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ASSESSMENT OF PROXIMATE COMPOSITIONS IN MYANMAR PIGEON PEA VARIETIES

Khamm Myat Thu[1], Myat Lin[2], Htay Htay Oo[3], Myint Aye[4]

1. **Khamm Myat Thu**, Ph.D. Candidate, Advanced Center for Agricultural Research and Education (ACARE),Department of Postharvest Technology, Yezin Agricultural University Naypyitaw, Myanmar.
2. **Dr. Myat Lin,** Professor and Head, Advanced Center for Agricultural Research and Education (ACARE), Departmentof Postharvest Technology, Yezin Agricultural University Naypyitaw, Myanmar.
3. **Dr. Htay Htay Oo**, Professor and Head, Department of Agronomy, Yezin Agricultural University Naypyitaw, Myanmar.
4. **Dr. Myint Aye**, Associate Professor, Department of New Genetics, Advanced Center for Agricultural Research and Education, Yezin Agricultural University, Myanmar.

Abstract:

Pigeon pea comprises a great deal of protein, fiber, minerals, and vitamins, however the amount of these nutrients varies greatly. The nutritional components of pigeon peas are considered crucial for human nutrition, and nowadays pigeon pea is incorporated into food products. Identification of high-quality pigeon peas is essential for increasing consumption and enhancing human nutrition. This study evaluated the proximate compositions of five pigeon pea varieties in Myanmar. Standard methods were used to assess the pigeon pea flours for proximate compositions; namely; moisture, protein, ash, crude fat and crude fibre. Total carbohydrate content was determined by subtracting the crude protein, fat, ash and crude fibre percentages from 100. The proximate compositions resulting from this research were moisture (7.22-8.39%), crude protein (20.78-23.25%), ash content (3.27-3.56%), crude fat (1.15-2.17%), crude fibre (2.28-2.64%) and Carbohydrates (61.87- 63.84%) respectively.

Key Words- Pigeon pea, Proximate compositions, Moisture, Protein, Fat, Fiber, Ash, Carbohydrate

1. Introduction

Myanmar is not only the leading country for the production and export of pulses in the ASEAN regions but also the world's third-largest exporter. In Myanmar, pigeonpea (*Cajanus cajan*) is a favourite crop of smallholder farmers in the dry zone area by reasons of its

CORRESPONDING AUTHOR:	RESEARCH ARTICLE
Dr. Myat Lin Professor and Head Department of Postharvest Technology, (ACARE), Yezin Agricultural University (YAU) Email: drmyatlinn@yau.edu.mm	

multiple uses and its role in sustainable agriculture. It is the third most important pulse crop and is exclusively grown for export. Export of pigeon pea was around 213,800 metric tons in 2020-2021 (DoP, 2021).

Pigeon pea also plays a significant role in sustaining the degree of nutrients in soil productivity by fixing atmospheric nitrogen for crop productivity, adding organic matter and micronutrients, and breaking hard plough pan with its long taproots for crop productivity (Damaris, 200). Although the nutrition in pigeon pea alters greatly, it is a good source of protein, fiber, minerals, and vitamins. Pigeon pea varieties have a protein content of 23-26% (Oshodi *et al.*,1993). Its protein content is comparable with those in other legumes like cowpea and groundnut which have been used in complementing maize. The nutritional and economic importance of pigeon peas has been widely documented. The great potentials of this pea are not yet exploited because of its hard-to-cook nature and anti-nutrient contents (Emefiene *et al*., 2013).

Pigeon pea is rich in carbohydrates, crude fibre, minerals and certain B-group vitamins. The composition of dry seeds of pigeon pea revealed: crude protein 19-23%; starch 45-55%; soluble sugars 3-5%; fat 1-2%; crude fibre 1-5%; ash 3-4; lysine, 1.2-1.4 g/ 16g N; methionine, 0.1-0.3 g/16g N and cysteine, 0.3-0.5 g/ 16g N (Lawn and Troedson, 1990). It contains 20-26% protein, 1-2% fat, 53 -65% carbohydrate, and 3.8-8.1% ash (Ajayi *et.al*., 2010; Saxena and Kumar, 2010). Pigeon pea, a good source of water-soluble vitamins and carotenoids (Ellong *et al*., 2015), has high lysine content but is low in cysteine and methionine (Akande *et al*., 2010). A

