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Kharjoor (Dates Fruit)-An Alternative Balanced Nutritional Diet with Medicinal Benefits

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ABSTRACT
Diet is an in integral ingredient responsible for health and immunity. A complete diet includes requisite amount of carbohydrates, proteins, fats, vitamins, macro and micro minerals and above all an adequate amount of dietary fiber. It is not only cereals or legumes and vegetables that form a diet. A diet should also include fresh and nutritious fruits. Dates fruit is one such fruit which is available around the globe and also contains all the nutrients in proportion, to the required dietary allowance (RDA). It is available all year round, easy to store and because of the nutritional value it carries, it can be considered as a wholesome dietary fruit. In addition to its nutritional value, it also carries various medicinal properties and thus can be consumed as a congenial food in various diseases and nutritional disorders. Daily consumption Dates fruit may be a good alternative for the treatment of nutrition deficiency related diseases. In the era of consumption of junk food which is deficient of nutritious content, dates may be considered as a nutritious food and can play a major role in human nutrition and health because of their wide range of nutritional functional components as well as serving as an important healthy food in the human diet.
Keywords: *Date fruit, Kharjura, Nutrition, Nutritious food, Micronutrients*

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INTRODUCTION

Health or medicinal foods have recently received immense interest among the health professionals and public. Consequently, health markets across the globe have been swamped with products that claim to improve health as well as prevent and treat chronic diseases. Because of increased commercial exploitation of medicinal foods, all varieties of fruits and vegetables were re-evaluated for their phytochemical composition and health benefits under both laboratory conditions and clinical settings. Although date fruit (DF) is mostly admired for its nutritional and pharmacological properties by the people of Middle East Asia and northern Africa, it is still hardly recognized in the west or elsewhere due to the lack of sufficient scientific documentation. Owing to its high nutritive values and potential health promoting activities, DF may be considered as an emerging and potential candidate for the development of health-promoting foods.

Background:

Dates (Sans. *Kharjura*) are produced largely in the desert regions of Southwest Asia and North Africa, and are sold everywhere in the world as a high-value fruit crop. The fruit of the date palm (edible flesh of the fruit) is delicious and highly nutritious [1]. There are more than200 different date varieties. They consist of 70% carbohydrates, mostly in form of sugars. In most varieties, the sugar content is almost entirely invert sugar that is rapidly absorbed and brought in utilization by the human body. It also contain high amounts of dietary fiber, and are thought to be a good source of some minerals, viz. iron, potassium, and calcium. Little information is available on functional constituents of Khajoor (dates fruit) and their potential value as functional foods.

Foods providing health benefits beyond just the basic nutrition are known as functional foods. The functional constituents of dates include dietary fiber, which is important for the health of the gastrointestinal tract. Dietary fiber consists of the edible plant material which cannot be hydrolyzed by the human digestive tract and is left and excreted as it is. The moisture content, protein, fat, ash, carbohydrates, and energy of fresh and dried dates vary as per the species [1]. Sun drying is the

traditional way of preserving dates. Since sun drying depends on uncontrolled factors such as daytime temperature, diurnal temperature variations, and humidity, the production of uniform and high quality products is not expected. The average moisture content of 10 fresh date varieties is 42.4 g/100 g where the average moisture of 16 dried varieties is 15.2 g/100 g. The significant reduction in the moisture content of dried dates is mainly due to sun drying where fresh fruits lose moisture to the air. Dates are also a good source of energy mainly due to their high sugar content. The average energy of fresh and dried dates is 213 and 314 kcal/100 g respectively [2]. Fructose, glucose, and sucrose are the only sugars detected in fresh and dried dates. The average content of fructose, glucose, and sucrose in fresh dates is 19.4, 22.8, and 4.03 g/100 g respectively, with an average total of 43.4 g/100 g. Sugars increase in dried dates to an average of 29.4, 30.4, and 11.6 g/100 g for fructose, glucose, and sucrose respectively, with a total content of 64.1 g/100 g averaging from various species. Fructose and glucose are the major sugars in most dates varieties and are found almost in equal amounts.

