this legume is Indonesia [10], [12]–[15].

Behaving similarly to the species of Fabaceae familia, D. lablab is also a kind of legume rich in protein content [16]. Such condition is due to big capacity of D. lablab nitrogen fixation. There are also found a number of bioactive compounds that are very advantageous to cure such particular diseases as liver problems [17], [18], diabetes [15], [19], and tumor [20]. Due to high protein content and other nutritional contents found in the plant, D. Lablab L. is categorized as high protein food source that is very ideal to meet people’s need of vegetable protein.

Generally speaking, this plant is mostly found in Lombok, with various types of seed-coat colors, to name black, purplish black, dark brown, light brown, and cream-colored (Jayanti et al, 2011). In Madura, Probolinggo, Bondowoso, and other dry areas in Central Java, such as Wonogiri and Ponorogo, this plant is still popular to cultivate. In line with the fact, a number of D. lablab accessions with their various seed-coat colors and seed-coat types can be found in Indonesia. Unfortunately, in spite of its distribution in some parts of Indonesia, the cultivation of D. lablab is still marginalized compared to other legume species. This condition is a consequence of governmental policy in cultivating seeds of legumes, which is only focused on peanut (Arachis hiphogea), soybean (Glicine maks L.) and green beans (Phaseolus radiatus) (Kementrian Pertanian Direktorat Jenderal Tanaman Pangan (Ministry of Agriculture Directorate General of Food Crops, 2017).

Referring to the abovementioned introduction, a sustainable effort is of necessity to outspread information about the potential of D. lablab. The effort, further, is supposed to raise Indonesian people’s awareness of the existence of the plant as alternative food source with high protein content. Accordingly, the possible effort to strive is by bringing on a research that focuses on the nutritional content of this plant. Unfortunately, such research is still of rarity in Indonesia. Some previous
studies conducted only focused on discussing the morphological and molecular diversities [14] and anatomy [12] of D. lablab. Meanwhile, another study discussing the nutritional content of D. lablab only included accession from Lombok with a limited parameter on the protein content [13]. For that reason, this research was brought on with the purpose of investigating the differences of water, ash, lipid, protein, and amylose contents of various accessions of D. lablab found in several parts of Indonesia.

METHOD

This comparative research involved D. lablab L. population gained from Malang, Madura, West Nusa Tenggara (WNT), and Probolinggo. The selected accessions of D. lablab L. were those of which morphological seeds had been found and identified in our previous research. For each of the population, two samples were taken for nutritional content analysis. Further, the research highlighted the analysis on several proximate parameters, namely water, ash, lipid, protein, and amylose. All contents other than water were investigated not only based on gross weight of the samples, but also their dry weight. The procedure of analysis on water, ash, and lipid was on the basis of SNI [22], protein based on AOAC [23], and amylose based on IRRI [24]. Those proximate analyses were administered in Balai Penelitian Tanaman Aneka Kacang dan Umbi, Malang.

After all data of the proximate analyses had been completed, data analysis was administered. Data analysis method applied for this study was One-Way Multivariate Analysis of Variance (MANOVA). Both of multivariate and univariate analyses were administered during data analysis process in which the accessions of D. lablab were positioned as independent variable; while the nutritional contents were investigated as dependent one. Further testing was administered only if significant influence was found by univariate analysis. Moreover, the posthoc testing selected to help data analysis constituted Least Significant Difference (LSD) testing with the significance of 0.05.

RESULT

D. lablab constitutes one of local food sources potential to meet the need of alternative food source with high nutritional contents and found in some parts of Indonesia. In this current research, there were 12 accessions of D. lablab spread out over Probolinggo, Madura, Malang, and WNT – their nutritional contents were analyzed. The results of MANOVA testing, to investigate if there were chemical differences occurring from those several accessions, were presented in Table 1. Referring to Table 1, it was identifiable that the difference found on those accessions resulted in different chemical contents found in the seeds [F (99, 39) = 67.161, p < .001; Wilk’s Λ = 0.0001, partial n2 = .982]. This indicated that there was difference of chemical contents on the seeds of several D. lablab accessions originated from some parts of Indonesia.

