



Nutritional Analysis of Date Fruits (*Phoenix dactylifera L.*) in Perspective of Bangladesh

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Abstract: Present study reveals a thorough investigation of nutritional values of three different varieties (Trounja, Lagou, Gounda) of Tunisian dates available in Bangladeshi local markets. Moisture and total solids were (13.2-14.1%) and (85.9-86.8%), respectively. Ash and crude fibers contents were (2.13-2.18%) and (6.05-6.9%), respectively. The dates were rich in carbohydrate (51.8–55.0% dry weight), while they contained low concentrations of protein and lipid (2.0–2.2% and 0.12–0.72%, respectively). Dates represented little amounts of vitamin-A (0.7-1.2 mg%) and vitamin-C (0.7-0.9 mg%). High source of energy, as 100gm of date flesh can provide an average between (226.49-241.79) kcal. 11 minerals were determined from dates by Atomic Absorption Spectrophotometer. The predominant mineral was potassium (460-680 mg%). They contained low content of sodium (0.6-1.0 mg%). Rich source of calcium (51-60 mg%), phosphorus (52-60 mg%), magnesium (48-53 mg%) were found. Good source of iron (0.79-0.90 mg%), manganese (0.85-1.1 mg%), zinc (0.69-0.72 mg%), copper (0.32-0.36 mg%), chromium (0.36-0.42 mg%) and selenium (0.22-0.31 mg%) were found.

Keywords: Nutritional Values, Source of Energy, Atomic Absorption Spectrophotometer, Potassium and Calcium

1. Introduction

Date fruits are the staple food of the Middle East and very popular in Islamic countries. The nutritional value and its health benefits are well known across the globe due to rich in high profile nutrients and health promoting properties. Date palm (*Phoenix dactylifera L.*) is a multipurpose tree providing, fiber, carbohydrates, minerals and vitamins besides having certain medicinal properties [1, 2]. Date fruits are the products of date palm tree, belonging to the family of *Arecaceae*. It is one of the oldest cultivated plants in the world [3, 4] and is the most important subsistence crop in all Northern Africa and the Middle East, although it is also cultivated in other parts of the world. Worldwide production of date fruit has increased almost threefold over the last 40 years, reaching 7.68 million tons in 2010 [3]. Dates are loaded of various nutrients with medicinal importance for ailment of certain diseases. Because

of its high nutritional value and its long life the date palm has been mentioned as the 'tree of life' [5]. Whole part of dates are useful, also the byproducts arising from date processing can be used for different purposes. Dates are also used as food preparations like sweets, snacks, confectionary, baking products, institutional feeding and healthy foods. There wholesome savory taste of all natural sugar invites the most culinary creativity. As an ingredient to any recipe, dates provide the perfect natural alternative to added sugar. Wonderfully delicious, dates are one of the most popular fruits packed with an impressive list of essential nutrients, vitamins and minerals that are required for normal growth, development and overall well-being. It is the sources of natural sugar like glucose, fructose and sucrose that furnishes body with instant energy. Dates may contribute to the human diet with high quality of some essential amino acids [6]. The protein in dates contains 23 types of amino acids, some of

which are not present in the most popular fruits such as oranges, apples and bananas [3;4]. Date fruit has been recommended in folk remedies for the treatment of various infectious diseases, cancer and heart diseases [7, 8]. Recently, it has been found that date fruit might be of benefit in glycemic and lipid control of diabetic patients [9] and have also been identified as having antioxidant and antimutagenic properties [1, 10]

However, the biochemical properties and nutritional values of the available dates in Bangladesh are still unknown. There is not detailed report of biochemical and nutritional investigations of available date fruits in Bangladesh. Therefore, we approached to establish a thorough analysis regarding nutrient contents in available date fruits in Bangladesh. Due to lack of modern facilities we stopped our research works as an immature stage. Further study on date fruits from Bangladesh can lead to the development of a new therapy for the treatment of various physiological disorders.

2. Materials & Methods

2.1. Sample Collection

Three varieties of fresh date fruits (*Phoenix dactylifera* L) were purchased from a retail food store (Rajshahi, Bangladesh).

2.2. Chemical Analysis

All the samples were washed thoroughly in running tap water and then air dried. The fruits were cut, deseeded and the pulp portion was homogenized in blender for analysis.

Samples were chemically analyzed for Moisture and Ash according to the official methods of analysis described by the Association of Official Analytical Chemist [11].

These methods rely on measuring the mass of water in a known mass of sample before and after the water is removed by evaporation.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_1} \times 10$$

Where; W_1 = Weight (g) of sample before drying

W_2 = Weight (g) of sample after drying

The basic principle of this technique is that water has a lower boiling point than the other major components within foods, e.g., lipids, proteins, carbohydrates and minerals. Sometimes a related parameter, known as the total solids, is reported as a measure of the moisture content.

$$\text{Solids (\%)} = \frac{W_2}{W_1} \times 100$$

Thus, %Total solids = (100 - %Moisture). To obtain an accurate measurement of the moisture content or total solids of a food using evaporation methods it is necessary to remove all of the water molecules that were originally present in the food, without changing the mass of the food matrix.