Table 1: Average macronutrient content of date fruit (g/100 g)

Moisture g/100 g	Protein g/100 g	Fat g/100 g	Ash g/100 g	Carbohydrates g/100 g	Energy kcal/100 g	Fiber g/100 g	Phenolics mg/100 g	Antioxidants µ mol/100 g
6.8	5.1	9.0	1.1	78.0	394	73.1	3942	80400

Date Fruit: Richest Source of Dietary Minerals:

Living organisms require not only dietary minerals, but also several chemical elements other than carbon, hydrogen, nitrogen, and oxygen, ubiquitously present in common organic molecules for uninterrupted continuation of the biochemical reactions to continue to ensure healthy survival. These minerals and chemicals are required to maintain skeletal structure, perform various biochemical reactions, and also support the cellular functions. Thus, adequate intake of these dietary elements is required for optimal growth and maintenance of the human body functions. Based on the available data, DF may be considered as the richest source of dietary minerals in comparison to any other fruit currently consumed by humans. The mineral composition of a variety of DF have been published in detail elsewhere [4-7]. Several studies report variations in mineral content across different varieties of DF [4-8]. These variations may be due to the differences in geographical location, mineral content in the soil, fertilizer composition, and other various influencing factors. It was also reported that the amount of many of the minerals in dates changes (20–50%) depending on the maturity of the dates. The mineral content of fresh and dried dates and their Recommended Dietary Allowance (RDA) or Adequate Intakes (AI) are fairly adequateas the consumption of 100 g of dates provides over 15% of the daily RDA/AI of these minerals. Dates are also rich sources of micro minerals like selenium, copper, potassium, and magnesium. Moderate concentrations of manganese, iron, phosphorus, and calcium, per 100 g of dates, provide over 7% of the daily RDA/AI. The high potassium and low sodium contents in dates are desirable for people suffering from hypertension [3] and other sodium retention disorders of the body. In comparison with other dried fruits (plums, apricot, figs, raisins, and peaches), USDA National nutrient database reported, that 100 g of these fruits contain on average of 0.8 µ g Se, 0.3 mg Cu, 864 mg K, and 43 mg Mg. Thus, dates are regarded as a good source of these minerals. DF may also be considered as the richest source of macrominerals such as Ca, P, Mg, and K and microminerals such as Fe, Zn, Cu, Mn, and Se compared to any other commonly consumed fruits. Dates are also recognized as a fruit with extremely high levels of potassium and very low amounts of sodium [9, 10]. DF has also been described as a major source of Fe among fruits and berries. Based on the various published reports, some varieties of dates have been reported to contain Fe ranging from 4–60% of RDA [2]. Duke's ethnobotanical database reports that dates contain 10–151 ppm (1.0–15 mg/ 100 g) of Fe. Another important microelement present in high concentration in dates is Zn. In the *Medjool*, a specific variety of dates, the amount of Zn is about 2–11 times higher than the fruits that are regularly consumed. A more remarkable nutritional significance of dates is the presence of high levels of selenium, which is deficient in many of the fruits eaten. In certain date varieties, it has been documented to contain 100–300 µg of Se in 100 g of dates [5, 10]. In addition to the listed minerals it has been reported that certain varieties of dates cultivated in the Middle East contain fluorine (0.1–0.2 mg/ 100 g), cobalt (0.8–1.0 mg. 100 g), boron (3.3–5.6 mg/ 100 g) and chromium (0.01 mg/ 100 g) [5] and contains 0.06 ppm (6.0 µg/ 100 g) of iodine [11]. Selenium is required for the action of a coenzyme activating the antioxidant enzyme glutathione peroxidase, and therefore, has a role in the protection of body tissues against oxidative stress arising from free radicals, maintenance of defenses against infection, and the modulation of growth and development.

Table 2: Average Mineral content of fresh and dried dates (mg/100 g)

	Mg	Na	Ca	P	K	Mn	Fe	Zn	Cu	Se
Fresh dates	43.3	90.9	20.2	41.0	486	0.29	0.64	0.24	0.21	0.24
Dried dates	64.2	32.9	70.7	58.1	713	0.27	0.83	0.27	0.24	0.31
RDA/AI mg/day	420	—	1000	700	3500	2.3	8.0	11	0.9	0.055

Date Fruit: A Good Source of Vitamins:

Vitamins are essential for the normal growth and optimum development of an organism. Although required only in low amounts, vitamins have diverse biochemical functions. They function as hormones, antioxidants, cell signaling mediators, and regulators of cell growth, differentiation and integration. Many vitamins, especially B complex vitamins, functions as coenzymes of variety of enzyme reactions [10, 12]. They include B complex vitamins such as thiamine (B_1), riboflavin (B_2), niacin (B_3), pantothenic acid (B_5), B_6, and folate B_9 and vitamin K. Vitamin C content is comparatively found to be very low concentrations. However, in certain varieties of DF, vitamin C concentration ranges from 1.0 mg to 16 mg/100 g of DF. Choline and its metabolite betaine grouped under vitamin B,are also found in higher amounts in DF. Choline is required for structural integrity of cell membranes, cholinergic neurotransmission (acetylcholine synthesis), and as a major source for methyl groups. Betaine is utilized as an osmolyte and source of methyl groups and thereby helps to maintain liver, heart, and kidney health. Therefore, DF may be considered as a good source of many vitamins compared to fruits that are regularly consumed.