Table 1. The results of MANOVA testing on the influences of accessions upon chemical content of D. lablab

<table>
<thead>
<tr>
<th>Value</th>
<th>F</th>
<th>Sigg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0001</td>
<td>67.161</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

In order to identify which proximate parameters were influenced by accession difference, univariate testing was administered. The summary of univariate testing results was presented in Table 2. Alluding to Table 2, it was shown that accession difference could generate significant influence upon water, ash, lipid, protein, and amylose contents (p < .001). Additionally, the results have shown that the factor of accessions entirely influenced the proximate parameters measured in this research. For that reason, posthoc testing was administered on the whole proximate data gained.

Table 2. The results of univariate testing on the influences of accessions upon nutritional content of D. lablab seeds

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>F</th>
<th>Sigg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>153.971</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>352.446</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lipid</td>
<td>10.972</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Protein</td>
<td>10.033</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Amylose</td>
<td>184.833</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>318.986</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lipid</td>
<td>13.610</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Protein</td>
<td>5.923</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Amylose</td>
<td>198.992</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The results of posthoc testing on the seeds in terms of wet and dry mass contents were respectively displayed in Table 3 and 4. In respect to Table 3, the water content in the accession of Probolinggo-1 was significantly higher than other accessions. Next, Table 3 indicates that the accessions of WNT-5, Probolinggo-2; Madura-1 and WNT-4; and Probolinggo-1 and Madura-1 were categorized as a group of accessions with the highest level of ash, lipid, protein, and amylose contents. On the other hand, based on Table 4 with the highlight in the dry weight seeds, the accessions of Probolinggo-2; Malang, Madura-2, Madura-3, Probolinggo-1, and Probolinggo-2; Madura-3; and Probolinggo-1 contained the highest level of ash, lipid, protein, and amylose contents. The water content gained from several seeds of D. lablab in this research ranged from 8.95% to 19.35%. This water content range was not significantly different from that of 25 genotypes of D. lablab owned by Department of Agricultural Botany, India [25] and D. lablab gathered from local markets in India [26]. In general, water content is not the most essential nutrition legume is supposed to contain. Nevertheless, information related to water content is deemed as pivotal insight due to its close connection with storage stability of seeds.
In this study, the ash content ranged from 3.40 to 4.11% (wet mass) and from 4.11 to 4.90% (dry mass). The range of the content was not dramatically different from that of D. lablab from India [30] and Kenya [31]. Ash content referred to inorganic residue with mineral as its primary content [32]. The higher the level of ash content, the higher the level of mineral content would be. Defining ash content is considered crucial for food source due to several reasons; one of which is that mineral content would define the physicochemical characteristic of the food source. Further, information with respect to physicochemical characteristic in legumes needs to be identified as the physicochemical property in legumes could undergo a transformation when fermentation process is being run [33].

Referring to lipid content, the lowest levels of dry and gross weights respectively signified 0.33 and 0.37%; meanwhile the highest levels respectively constituted 0.75 and 0.90%. The amounts of the content were lower than D. lablab analyzed by Kilonzi et al. [31], but not significantly different from those of Davari and Kasture [25] as well as Hossain et al. [26]. Lipid was categorized as the component with the highest level of nutrition with the highest level of protein was defined as the nutrition with the highest level of mineral content would define the physicochemical characteristic of the food source. Further, information with respect to physicochemical characteristic in legumes needs to be identified as the physicochemical property in legumes could undergo a transformation when fermentation process is being run [33].

Referring to lipid content, the lowest levels of dry and gross weights respectively signified 0.33 and 0.37%; meanwhile the highest levels respectively constituted 0.75 and 0.90%. The contents of lipid amyllose content. The contents of amyllose signified 11.89-14.93% (wet) and 13.10-17.04% (dry). Amylose is a macromolecule containing units of D-glucose [38]. Amylose is also categorized as polysaccharide which constitutes the main source of energy in human’s diet [39]. As a consequence, the existence of food source with high amyllose content can be an alternative solution for low nutrition issue in Indonesia. Indeed, consuming the plant as food source will meet the daily need of carbohydrate.

CONCLUSION

In this current research, proximate analysis was administered on 12 D. lablab accessions gathered from WNT, Madura, Probolinggo, and Malang. Further, whilst protein was defined as the nutrition with the highest level of content, lipid was named as the component with the lowest level of content. MANOVA testing results have indicated that the difference found in the accessions resulted in different nutritional content of D. lablab seeds.

REFERENCES

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