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## Mineral profile, proximate and amino acid composition of three dates varieties (*Phoenix Dactylifera* L.)

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### ABSTRACT

Proximate, mineral and amino acid composition of three varieties of date fruits (Dagalla, Dan-Mali and Fari) were investigated. The parameters evaluated were moisture content; ash content; crude protein; crude lipid; crude fibre; carbohydrate; mineral ions and amino acids. The results obtained showed that, moisture content was generally low (1.3- 4.6%), ash contents were within the range of 3.0- 3.3%. The values for crude protein and fibre for Dagalla were  $1.53\pm 0.03\%$ ;  $2.00\pm 0.50\%$ ; Dan-Mali  $1.34\pm 0.05\%$  and  $2.83\pm 0.95\%$  and Fari  $1.53\pm 0.03\%$  and  $2.17\pm 0.44\%$ . The crude lipid value in Dagalla ( $1.00\pm 0.00\%$ ) was twice the amount for Dan-Mali and Fari; signifying higher fat content in Dagalla dates. All the three dates varieties have high carbohydrate content ( $90.64\pm 0.6\%$ ,  $90.47\pm 0.5\%$  and  $89.99\pm 1.0\%$ ) for Fari, Dagalla and Dan-Mali respectively. The calorific value for all the three dates was around 377.51-386.51kcal/100g. The potassium ( $K^+$ ) content was high in all the three varieties (Fari 360mg/100g; Dan-Mali 310 mg/100g and Dagalla 265mg/100g) suggesting that these dates contributes substantially to the dietary intake of potassium.  $Na^+$  concentration was 6.13mg/100g on average in all the samples.  $Ca^{2+}$  and  $Mg^{2+}$  showed moderate concentrations (1.32-1.25mg/100g) for all the samples. Twelve amino acids were detected. Aspartic acid, proline and alanine were present at high concentration in all the three dates fruits. This work revealed that the dates fruits can be considered as efficient sources of carbohydrate, mineral nutrients, quality amino acids and can play a major role in human nutrition and health.

**Key words:** Proximate, Minerals, Amino acid, analysis, *Phoenix dactylifera* L.

### INTRODUCTION

*Phoenix dactylifera* (Dates in English, *dabino* in Hausa and *tamr* in Arabic) is a palm plant belonging to the family *Aracaceae*. The tree is commonly found in the Canary Island, Northern Africa, Arabia and south west of Asia to Pakistan and India. It is cultivated for its sweet bearing fruits and as such, is considered to be the most important tree in most of the Arabian countries [1]. Dates fruits are considered a complete diet and a very important item of food. With plenty of vitamins and minerals, dates have 25% more potassium than bananas while being free from fat, sodium and cholesterol. Dates play an important role in the diet and treatment of obesity and are the most important sources of energy and food in date producing and non date producing areas [2].

In Nigeria, particularly in the northern part, date has become a major source of nutrition and energy source among Muslims and even the non-muslim community. For Muslims, it is a customary religious meal for breaking day long fast during the holy month of Ramadan [3].

Though there are numerous documented literature around the world on nutritional and medicinal uses of different varieties of date fruits, there is little documented information on the dates fruits dominating (sold all-year-round) the Nigerian markets. In this work, we report the proximate, mineral profiles and amino acid composition of three popular varieties of dates fruits consumed in Nigeria, *Dagalla*, *Dan-mali* and *Fari* (Figure 1).



Figure 1: Picture of the three dates fruits under study.

## MATERIALS AND METHODS

### 1.1 Materials

The chemicals used throughout the work were of analytical grades and purity (98%-99.9%). Major equipment employed were flame spectrophotometer (Corning 400, London, UK), and Atomic Absorption Spectrometer (Alpha-4 Model).

### 1.2 Collection and Preparation of plant material

The three varieties of date fruits were obtained from Sokoto Central Market in September, 2013 and identified as: *Dagalla*, *Dan-Mali* and *Fari*. The pulps of the fruits were separated each from the seed manually under hygienic condition and the pulp was sun-dried. The dried pulps were grinded into powder and sieved through 2.00mm mesh to obtain a representative sample.

