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NUTRIENT COMPOSITION STUDIES OF THE MESOCARP AND SEED OF ALMOND PLANT

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Abstract:
The study investigated the proximate, mineral and amino acid compositions of the kernel and mesocarp of Almond fruit (Prunus dulcis) obtained from Niger State, Nigeria, using standard procedures. Results from proximate analysis show that the crude protein content of the kernel (2.83±0.02%) was more than that of the mesocarp (0.77±0.12%). The carbohydrate content of the mesocarp (77.20±0.27) was higher than the kernel (28.34±0.10). The result for mineral analysis reveals that the kernel has higher potassium content (2630.70±10.0 mg/100g) than the mesocarp (1824±21.63 mg/10g). The mesocarp however is richer in iron (76.33±1.52 mg/100g) compared to the kernel (18.65±0.53 mg/100g). Zinc, magnesium and calcium were present in significant amount. Amino acid analysis shows that leucine has the highest concentration (6.92 g/100g) while tryptophan has the least (1.42g/100g). Norleucine was below detection limit. The findings from the mineral and proximate compositions were generally within appreciable range for human diet, thus suggesting that the kernel and mesocarp of almond could be recommended as a rich food supplements for human and livestock.

Keywords: Proximate, mineral, amino acid, almond and mesocarp

Introduction:

Edible nuts are known to be rich in proteins, lipids, vitamins and minerals. Their valuable nutritional record is attributable to these compositions [1]. There is an increasing trend in the demand for almond over the last decade. This is because it is a good source of food nutrients commonly used in eateries, desserts, baked foods and breads [2]. Almond (*Prunusdulcis*) belongs to *Prunus* and *amygdalus* as genus and subgenus, respectively, and it is a widely cultivated seed species of the tree. Its corrugated shell (endocarp) which is the surrounding seed distinguishes it from other subgenera [3]. The fruit is rich in nutrients and minerals; this is why it is highly rated by consumers. It is widely appreciated because of its supposed virtue in preventing intoxication and its nutrient compositions [4].There are two varieties of almonds, the bitter almond (*Prunusdulcis varamara*) and the sweet almond (*prunusdulcis vardulcis*).The nuts are good sources of edible oils and fats [5]. It is mostly found in residential areas where it is used as ornamental plant. Both young and old have access to it as food. They are rarely cultivated in large quantity for commercial purpose.

Much work has been done on the proximate and mineral compositions of common nuts and seeds, such as cashew, kernel, and groundnut amongst others [6]. This is because they have been known for long for their nutrient content.

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Very little information on chemical evaluation on almond has been reported. There are, thus, scanty studies on almond seeds most especially in this part of the country. The aim of this work is to investigate the proximate, mineral and amino acid content of almond fruits (*Prunusdulcis*).Findings from this study will have additive input on the existing data base of the nutritional value of almond seeds.

MATERIALS AND METHODS

Collection of Sample

A total of 50 ripened almond fruits were collected randomly from the Staff Quarters of the Federal University of Technology Minna, Niger State, Nigeria. The varieties collected were sweet almond (prunusdulcisvar dulcis) as identified at the Department of Crop Science of the University. They were kept in a polythene bag and transported to the laboratory for preparation and analysis.

Preparation of the Sample

The almond fruits were washed thoroughly using distilled water. The fleshy parts of the fruits were then separated from their nuts and air dried separately for seven days. The dried almond fruits (mesocarp) were grinded to reduce into powdery form and then the exocarp (shell) were cracked in order to obtain the kernel within it. The nuts were also pounded after air drying, to reduce the particle size. Both the fleshy part of the fruit (mesocarp) and the nut were kept for further analysis.

Mineral Analysis

Digestion of Samples

The samples were digested in line with the method described by [7]. Sodium and potassium were determined using flame photometry method while magnesium, calcium, zinc and iron were determined using atomic absorption spectrometer (Model: AA240FS).