Besides its nutritional value, pigeon pea also possesses various medicinal properties due to the presence of a number of polyphenols and flavonoids (Singh 2016). The nutritional components of pigeon peas are considered crucial for human nutrition, and it is evident from several studies that the consumption of pigeon peas is associated with a lower risk of several diseases (Singh and Basu, 2012). Pigeon pea is accepted in many parts of the world since it is very much resistant to drought (ICRISAT). Pigeon pea seeds complement cereals such as corn, maize, wheat and rice. It forms a good portion of the human diet in many African, Asian and South American countries as well. Pigeon pea is an economical source of protein, carbohydrate, minerals and vitamins such as B-complex particularly in the vegetarian diet. Along with the cereals pigeon pea provide well-balanced diet and can be comparable to other dense protein sources like whey and soy (Akporhonor et al. 2006). Nowadays pigeon pea is incorporated into food products like biscuits, noodles, pasta, and sausages as a novel ingredient for nutritional purposes, thanks to their high fibre and protein content, gluten-free status, low glycemic index, antioxidant levels, as well as functional properties like fat absorption and water binding capacity (Keshav, 2015). The nutritional components of pigeon peas are widely considered crucial for human nutrition, because of phytochemicals, bioactive compounds which play vital roles in humans. However, as far as I'm concerned, systematic efforts were not made so far to document the proximate compositions of pigeon pea varieties in Myanmar.

2. Objective

This research was aimed at assessing the proximate compositions of Myanmar pigeon pea varieties. The information generated here may be utilized for the improvement of pigeon pea consumption from the aspects of nutrition.

3. Materials and Methods

3.1 Materials

The seeds of five pigeon pea varieties, namely; Monywa Shwe Dinga, Yezin-5, Yezin-8, Yezin-9, and Yezin-10, were obtained from the Regional Research Center (Zaloke), Department of Agricultural Research, Monywa Township, Sagaing Region, Myanmar. All of the pigeon pea seeds were dry-cleaned and particles such as stalks, pebbles, and immature and broken seeds were removed. They were then packaged in labelled plastic containers. To obtain flour, some seeds were ground in a grinder (Panasonic AC 400 Mixer Grinder). The flour was packed in an airtight bottle and stored at ambient temperature for subsequent analysis. Proximate compositions of pigeon pea seeds, specifically; moisture, protein, ash, crude fat and crude fibre were determined on a dry weight basis according to the standard A.O.A.C. procedures. Total carbohydrate content was determined by subtracting the crude protein, fat, ash and crude fibre percentages from 100. All the reagents used were of analytical grade. Evaluation of proximate compositions was made with the objective of finding out the proximate compositions of five pigeon pea varieties. All of the experiments were carried out at the Department of Postharvest Technology, ACARE, Yezin Agricultural University from April to June 2022.

3.2 Analytical Methods

3.2.1 Determination of moisture

The moisture content of the sample was determined using an oven-drying method and the results were expressed as percentages (AOAC, 2005). Pigeon pea flour (5 g) from each sample was kept on a pre-weighed moisture dish and dried at 105℃ for 24 h in an oven dryer (Hot air oven-AN CRYO-HAO-250, India). After drying, the covered dish was cooled in a desiccator for 30 minutes to reach ambient temperature and weighed using a 4-digit analytical balance (BL 224, India). The sample was again dried at 105℃, cooled in a desiccator and weighed until weight was got constant. The experiment was performed in four replications and the results were averaged. The percentage of moisture content present in the sample was calculated using the formula given as follows.

$$\text{Moisture Content (\%)} = \frac{(W_2 - W_0)}{(W_1 - W_0)} \times 100$$

3.2.2 Determination of crude protein

The protein content of five pigeon pea samples was conducted by using the Kjeldhal method (AOAC, 2005) using DKL heating digester and UDK automatic distillation and titration system (VELP SCIENTIFICA, F30100210, Italy).

3.2.3 Determination of crude fat

Fat content was carried out through the solvent extraction method (AOAC, 2003) usingRandall apparatus (VELP SCIENTIFICA SER 158 solvent auto extractor). First of all, the

emptyextraction cup was dried at 105℃ for 1 h and weighed and recorded it. Sample (8 g) was taken into the extraction thimble. Next, it was closed with an oil-free cotton plug and kept in the beaker. 100 ml of solvent (n-hexane) was poured into the extraction cup. And then, the extraction thimble with the sample was fitted into the extraction cup. It was loaded into an ultra-fast heating plate of the SER 158 solvent auto extractor and switched "On" the system. The process was taken about 2.5 h. After that, the extraction cups were removed from the system. The extraction cups were placed in a hot air oven and were cooled in a desiccator. Eventually, the final weight of the extraction cup containing the extract was weighed and recorded it. The amount of fat present in the sample was calculated as:

$$\text{Crude Fat (\%)} = \frac{(W_2 - W_1)}{(W_0)} \times 100$$

Where;
W_1 = Weight of empty beaker (g),
W_2 = Weight of beaker with oil (g),
W_0 = Weight of sample (g)

3.2.4 Crude fiber

Crude fiber content was measured according to the AOAC (2005) method using VELP SCIENTIFICA ANKOM ^{200} fiber analyzer.