### 1.3 Methods

#### 2.3.1 Measurement of pH and solubility

Measured quantities (2g) of powdered date pulp of each sample was weighed and transferred into 200cm<sup>3</sup> beaker containing 20cm<sup>3</sup> of distilled water. The contents of each sample was warmed in a water bath at 25<sup>0</sup>C for 15 minutes and the pH was measured using a pH meter which was pre-calibrated with a buffer solution of pH 4.68 set at 25<sup>0</sup>C.

#### 2.3.2 Proximate analysis

Proximate analysis of the three samples was carried out according to the methods of the Association of Official Analytical Chemists [4].

#### 2.3.3 Elemental analysis

Mineral elements were extracted from the samples by wet digestion as described by Tayie and Asiebey-Berko, (2001). From this filtrate, lead (Pb), manganese (Mn), zinc (Zn), chromium (Cr) and copper (Cu) were determined using Atomic Absorption Spectrophotometry. Calcium and magnesium were determined by EDTA titration method (AOAC, 2000). Sodium and potassium were determined using flame photometer (Corning 400, London, UK) as described in AOAC [4].

#### 2.3.4 Amino acid composition

Amino acid content was determined according to method described in AOAC [4]. 200mg powder of each sample was taken in a hydrolysis tube and 5ml of 6N HCl was added and the tubes were tightly closed and incubated at 110<sup>0</sup>C for 24hours. Each solution was then filtered through 125mm filter paper. 200ml of the filtrate was

concentrated at 140°C for 1hour. A dilute buffer of pH 4.68 was added to 1ml of the dried samples. The samples were then injected into amino acid analyzer (SYKNM).

