Quantification of Protein and Amino Acid Composition in Some Oilseeds

Arowora Kayode Adebisi, Ezeonu Chukwuma Stephen*, Imo Chinedu, Udeogu Emmanuel

Department of Biochemistry, Faculty of Pure and Applied Science, Federal University Wukari, Wukari, Nigeria

Email address
chukmaristos@yahoo.com (E. C. Stephen)
*Corresponding author

Citation

Abstract
The study investigated the levels of protein, energy, and moisture content as well as amino acid composition in some oilseed samples, using High Performance Liquid Chromatographic (HPLC) Technique, while other analysis were carried out using the standard methods of Association of official analytical chemists. All the samples were procured from Wukari market, Taraba State. The mean moisture content determined for the samples was at safe levels at the range (8.76±0.0141 - 9.75±0.0000 %). The highest protein level obtained (40.006±0.0078 %) was in *Glycine max* while the least was observed in *Citrullus vulgaris* (20.449±0.0233 %). Amino acids had the following range in the samples analysed such as: *Glycine max* (2.065±0.007-9.115±0.0070 g/100g), *Sesamum indicum* (Sesame seeds) (1.5±0.0141 - 9.11±0.0141 g/100g), *Arachis hypogaea* ((1.645±0.0070-9.710 g/100g), and *Citrullus vulgaris* seed samples (1.050±0.0141-8.150±0.0141 g/100g). The study revealed that *Glycine max* (Soybean seeds) had the highest level of energy and protein composition among all samples analysed, while the lowest was *Citrullus vulgaris* (Melon seeds). Based on the findings of this study, it can be concluded that soybeans can be utilized as an ideal source of protein for formulation of infant foods for quick recovery of infants and children suffering from Protein Energy Malnutrition (PEM).

1. Introduction

Nigeria is endowed with different varieties of oilseeds and legumes which traditionally are part of native food in families. However, the nutritional and economic values of these legumes and oilseeds have not been completely determined for both human and livestock utilization. According to Sing et al. [1] one of the least expensive ways of increasing protein levels in the diets of low income families is by encouraging the consumption of local indigenous edible seeds especially oilseeds and legumes, which have been found to be rich in protein. Such practice has great potential in ensuring adequate nutrients and energy intake by infants and children in poor setting, where protein energy malnutrition (PEM) has continued to hamper optimal growth and development, hence the use of local indigenous foods is being practiced in many developing countries (Nigeria inclusive). Likewise, sustainable livestock production is dependent on the availability of various sources of nutrients that are required for the formulation of animal feeds. Principal among these are protein and energy sources as peanut, soybeans, sesame and melon, which are important foodstuff for humans [2]. This research was aimed at evaluating the nutritional levels of proteins *viz-a-viz* amino acid...
2. Materials and Methods

2.1. Study Location

The study was conducted at Federal University Wukari in Taraba State, Nigeria, located in north-eastern region of Nigeria on Longitude 9.783°E and Latitude 7.850°N. The physico-chemical analysis was carried out at the Department of Animal Production Laboratory of Adamawa State University, Mubi, Adamawa State, Nigeria.

2.2. Sources of Oilseed Samples

The oilseeds used for this project were purchased from new market at wukari in Taraba State. These oilseeds are; peanuts, *(Arachis hypogaea)*, sesame *(Sesamum indicum)*, melon *(Citrullus vulgaris)*, and soybeans *(Glycine max)* seeds.

2.3. Treatment of Sample

The oilseed samples were air-dried, milled and kept in a polythene bag in a cool and dried place pending analysis.

2.4. Physico-chemical Analysis

Standard methodologies by Association of Official Analytical Chemists [3] were used to determine:

2.4.1. Moisture Content

Moisture contents of the various oilseeds were determined using oven (GenlabMiNO/30 UK). Differences in weight are calculated as:

\[
\% \text{ Moisture} = \left( \frac{Wt \ of \ dish \ + \ Sample \ before \ Drying} {Wt \ of \ Sample \ Taken} \right) - \left( \frac{Wt \ of \ Dish \ + \ Sample \ after \ Drying} {Wt \ of \ Sample \ Taken} \right) \times 100
\]

2.4.2. Protein Analysis

Protein levels in sample using the Kjeldahl Nitrogen determination of protein with results adjusted through calculation as:

\[
% \text{ Protein} = N \times 6.25
\]

2.4.3. Amino Acid

Amino acid analysis was carried out with the aid of High Performance Liquid Chromatography (HPLC) equipped with UV 338nm detector, column with C 18, 2.5 x 200mm, 5µm column and a mobile phase of 1:2:2 (100mM sodium sulphate, pH 7.2; acetonitrile; methanol (v/v/v) at a flow rate of 0.45 ml/minute and an operating temperature of 40°C.

