

The Nutritional Evaluation and Medicinal Value of Date Palm (*Phoenix dactylifera*)

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Abstract: The fruit flesh and seeds of *Phoenix dactylifera* were analyzed. The proximate analysis, mineral composition, phytochemical constituents and amino acids of the fruit flesh and seeds were evaluated. The fruit flesh has moisture content of 3.50 ± 0.06 g/100g, crude protein 17.15 ± 0.15 g/100g, crude lipid 0.52 ± 0.01 g/100g, ash content 1.50 ± 0.07 g/100g, carbohydrate 75.85 ± 0.18 g/100g, calorific value 337.7 ± 9.70 kJ/100g and crude fiber is below detection limit. For seeds these values are 4.03 ± 0.06 g/100g, 12.6 ± 0.13 g/100g, 4.50 ± 0.09 g/100g, 2.00 ± 0.10 g/100g, 79.50 ± 0.19 g/100g, 344.05 ± 9.70 kJ/100g, 1.50 ± 0.00 g/100g respectively. Mineral compositions and vitamin C content for the samples were investigated as well. The data indicated they are very good sources of mineral elements such as K, Na, Ca, Mg, Zn, Fe and P. The results also showed that they both contain essential and non-essential amino acids. The phytochemical analysis revealed the presence of flavonoids, tannins, saponins, cardiac glycosides and steroids in both fruit flesh and seed. Results compare well with those of other edible fruits.

Keywords: Nutritional, *phoenix dactylifera*, fruit flesh, seed.

1. Introduction

Fruit constitutes an important part of a balanced diet as they are natural sources of food nutrient needed by human and animals. Such food nutrient includes protein, carbohydrate, minerals and dietary fiber. With the global focus on increased food production and emphasis on provision of nutritive food for the world population [1], it is very important to consider our locally available fruits and to determine their nutrient composition for the purpose of increasing the production of such fruits. The plant under investigation *Phoenix dactylifera*, commonly known as Dabino by the Hausa tribe, belongs to tree palm family Arecaceae. It is found mostly in canary islands, Northern Africa and West-Africa especially in Nigeria [2]. The fruits of date palms are consumed throughout the world and are important part of the diet in the Middle East [3]. Dates are being consumed in modern cultures for the pleasant flavour, odour, and their biting texture in addition to their use for flavouring foods, beverages and medicine [4]. Reports show that the dates palm is delicious, having separate male and female plants [22, 23]. They can easily be grown from seed (<http://www.en.wikipedia.org/wiki/Phoenix-dactylifera>). Phytochemical screening showed that dried date palm pollens contain sterols, triterpenes, saponins, proteins, carbohydrates, and glycosides and lack volatile substances [5,19].

It is the intention of this research to investigate the fruit of *Phoenix dactylifera* (Dabino) commonly found in Sokoto, Jigawa, Kebbi states in the North-western Nigeria. In this study, the proximate composition and the mineral content of the fresh fruits and seeds were determined. Also the ascorbic acid and amino acid and phytochemical constituents were determined in order to authenticate the level of toxic substances in the fruit.

2. Materials and Methods

2.1. Sample Collection and Treatment

Fresh and matured date palm fruits were collected from Sokoto and Zamfara states of Nigeria. The fruits were identified as *Phoenix dactylifera* (Dabino in Hausa) in Botany Department of Biological Sciences, Usmanu Danfodiyo University Sokoto. The fruits were further divided into 2 parts and labeled as sample: F for Fruit Flesh and S for Seed.

The fruits were oven dried at 55°C for 24 hours. The dried sample were grounded into powder using pestle and mortar, and then sieved through 20-mesh sieve. The powder was used for analysis.

The methods recommended by the Association of Official Analytical Chemist [6] were used to determine moisture content. The ash content, crude lipid, crude fiber, nitrogen content, crude protein were also estimated by multiplying the value obtained for percentage nitrogen content by a factor of 6.35 to determine moisture content, 2g of fresh fruits were weighed in Petri dishes and dried in an oven

at 105°C for 24 hours, cooled in a dessicator and then weighed. The percentage loss in weight was expressed as percentage moisture content [6, 7]. Residual moisture contents were determined on 2g of the fruit flesh and seed. Ash content was determine by the incineration of two grams of each powder sample in a muffle furnance (Lenton furnaces, England) at 600°C for 2 hours the residue weight was expressed as percentage ash content [19].