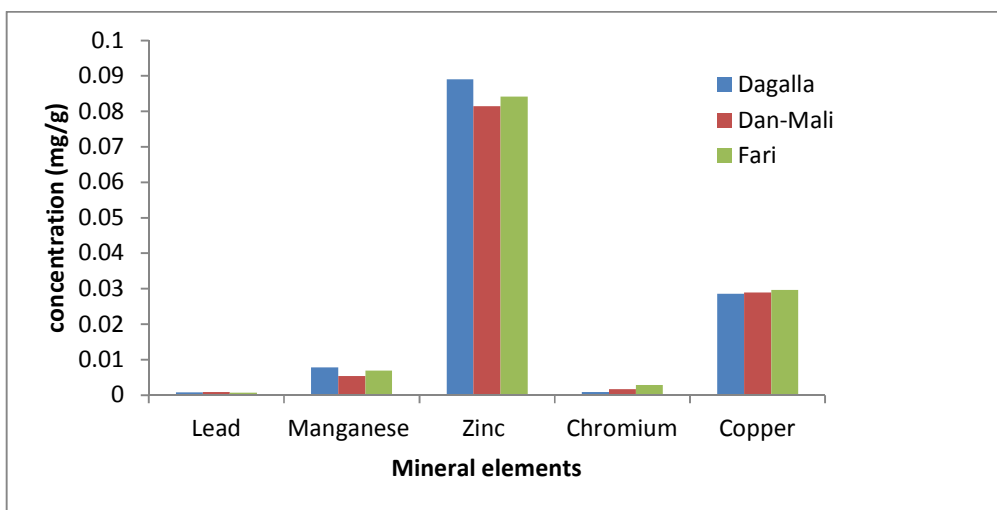
**RESULTS AND DISCUSSION**

**3.1 Results**

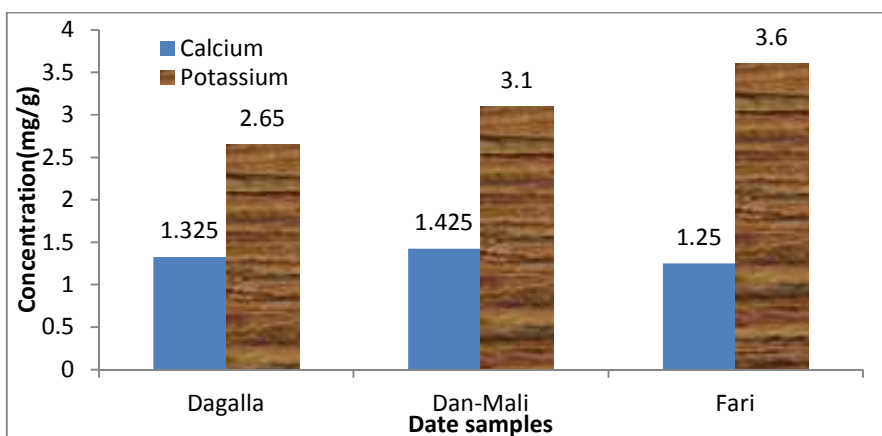
The pH values, proximate and amino acid compositions of the three dates fruits; *Dagalla*, *Dan-mali* and *Fari* are shown in Tables 1-2 respectively while mineral composition of the dates fruits is shown in Fig 2-3.

**Table 1: pH values and Proximate Composition of the three dates fruits (*Phoenix dactylifera* L).**

Content	Dagalla	Dan-Mali	Fari
pH	5.30	5.00	5.30
Moisture Content (%)	1.33±0.577	4.60±1.761	2.17±0.764
Ash content (%)	3.00±0.500	3.33±0.289	3.17±0.289
Crude Protein (%)	1.53±0.036	1.34±0.050	1.53±0.036
Crude Lipid (%)	1.00±0.000	0.50±0.000	0.50±0.000
Crude Fiber (%)	2.00±0.500	2.83±0.955	2.17±0.441
Available Carbohydrate (%)	90.47±0.530	89.99±1.065	90.64±0.614
Calorific Value (kcal/100g)	386.51±3.270	377.51±3.081	381.18±2.304



**Figure 2: Amount of Copper, Chromium, manganese, lead and zinc in dates samples**



**Figure 3: Amount of calcium and potassium in dates samples**

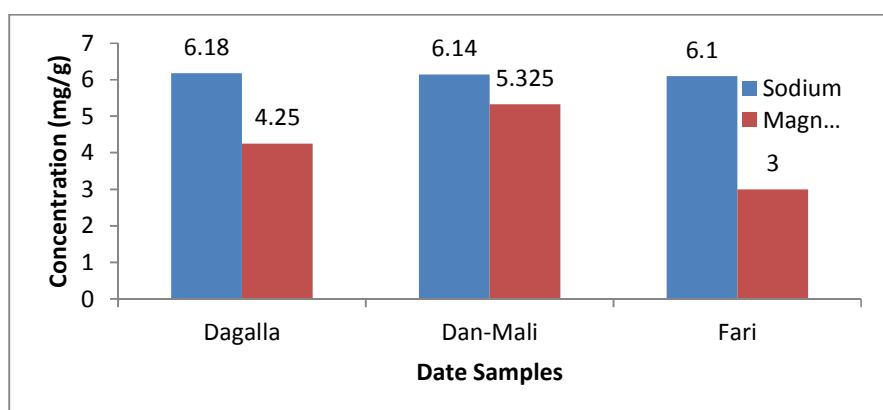


Figure 4: Amount of magnesium and sodium in dates samples

Table 2: Amino Acid Composition of the three different dates fruits (*Phoenix dactylifera* L).

