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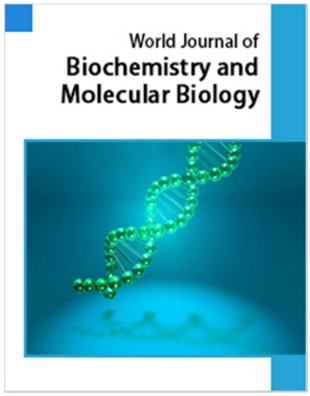

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Quantification of Protein and Amino Acid Composition in Some Oilseeds

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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

contents in some selected oil seeds.

Gross energy composition of some oilseed samples sold at Wukari market in Taraba State, Nigeria were also investigated.

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:

$$\%\, Moisture\ = \frac{(Wt\ of\ dish + Sample\ before\ Drying) - (Wt\ of\ Dish + Sample\ after\ Drying) \times 100}{Wt\ of\ Sample\ Taken}$$

2.4.2. Protein Analysis

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

$$\%\, N\ = \frac{0.00014\ \times Titre\ value\ \times 50\ \times 100}{Wt.of\ sample\ taken}$$

$$\%\, Protein\ = N\ \times\ 6.25$$

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 1. *Calorific Composition of Samples Analyzed.*

Samples	Mean value(Kcal/100g)
Peanuts	542.390±0.0283
Sesame seeds	607.840±0.0141
Melon seeds	411.935±0.0212
Soybeans seeds	725.350±0.0141

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

Table 2. *Moisture Composition of Samples Analyze.*

Samples	Mean value (%)
Peanuts	8.760±0.0141
Sesame seeds	9.410±0.0141
Melon seeds	8.870±0.0141
Soybeans seeds	9.750±0.0000

Mean value ± standard deviation (n=2)

Table 3. *Protein Composition of Samples Analyzed on Dry Matter bases.*

Samples	Mean value (%)
Peanuts	30.485±0.1626
Sesame seeds	30.130±0.0233
Melon seeds	20.449±0.0233
Soybeans seeds	44.006±0.0078

Mean value ± standard deviation (n=2)

Table 4. *Amino Acids Profile of Soybeans Sample.*

Amino acid	Mean value (g/100g Protein)
Lysine	6.075±0.0070
Threonine	3.740±0.0141
Cysteine	2.065±0.0070
Valine	5.245±0.0070
Tryptophan	7.640±0.0141
Methionine	2.720±0.0141
Isoleusine	5.315±0.0070
Leusine	7.095±0.0212
Tyrosine	4.140±0.0141
Phenylalanine	3.880±0.0141
Histidine	2.970±0.0141
Arginine	6.180±0.0141
Aspartic acid	7.130±0.0141
Serine	6.375±0.0070
Glutamic acid	9.115±0.0070
Proline	3.630±0.0141
Glycine	3.710±0.0141
Alanine	3.615±0.0070

Mean value ± standard deviation (n=2)

Table 5. *Amino Acids Profile of Sesame Sample.*

Amino acid	Mean value (g/100g protein)
Lysine	4.730±0.0141
Threonine	2.985±0.0070
Cysteine	1.530±0.0141
Valine	4.360±0.0141
Tryptophan	6.830±0.0141
Methionine	2.115±0.0070
Isoleucine	4.065±0.0070
Leucine	6.845±0.0070
Tyrosine	3.515±0.0070
Phenylalanine	3.325±0.0070
Histidine	2.465±0.0070
Arginine	4.820±0.0141
Aspartic acid	9.110±0.0141
Serine	4.730±0.0141
Glutamic acid	7.230±0.0141
Proline	1.945±0.0070
Glycine	2.470±0.0141
Alanine	2.790±0.0141

Mean value ± standard deviation (n=2)

Table 6. *Amino Acids Profile of Peanut Sample.*

Amino acid	Mean value (g/100g protein)
Lysine	5.245±0.0070
Threonine	3.115±0.0070
Cysteine	1.645±0.0070
Valine	5.075±0.0070
Tryptophan	7.120±0.0141
Methionine	2.335±0.0070
Isoleusine	4.765±0.0070
Leusine	7.030±0.0141
Tyrosine	3.870±0.0141
Phenylalanine	3.790±0.0000
Histidine	2.820±0.0141
Arginine	5.615±0.0070
Aspartic acid	9.710±0.0141
Serine	5.040±0.0141
Glutamic acid	7.150±0.0212
Proline	2.120±0.0141
Glycine	2.955±0.0070
Alanine	2.775±0.0070

Mean value ± standard deviation (n=2)

Table 7. *Amino Acids Profile of Melon Seed Sample.*

Amino acid	Mean value (g/100g Protein)
Lysine	4.110±0.0141
Threonine	2.520±0.0212
Cysteine	1.050±0.0000
Valine	4.305±0.0070
Tryptophan	6.285±0.0070
Methionine	1.260±0.0141
Isoleucine	3.510±0.0141
Leucine	6.810±0.0141
Tyrosine	3.410±0.0141
Phenylalanine	3.210±0.0141
Histidine	2.405±0.0070
Arginine	4.625±0.0070
Aspartic acid	8.110±0.0141
Serine	4.010±0.0212
Glutamic acid	8.150±0.0000
Proline	2.310±0.0141
Glycine	3.110±0.0141
Alanine	3.210±0.0141

Mean value ± standard deviation (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).

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