2.4.4. Gross Energy Composition

The gross energy composition of the samples was determined using Gallen Kamp Oxygen Ballistic Bomb Calorimeter. Energy values of the sample in kilocalories per gram of sample were calculated.

3. Results

The values obtained in the various analyses are reflected in the result seen on the tables below for the various parameters assayed.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Calorific Composition (Kcal/100g)</th>
<th>Table 1. Calorific Composition of Samples Analyzed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>542.390±0.0283</td>
<td>Mean value ± standard deviation where (n=2).</td>
</tr>
<tr>
<td>Sesame seeds</td>
<td>607.840±0.0141</td>
<td></td>
</tr>
<tr>
<td>Melon seeds</td>
<td>411.935±0.0212</td>
<td></td>
</tr>
<tr>
<td>Soybeans seeds</td>
<td>725.350±0.0141</td>
<td></td>
</tr>
</tbody>
</table>

Mean value ± standard deviation where (n=2).
4. Discussion

Plant sources, especially legumes, are increasingly being used by thickly populated regions of the world to alleviate the problem of protein energy malnutrition. Yet, the extent of interest in these plants, especially among the lesser known ones, is still very poor probably because their nutritional advantages have been inadequately highlighted. The protein levels in this study per oilseed quantified is as follows: *Arachis hypogaea* (30.49 ± 0.16%), *Sesamum indicum* (30.13 ± 0.02%), *Citrullus vulgaris* (20.45 ± 0.02%) and *Glycine max* (44.01 ± 0.01%) which were generally higher compared to those of *Cleome rutidosperma* (11.73%), *Lagenaria siceraria* (8.93%) and *Cucurbita maxima* (16.80%) as reported by Ojiako and Igwe [4]. However, their protein contents are slightly similar to those reported for common edible seeds such as 28.7% for fluted pumpkin [5]. This implies that the understudied oilseeds are all high in protein contents generally and specifically from those cultivated in northeastern parts of Nigeria.

The result of energy composition of this research for *Arachis hypogaea* is similar to that reported by Asibuo et al. [6]. The presence of high energy content (725.350 ± 0.0141 Kcal/100g) in soybeans seeds when compared to that of melon seeds (411.935 ± 0.0212 Kcal/100g), sesame seeds (607.840 ± 0.0141 Kcal/100g) and Peanut seeds (542.390 ± 0.0283 Kcal/100g) makes soybeans a suitable source of nutrient that can improve the energy density in the nutrition of man and animals.

The following range was observed in the levels of essential amino acids in the samples analysed; *Arachis hypogaea* (2.335 - 7.120 g/100g), *Sesamum indicum* (2.115 - 6.845 g/100g), *Citrullus vulgaris* (1.260 - 6.810 g/100g) and *Glycine max* (2.720 - 7.640 g/100g). The range determined for non-essential amino acids were Glycine max (2.065 - 9.115 g/100g), *Sesamum indicum* (1.530 - 9.110 g/100g), *Arachis hypogaea* (1.645 - 9.710 g/100g), and *Citrullus vulgaris* (1.050 - 8.150 g/100g). The results in this study showed that histidine is the limiting amino acid in these oilseeds. These results are at variance with those of Mariod et al. [7] whose research findings showed that isoleucine and valine were the first limiting amino acids for *Cucurbita pepo* seed meal, and those of the African pear cake (*Dacryodesedulis*) by Omoti and Okiy [8] whose research showed that this fruit contains high contents of the amino acids; lysine, leucine and histidine. The aforementioned observations could be due to variation in the nutritional composition of oilseeds and also to the agro-ecological nature of the places they were cultivated. Thus these oil seeds are great sources of amino acid needed by humans and other animals.

5. Conclusion

It was discovered that the protein in the soybean seeds recorded the highest level (44.006%) in this investigation. This would contribute to the growth and repair of worn-out
tissues, and also improve the nutritional status of humans and animals when formulated in their diets. Based on the aforementioned, soybeans can be utilized as an ideal source of protein for quick recovery of infants and children suffering from Protein Energy Malnutrition (PEM).

References