Amino Acid(mg/100g)	Dagalla	Dan Mali	Fari
Aspartic acid	6.24	4.06	3.27
Threonine	0.89	3.82	1.08
Glycine	0.24	0.98	0.46
Alanine	5.65	3.20	3.06
Valine	4.09	2.26	3.02
Isoleucine	1.96	1.47	1.50
Leucine	2.06	0.63	2.00
Phenyleadnine	2.02	0.49	0.86
Histidine	0.73	0.26	0.42
lysine	2.19	0.07	Nil
Proline	10.83	7.06	9.20
Tyrosine	0.53	Nil	9.40

## DISCUSSION

### 3.2.1 pH and Solubility

The pH value in *Dagalla* was found to be (5.30) and (5.00) and (5.30) in *Dan Mali* and *Fari* respectively which is an indication that all the three samples employed in the study are acidic.

### 3.2.2 Proximate composition

The % moisture content in the three samples was found to vary considerably. It was high in *Dan-Mali* (4.60%) followed by *Fari* (2.17%) and *Dagalla* (1.33%) in decreasing order. These values were low compared to that in Aseel (7.2±0.34%), Daki (5.0±0.25%) and were higher when compared to Halavi (0.84%) [5]. The Low values of moisture are significant values for good storage quality. These dates could indicate long shelf life [6].

The % ash in *Dan-Mali* (3.33%) was higher followed by *Fari* (3.17%) and *Dagalla* was found to contain the least composition (3.0%). These values were higher when compared to ash values in Coconut (2.87±0.1%), Halavi (2.07±0.04%) [5]. Higher ash content in dates indicates that the total inorganic mineral is high [7].

*Dagalla* and *Fari* were found to contain the highest crude protein (1.53±0.04%) respectively and *Dan-Mali* contains the lowest (1.34±0.05%). The crude protein was low when compared with protein rich foods in cowpea seed (24.7%) and lentil (26.1%) [8]. This low protein content indicates that though date is used as a staple food it cannot serve as a source of protein supplement to human.

There was little lipid in the date pulps. The amount of lipid found in *Dagalla* was highest (1.00±0.00%) followed by *Dan-Mali* and then *Fari* (0.50±0.00%) respectively. The low fat content indicates the date pulp may not be a source of oil.

*Dan-Mali* ( $2.83\pm 0.95\%$ ) was found to contain the highest value for the crude fibre followed by *Fari* ( $2.17\pm 0.44\%$ ) and *Dagalla* ( $2.00\pm 0.50\%$ ). Crude fiber is very important in diet because it decreases serum cholesterol levels, and the attendant risk of coronary heart diseases and hypertension [9].

Carbohydrate composition was highest in *Fari* ( $90.64\pm 0.61\%$ ), followed by *Dagalla* ( $90.47\pm 0.53\%$ ) and *Dan-Mali* ( $89.99\pm 1.07\%$ ). Carbohydrates provide the necessary calories in the diet of most people of the world [6]. High value of carbohydrate in date makes it a very useful fruit for consumers. However, *Dagalla* ( $386.51\pm 0.53\text{kcal}/100\text{g}$ ) was found to have the highest value of energy, *Fari* ( $381.18\pm 2.30\text{kcal}/100\text{g}$ ) and *Dan-Mali* ( $377.51\pm 3.08\text{kcal}/100\text{g}$ ) were found to contain the lowest calorific value.

### 3.2.3 Elemental analysis

Calcium is the most abundant mineral in the body. It regulates many cellular processes and has other vital roles in living organisms [10]. The Dietary Reference Intake (DRI) value for calcium is 1000 mg/day [11]. The result of this work showed that calcium was in the range of  $1.43\pm 0.29\text{mg}/100\text{g}$  in *Dan-Mali*;  $1.25\pm 0.10\text{mg}/100\text{g}$  in *Fari* and  $1.33\pm 0.15\text{mg}/100\text{g}$  in *Dagalla*.

Manganese is essential for proper brain function and it metabolizes proteins and carbohydrates. Manganese is required for cholesterol, fatty acid as well as collagen formation [12]. *Dagalla* ( $0.08\pm 0.01\text{mg}/100\text{g}$ ) was found to contain the highest amount of manganese followed by *Fari* ( $0.07\pm 0.00\text{mg}/100\text{g}$ ) and *Dan-Mali* ( $0.05\pm 0.00\text{mg}/100\text{g}$ ). The DRI values of manganese for female and male are 1.8 and 2.3 mg/day respectively. Daily consumption of dates could easily complement the DRI values for manganese.