Available carbohydrate was estimated by difference by subtracting the total sum of percentage crude protein, crude lipid, crude protein, crude fibre and ash content from 100% dry weight of each sample [6]. The energy value was determined using formula below.

$$\text{Energy} = (\text{g protein} \times 2.44) + (\text{g lipid} \times \text{carbohydrate} \times 8.37 \times 3.57)$$

All analyses were carried out in triplicate and reported as mean \pm standard deviation on dry weight (DW). Mineral analysis was carried out after wet digestion of two grams of each powder sample (fruit flesh and seed) with nutric/perchloric/sulphric acid in ratio (9:2:1) mixture, while phosphorus was determine colorimetrically with a Jenway 6100 spectrophotometer using phosphorus vanadomolybdate method [7]. Calcium and Magnesium were determined by EDTA methods [7]. Sodium and potassium were analyzed with a corning 400 flame photometer. Zinc and Iron were analysed using Atomic Absorption spectroscopy (AAS) with standard air-acetylene flame [7]. The extracted sample was air dried in the Laboratory and crushed using wooden pestle and mortar. The crushed samples were sieved through 20-mesh sieve to obtained a fine powder and 50grams of the powder fruit flesh and seed were extracted using percolation process in 250ml distilled water at 35°C overnight. The extract was filtered and filtrate was evaporated to dryness with the help of rotary evaporator. The filtrate was used to carryout phytochemical analysis in order to determine the following phytochemicals; saponins, alkaloids, flavonoids, cardiac glycosides, volatile oil using standard procedures [8, 9].

2.2. Determination of Vitamin C

3g of each sample was dissolved in 2 ml of 10% glacial acetic acid and blended for 10minutes and filtered. The residue was further washed with 5ml portion of 10% glacial acetic acid. 60 ml of 0.3m H₂SO₄ was added and followed by the additional 2g of solid potassium iodide and 25 ml of 0.01m potassium iodate with 25 ml of the filtrate was titrated with 0.07M sodium Thiosulphate solution [10].

2.3. Determination of Amino Acid

Amino acids determination was analyzed by automatic amino acid analyzer. The sample of 100g was hydrolyzed with 10ml of 6M HCL in a sealed tube at 110°C in an oven for 24hrs. After hydrolysis, the acid was evaporated in a vacuum evaporator under reduced pressure at 78°C. The HCl free residue was dissolved in 4ml of loading buffer (0.2M, pH 2.4) to inject into apparatus [11].

3. Results and Discussion

The results of the proximate composition of the fruit flesh and seed of *Phoenix dactylifera* are shown in Table 1. The moisture contents are relatively low when compared with edible fruits reported for chrysophyllum albidum pulp/seed (18.3-25g %) [12]. The crude protein contents are low comparing with values of pulp of Dialium guineense (52.9g/kg) [13] and seed of Deterium microcarpum (7.2±0.14g/100g) [14, 15]. The crude lipid for the fruit flesh is low but the seed has value of 4.50±0.09g/100g which is within the range of values of edible seed as reported in some seeds of wild plant (10.00±0.61- 12.91±0.07g/100g) (15). The ash content which is an index of mineral in most edible fruits is lower in the fruit flesh (1.5±0.07g/100g) while the seed has value of 2.0±0.08g/100g is within the range of edible fruits such as dialium guineense (20g/kg) [13]. The available carbohydrate is very high for both fruit flesh and seed with values 75.85±0.18 and 79.5±0.19g/100g respectively when compared with the seeds of some wild plants (25.00±0.13- 66.01±0.31g/100g) (14). The vitamin c contents are 100.26±1.12 and 100.±1.01ug/100g for fruit flesh and seed. And the calorific values for fruit flesh are 337.7±8.82 and 44.5±9.7 kj/100g for seed.