Table 3: Average vitamin content of date fruit (µg/100 g)

	A Retinol	B_1 Thiamin	B_2 Riboflavin	B_3 Niacin	B_6 Pyridoxal	B_9 Folate	C Ascor
Content	23.85	78.67	116.5	1442	207	53.75	3900
RDA/AI µ g/day	900	1200	1300	16000	1300	400	90000

Table 4: Average Amino Acid content of date fruit (mg/100 g)

Ala	Arg	Asp	Cys	Glu	Gly	His	Iso	Leu	Lys	Met	Phe	Pro	Ser	Thr	Try	Tyr
93.2	80.9	152	46	244	107	27.7	46.2	98.7	66.9	22.9	53.2	105	67.4	52.6	40.6	41.2

Date Fruit: Rich in Low GI Sugar Fructose:

Fructose is a monosaccharide, abundant in nature especially in sources like fruits, vegetables, and berries and is a valuable traditional source of energy. It has been considered beneficial and promoted over the years for the dietary or nutritional management of diabetes mellitus and insulin resistant conditions [13]. Consumption of fructose lowers the postprandial glucose compared with glucose, or glucose containing carbohydrates [14]. Fructose is also beneficial in diets for weight control because of its effects on appetite, food choices, and non-insulin dependent/thermogenesis. Most studies conducted to date have not demonstrated adverse effects on consuming moderate amounts of fructose [13]. It is presumed that increase in plasma fructose after consumption of fruits would be negligible because the fructose would be absorbed relatively slowly [15]. The gradual release of fructose thus allows intestinal brush border and hepatic enzymes to metabolize and assimilate fructose completely or almost completely. Therefore, fructose in fruits, vegetables, and whole foods are considered to be of less concern [16] compared to the consumption of purified fructose, sucrose, or other added fructose in foods. Fully ripened DF contains more than twice the amount of fructose compared to any other commonly consumed fruits. Occurrence of high amounts of fructose in dates provides several beneficial effects to human health and delay or prevents the development of chronic diseases. Studies have shown that infusion of catalytic amounts of fructose into the portal vein increases hepatic uptake of glucose by the induction of hepatic glucokinase [13, 15]. Small quantities of fructose also increase carbon flux through glycogen synthetase and stimulate glycogen synthesis. The low GI value of DF is attributed partly to the high concentrations of fructose and it has been reported that there exists an inverse correlation between fructose and the GI Values of DFs [17]. Moreover, it has been clearly demonstrated that DF consumption has a blunted insulin response in healthy volunteers compared to dextrose indicating a potential benefit in preventing the development of chronic diseases.

Date Fruit: A fiber Rich Diet

The indigestible dietary components of the plant materials such as polysaccharide components of the cell wall are known as dietary fiber. These components are divided into water-soluble (pectin and hydrocolloids) and -insoluble (cellulose, hemicellulose, and lignin) dietary fiber. Dietary fiber plays an important role in human health as low intake of dietary fiber has been linked to several diseases. DF contains more than twice the amount of dietary fiber than any other fruits. Based on the published reports, the total fiber content varies from 1.7–11.4% (w/w) depending on the fruit variety and method

of analysis. In a recent study [18] the total dietary fiber content has been reported between 14.4% and 18.4% of the dry matter.

Table 5: Average dietary fiber content of date fruit (g/100 g)

Soluble g/100 g	Insoluble g/100 g	Total g/100 g
0.84	5.76	8.00

Health benefits of date fruit:

In Indian traditional medicine, *Ayurveda*, and Middle Eastern folk-lore, DF is considered to have several medicinal properties. Dates have been considered to be a general tonic in *Ayurveda*. DF is a demulcent, expectorant, nutrient, emetic, laxative, aphrodisiac and prescribed for tuberculosis, gastroenteritis, coughs, respiratory diseases, asthma [19-22]. A recent ethnopharmacological survey reports that in certain regions of Morocco DF is widely used in folk-lore to treat diabetes and hypertension [23].