Copper is an essential mineral required for the proper functioning of organs and metabolic processes [13]. The values for copper for the three samples were roughly in the same range ( $0.03\pm 0.01\text{mg}/100\text{g}$ ). Copper accelerates wound healing by increasing blood flow to the affected area and movement of oxygen around the body [14]. The recommended DRI value for copper is 0.9 mg/day [11].

Chromium is a trace mineral important in health and nutrition; it works with insulin to help regulate and maintain normal blood glucose levels and can be found naturally in foods and comes in a variety of supplemental forms [15]. *Fari* contained the highest value of chromium ( $0.03\pm 0.00\text{mg}/100\text{g}$ ) followed by *Dan-Mali* ( $0.02\pm 0.00\text{mg}/100\text{g}$ ) and *Dagalla* ( $0.01\pm 0.00\text{mg}/100\text{g}$ ). It also plays an important role in glucose and fat metabolism [16]. These values mean that the dates varieties are a good source of chromium. The recommended DRI value for chromium is 35mg/day [11].

There was very little or no amount of lead in all the three Samples. The absence of lead in all the samples could be of great advantage to the consumers since lead has been reported to be highly toxic even at low concentrations [17]. Potassium is vital to cellular integrity and fluid balance as it plays an important role in nerve function. It also helps to metabolize proteins and carbohydrates in energy production, and regulates heart beat [6, 9]. *Fari*, *Dan-Mali* and *Dagalla* were found to contain ( $360\text{mg}/100\text{g}$ ), ( $310\text{mg}/100\text{g}$ ) and ( $265\text{mg}/100\text{g}$ ) of potassium respectively. This is an indication that the dates can supply reasonable amount of potassium considering the DRI value for potassium ( $4700\text{mg}/\text{day}$ ).

Zinc plays a vital role in cellular membrane structure and function, and helps to maintain adequate levels of vitamin A in the body [18]. It acts as a potent antioxidant and is essential for growth and development of body tissues, proper immune function and regulation of insulin [19]. *Dagalla* was found to contained the highest amount of Zn ( $0.09\pm 0.00\text{mg}/100\text{g}$ ) followed by *Fari* and *Dan-Mali* ( $0.08\pm 0.00\text{mg}/100\text{g}$ ). The recommended DRI value for zinc is 11mg/day [11].

### 3.2.4 Amino Acid Composition

The analysis of amino acid composition showed that the dates fruits of all the three samples contained a high concentration of aspartic acid, proline, and alanine. *Dan Mali* contained the highest percentage of threonine ( $3.82\text{mg}/100\text{g}$ ) followed by *Fari* which contained ( $1.08\text{mg}/100\text{g}$ ) where as *Dagalla* contained the highest concentration of valine followed by *Fari* and then *Dan Mali*, the aspartic acid was the highest in *Dagalla* and the lowest *Fari*. Amino acids are important biomolecules that both serve as building blocks of proteins and are intermediates in various metabolic pathways. They serve as precursors for synthesis of a wide range of biologically important substances including nucleotides, peptide hormones, and neurotransmitters. Moreover, amino acids play

important roles in cell signaling and act as regulators of gene expression and protein phosphorylation cascade [20], nutrient transport and metabolism in animal cells [21], and innate and cell-mediated immune responses.

### CONCLUSION

From the results of the present study, it can be drawn that the three studied date are an ideal high-energy food, rich in carbohydrates, dietary fiber and minerals such as calcium, magnesium, manganese, copper, chromium, potassium and zinc. They are also a good source of the K, Mg, Zn and Na which help the body maintain electrolyte balance and proper enzymatic activities. The dates fruits of all three varieties contain suitable amount of amino acids indicating their high nutritional value.

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