Proximate Analysis

Ash content was determined by pulverising 2g of the sample at 500 °C for 5 hours. The moisture and lipid contents were determined using the [7] method. Crude fibre determination was done in line with method of [8]. Protein determination was carried out using Kjheldahl method as reported by [9]. The carbohydrate content of the samples was determined by method of difference [7].

Determination of amino acid profile

The amino acid profile of the sample was determined using the method described by [10].

Determination of tryptophan

The tryptophan in the sample was hydrolysed with 4.2M sodium hydroxide according to the method proposed by [11].

RESULT AND DISCUSSION

Mineral Compositions

The results of the mineral composition of the kernel and mesocarp of the almond fruit are shown in Table 1.

Potassium

Table 1 reveals that potassium was the most abundant element in the analyzed samples exhibiting mean concentration of (2630.70±10.70mg/100g) in the kernel and (1824±21.63mg/100g) in the flesh. Interestingly, the concentration of potassium obtained in this study is almost five times the value of 441mg/100g reported by [12], in a similar study. More so, the values obtained are within the range of the dietary allowance of potassium (1875mg-5625mg) in adult [13].

Sodium

The concentration of sodium in the almond kernel (482±2.00mg/g) was higher than that detected in the mesocarp (125±5.00mg/g). The sodium content is also within the permissible content of 110mg-3300mg/100g required in human diet [3]. It can therefore, be inferred that the almond kernel can serve as an excellent dietary supplement for persons with sodium deficiency.

Iron

The iron content of the mesocarp (76.33mg/100g) is higher than that of the kernel (18.65mg/100g). Almond fruit is therefore a reliable source of iron when compared to some common seeds such as wild Corchorou solitorius (okra seed) whose kernel has iron content of 0.9mg/100g [14]. The dietary allowance for iron is 10g for 70kg man [13]. This shows that the fruit is good as a supplementary source of iron. The concentration obtained in this study is lower than 392mg/100g reported by [12] in a similar study. This observed variation may be attributed to environmental factors [15].

Zinc

The zinc content of the seed (11.30±0.30mg/100g) was close to that of the mesocarp (11.05±0.81mg/100g). The values obtained for Zinc in this study is higher than that reported for Kernel of raw almond (0.8-1mg/100g) by [16]. [17] reported zinc (4.58mg/100ml) for milk obtained from Almond seeds.

Magnesium

The magnesium content of almond seed was 317±71mg/100g while that of the mesocarp was 89.60±1.54mg/100g. The values obtained

Table 1: Mineral composition and proximate analysis of almond samples

parameters	Seed Kernel	Flesh (Mesocarp)
Na (mg/100g)	482±2.00	125±5.00
Fe (mg/100g)	18.65±0.53	76.33+1.52
Zn (mg/100g)	11.30±0.70	11.05±0.81
Mg (mg/100g)	317.71±2.45	89.60±1.54
Ca (mg/100g)	208.81±2.02	221.76±1.93
K (mg/100g)	2630.70±10.07	1824±21.63
Moisture content (%)	5.33±0.06	11.61±0.41
Ash content (%)	4.72±0.07	10.42±0.09
Lipid content (%)	54.55±0.30	5.01±0.19
Crude fibre (%)	4.21±0.09	3.10±0.02
Crude protein (%)	2.83±0.02	0.77±0.12
Carbohydrate (%)	28.34±0.10	77.20±0.27

for both the kernel (almond seed) and mesocarp were lower than that reported for beniseed (392mg/100g) [12].
Magnesium contributes to proper bone formation, maintaining muscle function, keeping body temperature in check and aiding proper absorption of essential calcium.

Calcium
The calcium content of the seed and mesocarp were 208.81mg/100g and 89.69mg/100g respectively. The result for almond seed is higher than 29 mg/100g reported by [12] for sesame seed.

Proximate Analysis
The results of proximate analysis for the kernel and mesocarp of almond fruit are shown in table 2 above.