3.2.5 Determination of total ash

Total ash content was found out as total inorganic matter by incineration of sample at 550ºC using a muffle furnace by AOAC (2005) method. Firstly, an accurately weighed 2.0 g of sample was put into a porcelain crucible, previously dried and weighed. Secondly, the crucible with the sample was ignited gently on a flame for complete charring and thirdly it was heated in a muffle furnace at 550 ± 10 ℃ for 4 to 5 h until ash was formed. Finally, the crucibles were removed from the muffle furnace, cooled in a desiccator and weighed. The per cent ash content can be calculated as the following formula:

$$\text{Total Ash (\%)} = \frac{(W_2 - W_0)}{(W_1 - W_0)} \times 100$$

Where;
W_0 = Weight of empty dish (g),
W1 = Weight of dish with sample (g), W2 = Weight of dish with ash (g)

3.2.6 Determination of carbohydrate

The content of carbohydrates was evaluated with the following formula (Raghuramulu et al., 2003).

Carbohydrate content (%) = 100 − [Percent of Moisture + Proteins + Crude fat + Ash + Crude fiber]

4. Statistical Analysis

Experimental designs were set up as (4 × 3) factorial arrangement in Completely Randomized Design (CRD) design with 4 replications. The data were analyzed by Statistix (version 8.0) software. The significance of treatments was accepted at 5% levels of significance (α = 0.05).

5. Results and Discussion

(i) Moisture content

The moisture content in the seeds of pigeon pea varieties ranged from 7.22-8.39 %. Amongst these varieties, the highest moisture content (8.39) was recorded in Monywa Shwe Din Ga and the lowest (7.22 %) was verified in Yezin-5. Earlier researchers have reported the moisture content in the grain of pigeon pea variety in the range of 5.2-13.5 % (Oshodi et al.,1993).

Table 1 Proximate analysis of five pigeon pea varieties

Varieties	Moisture (%)	Protein (%)	Ash (%)	Fat (%)	Fibre (%)	Carbohydrate (%)
Monywa Shwe Dinga	8.39 a	21.05 b	3.27 b	1.15 d	2.59 ab	63.54 a
Yezin -5	7.22 b	23.25 a	3.33 b	1.65 b	2.48 ab	61.87 b
Yezin -8	7.80 ab	20.78 b	3.46 ab	2.17 a	2.42 ab	63.36 ab
Yezin -9	7.50 b	21.39 b	3.56 a	1.61 b	2.28 b	63.66 a
Yezin -10	7.58 ab	21.24 b	3.35 b	1.36 c	2.64 a	63.84 a
LSD (0.05)	**0.86**	**1.22**	**0.19**	**0.13**	**0.33**	**1.56**
Pr>F	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
CV%	**7.43**	**3.75**	**3.91**	**5.39**	**8.72**	**1.63**

In a column, means followed by the same letter are not significantly different at (α=0.05), CV = Coefficient of Variation, LSD = Least Significance Difference

(ii) Crude protein

As shown in Table-1, the average protein content of pigeon peas ranged from 20.78-23.25% with a mean of 21.23%. Considerable variation was observed in protein content. Amidst all pigeon pea varieties, the highest crude protein (23.25) was recorded at Yezin-5, followed by Yezin-9 (21.39), Yezin-10 (21.24), Monywa Shwe Dinga (21.05) and Yezin-8 (20.78). The level of crude protein in pigeon peas of Yezin-5 was significantly different ($p < 0.05$) from the rest varieties. According to Anjulo, et. al., (2020), the average protein content of pigeon pea was ranged from (19.28% - 25.79%). Besides, according to Vasave (2003), Aparna (2004), Pawar et al. (2009) and Oke (2014), the reported level was ranged from 17.97% -

26.38%. These were relatively similar to those recorded in this experiment. In keeping with John (2005), the percent crude protein of commonly grown pigeon pea was in the range between 18% - 26%. Furthermore, similarly, Sharma et al. (2011) reported (2% - 22%), and Kachare et al. (2017) reported (17.62% - 25.45%) [70], these were all in good agreement with the results obtained in the present study. The permissible level of crude protein in pigeon pea recommended by FAO, 2016 was 22.3%