Table 1: Proximate composition of *Phoenix dactylifera*

Parameter g/100g	Fruit Flesh	Seed
Moisture content	3.50±0.05 ^a	4.03±0.06 ^b
Crude protein	17.15±0.15 ^a	12.6±0.13 ^a
Crude lipid	1.52±0.07 ^a	4.50±0.09 ^b
Crude fiber	0.5	1.50±0.00 ^a
Ash content	1.50±0.17 ^a	2.00±0.10 ^b
Carbohydrate	75.85±0.18 ^a	79.50±0.19 ^b
Energy kj/100g	337.7±8.82 ^a	344.05±9.70 ^b
Vitamin C µg/100	100.26±1.12 ^a	100.32±1.01 ^b

Mean ± standard deviation with different (s) letters in the same row are significantly differed at P < 0.05.

The mineral compositions of the fruit flesh and seed are presented in Table 2. Most of these minerals determined are essential elements for normal body functioning of humans. Table 5 lists the recommended daily diet requirement amount for adults and children. Table 3 shows the results of the phytochemical analyses present in fruit flesh and seed of date palm. The results revealed the presence of flavonoids, tannins, glycosides, cardiac glycosides and steroids respectively. While amino acid analysis gives a better explanation of the nutritional values of the fruit flesh and seed of date palm than the protein content, since the nutritional value is reduced when inadequate amounts of the essential amino acid are present [16,17]. Generally, pollen contains all the essential amino acids but the amounts may vary among plants specie [21]. The results obtained from this present study as shown in table 4 indicate that the fruit flesh and seed of date palm contain eight(8) essential amino acids and nine (9) non-essential amino acids and are favorably compared with work done on pollen grains of date palm as reported by [17].

Table 2: Mineral composition of *Phoenix dactylifera*

Element (mg/100g)	Fruit Flesh	Seed
Na	88.9±3.00 ^a	77.23±1.91 ^b
K	121.5±4.02 ^a	106.2±3.52 ^b
Ca	105.2±3.52 ^a	54.67±2.52 ^a
Mg	85.00±4.00 ^a	9.36±0.55 ^b
Fe	47.5±1.11	49.33±1.09
Zn	50.24±1.21	42.80±1.01
P	25.87±0.81 ^a	8.23±0.25 ^b

The mean ± standard deviation (SD) of triplicate analysis, mean with different superscript (a*b*) are significantly different at P< 0.05

Table 3: Phytochemical constituents of the water extracts of fruit flesh and seed of *Phoenix dactylifera*

Phytochemical	Dried fruit flesh	Seed
Flavonoids	+	+
Alkaloids	-	-
Tannins	+	+
Saponins	+	+
Glycosides	+	+
Cardiac Glycoside	+	+
Volatile Oil	-	-
Steroids	+	+

Table 4: Amino acids composition (g/100g) dry weight of fruits fresh and seed of Date Palm

Amino Acid	Fruit Flesh	Seed
Essential Amino Acids		
Isoleucine	1.28	0.68
Leucine	3.04	1.70
Lysine	2.25	1.10
Phenylalanine	1.16	1.08
Threonine	1.50	0.75
Valine	1.79	0.90
Histidine	1.56	0.80
Methionine	0.20	0.10
Nonessential Amino Acids		
Alanine	2.40	1.20
Arginine	1.32	0.65
Aspartic Acid	3.45	1.72
Glutamic Acid	1.64	0.80
Glycine	2.04	1.00
Serine	1.73	0.90
Cysteine	0.62	0.30
Tyrosine	1.56	1.20
Proline	0.26	0.14
Ammonia	0.42	0.42
Total amino acids	2.822	15.28

Values of mean of triplicate analysis

Table 5: Dietary recommendation for mineral elements

Elements	Children (7-10yrs)	Recommended Dietary allowance in mg/day		Pregnant and breast feeding mothers
		Male	Female	
Na	400	500	400	500
Ca	800	800	800	1,200
Mg	170	350	280	355
P	800	800	800	1,200
K	1,600	2,000	2,000	2000

Source: food and nutrition board [20]

4. Conclusion

This study analyzed the proximate, mineral compositions, phytochemical constituents and amino acids of fruit flesh and seed of Date Palm. From the results it can be concluded that fruit of Date Palm can be used as alternative source of food and vitamins and should be incorporated into our diet.

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