Ash and Crude fiber content was determined by the method

outlined in AOAC [11]. Lipid was extracted from a mixture of chloroform- ethanol [12]. Water-soluble proteins content of dates were determined [13]. The extraction was carried out with distilled water.

Carbohydrate content of date flesh was determined colorimetrically by the anthrone method [14]. Extraction of sugar from date flesh was performed described by Loomis and Shull [15]. Reducing sugar content of the dates was determined by dinitrosalicylic acid method [16]. Sucrose content was determined by the following formula [17]:

$$\text{Percent of non-reducing sugar} = (\% \text{ Total sugar} - \% \text{ Reducing sugar}) \times 0.95$$

Vitamin-A content was determined by laboratory procedure [14] and vitamin-C by titrimetric method [18].

The energy values of dates were evaluated using following formula [19]. Energy value (Kcal/100g = (2.62 × % protein) + (8.37 × % fat) + (4.2 × % carbohydrate).

All these minerals were determined using Atomic Absorption Spectrophotometer. Minerals were quantified on the basis of peak areas and comparison with a calibration curve obtained with corresponding standards. Minerals were expressed as milligrams per 100 g of fresh weight.

2.3. Preparation of Sample for Analysis of Mineral Content by AAS

About ten-gram of date fruits was dried in an oven at 100°C to 105°C. Ashing of the dried sample was then done in a muffle furnace by gradually increasing the temperature from 100°C to 600°C. A mixture of nitric acid (HNO₃) and water (1:1 v/v) was added to each sample and heated at low flame to removal of carbonaceous matter left in the ash. After cooling, few drops of concentrated HNO₃ acid were added to it to completely dissolve the sample. The samples were then transferred to a 100 ml volumetric flask and made the volume up to the mark with distilled water. These solutions were used as stock solution for the analysis of mineral by AAS.

3. Result and Discussion

In spite of socio-economic changes in the kingdom, date fruits are considered a good source of energy and significant amount of fiber [20]. The chemical properties of date are considered important in grading, preservation, storage and processing of dates. The average proximate composition of date palm flesh is summarized in Table 3.1 and Table 3.2.

We measured the PH values of the three varieties of dates Trounja, lagou and Gounda, were 6.1, 6.0 and 6.3 respectively. However, dates has been reported to be slightly acidic and ranges between PH 5 to 6 [21]. Our data is supported by the study of Lemine M.[22] in which authors have shown the similar PH values in some varieties.

Since moisture is a good parameter for food spoilage and acceptability, we investigated the moisture content of the three varieties of dates. We measured the moisture content as 14.1 %, 13.2% and 13.7% for Trounja, lagou and Gounda respectively. We did not get any significant difference in moisture content in these three varieties and the values were

very close to the value was reported [23]. We also checked the total solid content of Trunja, Lagou and Gounda dates were 86.20%, 85.9% and 86.8% respectively. The solid contents were almost same in three varieties of date and the results are similar to the study done by El-Sohaimy and Hafez E.E [23] was 86.50%.

Ash content is an index to the nutritive value of foods. So, we measured the ash content and we found the ash content were 2.13%, 2.18%, 2.15% which were very close to the study of El-Sohaimy and Hafez [23].

Al though dates are not a good source of protein [24], it may contribute to the human diet with high quality of some essential amino acids [6]. So, we measured the protein content of Trunja, Lagou and Gounda and the values were 2.2%, 2.0%, 2.1% respectively. The obtained data are in close agreement with those values are already reported [25; 26]. Borchani and his group analyzed eleven Tunisian cultivars of date for protein and found the highest protein content was 2.85 g/100g dry matter [27]. We also measured lipid content in the three varieties of date. Al though they contain a small amount of lipid however the highest lipid content was observed in Trunja (0.6%) and lowest in Gounda (0.41%), where Lagou contain (0.43%).