(iii) **Crude fat**

In accordance with Table 1, crude fat content in the seeds of pigeon pea varieties ranged from 1.36 – 2.17 % with a mean of 1.15. Yezin -8 recorded the highest (2.17) crude fat followed by Yezin-5(1.65) among all varieties. This observation is consistent with the reports of Eltayeb & Haron, 2010 and Sharma 2011) and John (2005) who reported the crude fat content ranges between 1.2% - 8.1%. However, the crude fat percentage of pigeon pea in this study was comparatively lower than the fat percentage (2.77%, 2.74%, 4.78%, 3.68%) reported by Kunyanga and Vellingiri (2013), Oke (2014), Olalekan and Bosede (2010) and Adamu and Oyetunde (2013) respectively. From my point of view, the low-fat content recorded in this experiment will help increase the storage life of the crop by decreasing the chances of rancidity and will also contribute to the low energy value of the pigeon pea variety.

(iv) Crude Fiber

The results presented in Table 1 revealed that the crude fiber content of pigeon pea was ranged from 2.28-2.64%, with the highest crude fibre content, was found in of Yezin - 10. Kunyunga et al. (2013), Adamu and Oyentunde, (2013) and Saxena, (2010) were reported higher content (6.98%, 6.6% and 5.54% respectively) of fiber in pigeon pea. Personally, this difference could be a result of varietal effects, incorporated with climatic conditions, soil and management conditions and stage as harvest because all of these are known to affect the plant nutrient accumulation. John (2005), Oke (2014), and Eltayeb et al. (2010) were reported the Crude fiber content between (1.2% - 8.1%) in pigeon pea. These were similar results and in good agreement with the current study. The permissible level of crude fiber in pigeon pea recommended by FAO, (2008) was 1.5%.

(v) **Ash**

Ash contents of pigeon pea in the study area were 3.27-3.56% with a mean of 3.39% (Table 1). In the midst of all varieties, Yezin-9 contained maximum ash (3.56) followed by Yezin-8 (3.46) and Yezin-10 (3.35), Yezin-5(3.33%) and Monywa Shwe dinga (3.27%). Hence maximum Ash content was found at Yezin -9 (3.56%) and minimum content in Monywa Shwe Dinga (3.75%). Oke, (2014), Adamu and Oyantunde, (2013) reported 8.22%, and 9.93% respectively (Oke, 2014) and Adamu & Oyetunde, 2013) These were relatively higher than those recorded in the present study. However, Kunyanga & Vellingiri (2013) Olalekan & Bosede (2010) Eltayeb & Haron (2010) reported 3.58%, 4.58%, and 3.2% ash content of pigeon peas respectively. The permissible level of ash in pigeon peas recommended by FAO was 3.8%. It was in near agreement with the current investigation. Carbohydrate and ash contents in various pigeon pea varieties were reported earlier ranging from 51.70-62.63% and 2.8 to 5.8% respectively (Aparna, 2004; Pawar et al., 2009: Oke, 2014).

(vi) **Carbohydrate**

The total carbohydrate content of pigeon peas under investigation ranged between 61.87-63.84 with a mean value of 63.26 % (Table 1). The maximum carbohydrate content was observed in Yezin -10 (63.84 mg/100g) and the lowermost value was found at Yezin-5 (63.66 mg/100g). Saxena (2010) reported 57.6 mg/100g (Oke (2014), Olalekan and Bosede (2010), Adamu and Oyetunde (2013), Kunyanga et al. (2013) reported between 51.4% - 58.8%. (Kunyanga, et. al., 2013; Oke, 2014; Olalekan and Bosede 2010; Adamu and Oyetunde, 2013). Moreover, the permissible level of carbohydrates in pigeon peas recommended by FAO was 60.4%. These were in good concurrence with the results attained from this study.

Conclusion

The purpose of this research was to access the proximate compositions of Myanmar pigeon pea varieties. All Myanmar pigeon pea varieties have great nutritional properties. According to this experiment, the data on protein analysis revealed that Yezin-5 (ICPL, 87119) was found to be the highest protein content and source amongst the five pigeon pea varieties. Hence pigeon pea variety, Yezin – 5 with the highest protein source is going to supply a major share of the protein requirement of our country.

CONFLICT OF INTEREST

The author has no conflict of interest.

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