Moisture content
The moisture content of the kernel and mesocarp were 5.33±0.06mg/100g and 11.61mg/100g respectively. The moisture content of the mesocarp is twice that of the kernel, which implies that the kernel can withstand a longer period of preservation when compared to the mesocarp. The result for kernel obtained in this study is lower that 25.29% reported by [13] in a similar study. It is however higher than 2.84% obtained by Agatemor and Mark (2006) for Almond seed.

Ash content
The mesocap has higher ash content (10.42±0.09%) when compared to the kernel (4.72±0.07%). Ash content represents the total mineral content in foods. The ash content of the seed is within 4.8±0.10 reported by [1] in tropical almond seed. It is however lower when compared to 6.76±0.72% reported by [4] for indian almond nut . It is also higher than 0.039% reported by [5] in a similar study.

Crude protein
The crude protein contents of the mesocap and kernel were 0.77±0.12% and 2.83±0.02 % respectively. The value obtained is lower than 11.52±1.10% reported by [4] for Indian almond nut and 23.4% from [16] for raw almond seeds obtained from Anambra. The high protein content of the kernel shows that it can be used as a better dietary supplement for people who ne

Carbohydrate content
The mesocarp of the seed was found to have a higher carbohydrate content (77.20±0.27%) when compared to the kernel (28.34±0.10%). The kernel of almond was observed to have higher carbohydrate content in comparison to some other seeds and nuts. [18] reported 19.16% for African oil bean seed; [14] reported 21.99% for wild okra seed while [19] reported 12.76% for egusi seed.

Fibre content
Crude fiber is a measure of the quantity of indigestible cellulose, pentosans, lignin, and other components of this type in foods. The fibre content of almond seed was 4.21%. The result is higher when compared to 0.40±0.12 reported by [1] in a similar study and 2.13% for African oil bean seed as reported by [18]. It is lower than 6.4% reported by [16] in a similar study. Fibre in diet helps to increase bulk, soften stool, and shorten transit time through the intestinal tract. It also offers a variety of

health benefits and is essential in reducing the risk of chronic disease such as diabetes, obesity, cardiovascular disease and diverticulitis [20].

Lipid content

The lipid content of the seed was 54.55±0.30%. The lipid content of almond seed is higher when compared to 3.3±0.1% reported by [1] in tropical almond nut and 21.76±20% reported by [4] a in a similar study.

Amino Acid Compositions

The results of the amino acid composition of the almond fruit sample are shown in Table 2.

Table 2: Result of amino acids for almond fruit (kernel) sample

Amino Acid	Concentration (g/100g protein)
Lysine	4.08
Histidine	3.35
Arginine	7.83
Aspartic acid	9.60
Threonine	3.11
Serine	3.89
Glutamic acid	14.38
Proline	3.50
Glycine	4.62
Alanine	3.28
Cysteine	1.52
Valine	4.01
Norleucin	0.00
Methionine	1.46
Tyrosine	2.90
Phenylalanine	4.56
Tryptophan	1.42
Isoleucine	3.26
Leucine	6.92

From the table, it is explicit that glutamic acid has the highest concentration (14.38g/100g) while tryptophan has the lowest concentration (1.42g/100g). The various amino acids investigate were present in appreciable amount. Norleucine was however below detection limit in the sample analysed.

CONCLUSION

From the results of this study, it can be concluded that almond (both seed and mesocarp) is very rich in various food nutrients. Due to its high protein content and low starch, almond nut can be incorporated into cakes and biscuit for diabetic patients and could be useful as poultry and animal supplement. Almond can also be used as a dietary supplement for people with deficiency of any of the minerals. The high lipid content shows that it can be a very important source of vegetable oils which could be used as raw materials for various industrial applications. Sequel to the above, it is therefore recommended that subsequent studies could be carried out on the antioxidant properties and fatty acid profile of this fruit. The exocarp of the fruit could also be analysed for its nutritional values.

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