Dates are high in carbohydrate content coming in at a whopping 77.31%- 88.02% serving of the fruit [27] for Tunisian cultivar, where Trunja 83.95%, Lagou 77.31%, Gounda 84.79%. But we found relatively less amount of carbohydrate. Trunja has the highest carbohydrate content 55.0 % while Gounda has the lowest carbohydrate content 51.8 % and Lagou contain 53.5%. Lemdina date cultivar comprises 44.67% of carbohydrate has been reported [22] which is smaller than that of the carbohydrate we found. Reducing sugar and non-reducing sugar content of dates (Trunja, Lagou, Gounda) were 45.0%, 42.3%, 44.5% and 6.65%, 10.64%, 6.93% respectively. The aforementioned authors analyzed ten date cultivars grown in the Saudi Arabia and found 68.2-78.3% reducing sugar and 2.9-5.1% non-reducing sugar [28]. The sugar in dates are easily digested and can immediately be moved to the blood after consumption and can quickly be metabolized to release energy for various cellular activities [23]. It has been reported that dates are high source of energy as 100 g of flesh can provide average of 314 Kcal [29] while we investigated the energy values were 241.79 kcal, 233.54 kcal and 226.59 kcal for Trunja, Lagou and Gounda respectively. Dates are rich in crude fiber and contain 6.9 %, 6.05 % and 6.5 % for Trunja, Lagou and Gounda dates, where Trunja has highest and Lagou has lowest content of crude fiber. Dates are good source of crude fiber and depending upon cultivar and stage of ripening, it ranged from 6.4 % to 11.5 % in 14 different varieties [3, 4]. Some of the low quality dates which are used for industrial purposes, have been found to contain up to 10% of crude fiber [30]. Many found the crude fiber from dates and reported this value 4.4-6.5% [3, 4]. High fiber containing food is essential for preventing constipation, Cancer and Diabetes mellitus.

Date fruits are also good sources of vitamin and contain at least six vitamins [3, 4]. Vitamin-A and vitamin-C contents

were 0.7mg%, 1.2mg%, 0.9mg% and 0.9 mg%, 0.7 mg%, 0.9 mg% for Trunja, Lagou, Gounda dates respectively.

Dates have been reported to contain at least 15 minerals [3, 4]. Among all the minerals studied so far, we found potassium was the most abundant and was significantly high in Trunja which was 860 mg%. This value was nearly double to the potassium content of Lagou which was 460 mg% and this value for Gounda was measured as 520 mg%. We measured calcium, phosphorus, magnesium were (60, 55, 51); (55, 60, 52); (53, 50, 48) mg% for Trunja, Lagou and Gounda. Date are also a rich sources of iron and we measured the highest iron content Trunja was 1.9 while lowest was measured in Lagou was 1.79. These three varieties of dates are also a good source of trace elements such as zinc, manganese, copper, chromium, selenium and low content of sodium in mg/100 gm. Overall analysis of minerals revealed that dates were relatively rich in potassium and low in sodium was also found by Agboola and his group [32]. This low sodium: potassium ratio made the date a desirable food for persons suffering from hypertension [24, 33]. Potassium, a nutrient that is great in the maintenance of a healthy nervous system and in balancing the body's nervous system. Phosphorus works with calcium to help with bone strength and growth, calcium that helps to keep muscles working correctly [23] and selenium, copper, zinc and manganese have anticancer properties [34]. Dates are also considered as a good supplement for correcting iron deficiencies and anemia [35].

Table 3.1. The nutrition contents in three varieties of dates.

Parameter	Trunja	Lagou	Gounda
pH	6.2	6.1	6.3
Moisture (gm%)	14.1	13.2	13.7
Total solid (gm%)	86.20	85.9	86.8
Ash (gm%)	2.13	2.18	2.15
Protein (gm%)	2.2	2.0	2.1
Lipid (gm%)	0.6	0.43	0.41
Carbohydrate (gm%)	55.0	53.5	51.8
Reducing sugar (gm%)	48.0	42.3	44.5
Non-reducing sugar (gm%)	6.65	10.64	6.93
% of Energy (kcal)	241.79	233.54	226.49
Crude fiber (gm%)	6.9	6.05	6.5

Table 3.2. Vitamins and minerals content of three varieties of dates.

Parameter	Trunja	Lagou	Gounda
Vitamin-A (mg%)	0.7	1.2	0.9
Vitamin-C (mg%)	0.9	0.7	0.9
Potassium (mg%)	860	460	520
Calcium (mg%)	60	55	51
Phosphorus (mg%)	55	60	52
Magnesium (mg%)	53	50	48
Iron (mg%)	1.9	1.79	0.82
Chromium (mg%)	0.42	0.37	0.36
Copper (mg%)	0.35	0.36	0.32
Manganese (mg%)	1.1	0.85	0.91
Zinc (mg%)	0.72	0.71	0.69
Selenium (mg%)	0.22	0.31	0.25
Sodium (mg%)	1	0.7	0.6

4. Conclusion

Dates have been a part of human diet is proven to contain

high levels of carbohydrate, proteins, vitamins, crude fibers and essential minerals. Therefore, dates not only delicious with sweet taste and a fleshy mouth feel but also considered as an almost ideal food that provides a wide range of essential nutrients with many potential health benefits. Secrete of this majestic tree have been evaluating rapidly, with the latest sequencing of the entire genome which hopefully help to improve nutritional values of date fruits. In future the investigation of phytochemicals and anti oxidants from dates can help to control diabetes and cancer.

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