Fruits are very popular as a source of antioxidants [24]. Water extract of fresh DF is a strong scavenger of reactive oxygen species like superoxide ($O^{\bullet -}$) and hydroxyl ($OH^{\bullet}$) radicals. The same extract also showed a strong inhibitory effect on *in vitro* macromolecular damages such as lipid peroxidation and protein oxidation; nearly five times higher than the antioxidant activity of vitamins such as Vitamin C and E. Aqueous extract of DF inhibited H_2O_2 -induced cell damage and apoptosis in a concentration dependent manner in HEPG-2, A172, U937, and PC12 cell lines suggesting a potent activity against free radical induced cell death [25]. It has been demonstrated that methanolic and water extract of DF flesh significantly enhanced the serum antioxidant status by increasing vitamin C, E, β-carotene, and retinol as well as reduced serum malondialdehyde levels [26].

In traditional medicine practiced in the Middle East and northern Africa, dates have been used for the treatment of diabetes [23]. Studies have been conducted to test the glucose tolerance with dates in healthy subjects demonstrating that the incremental area under the curve (IAUC) after DF meal was significantly lower than glucose. Moreover, insulin and C-peptide levels were also lower after the date meal compared to glucose. Another study was published in which the researchers determined the acute glycemic and insulin response to dates in diabetic and non-diabetic subjects which demonstrated that consumption of isocaloric amounts of dates by well-controlled NIDDM patients induced significantly lower glucose levels. The IAUC for glucose following date consumption was significantly lower than that for dextrose. IAUC for insulin in patients after dextrose and DF consumption did not change significantly. More interestingly, in healthy volunteers, the stimulation of insulin secretion after DF consumption was 2.7 times less than dextrose. These preliminary studies indicate that DF does not adversely affect the glucose tolerance in healthy people. Date sugars are phenol rich, potent antioxidant, and strong inhibitor of α-glycosidase, and α-amylase [27]. α-Glucosidase inhibitors are widely used for the control of blood glucose level in type II of diabetes. α-Amylase is also considered a potent drug target for the development of anti-diabetic drugs. α-Glucosidase inhibitors block the membrane-bound intestinal α-glucosidases that hydrolyze oligosaccharides, trisaccharides, and disaccharides to glucose in the small intestine. Salivary and pancreatic α-amylase inhibitors block hydrolysis of complex starches to oligosaccharides. Inhibition of these enzyme systems reduces the rate of digestion of carbohydrates and as a result, less glucose is absorbed into the circulation. Numerous studies have demonstrated abnormalities in the micronutrient status of patients with DM and some studies indicate that deficiency in certain minerals correlate with the presence of diabetic complications. Micronutrients have been investigated as potential preventive and treatment strategies for both Type 1 and Type 2 diabetes and for common complications of diabetes. DF is rich in minerals involved in glucose metabolism and may be potentially beneficial for the prevention of diabetes. These minerals include Mg, which is essential for energy-dependent transport systems, glycolysis, oxidative energy metabolism, and release of insulin, Zn which is intimately involved in insulin synthesis, secretion, and signaling, Cr which enhances insulin action, and Mn and Cu, which are found to alter glucose homeostasis when deficient. An important mineral is Se which has been shown to have insulin-mimetic action [28]. It stimulates glucose uptake, regulate glycolysis, gluconeogenesis, fatty acid synthesis, and pentose phosphate pathway. Thus, regular consumption of DF would, theoretically, maintain physiological levels of these minerals in the body and may prevent the development of diabetes in the healthy population as well as the progression or control of diabetes in patients who are deficient in these minerals. Diabetes is also characterized by increased oxidative stress due to hyperglycemia that leads to micro- and macrovascular complications. Therefore, use of antioxidants is considered to be preventive and a treatment strategy for diabetes alone or in combination with other treatment strategies [29]. DF has strong antioxidant activity. The antioxidant effect of dates is attributed to mainly the phenolic compounds as well as carotenoids present in it. They have been shown to inhibit ROS production by inhibiting several ROS producing enzymes and by chelating trace metals and inhibiting phospholipases A2 and C [30]. Studies have demonstrated significant decrease of α- and γ-tocopherol, β- and α-carotene, lycopene, β-cryptoxanthin, lutein, zeaxanthin, retinol, as well as ascorbic acid in the course of diabetes

[31]. DF contains significant amounts of many of these antioxidants and its consumption would restore the antioxidant capacity of the body. DF may also enhance the endogenous antioxidant enzyme activity by providing metal ions in the form of dietary minerals such as Se, Zn, Mg, etc., that function as cofactors in many antioxidant enzymes. It may be presumed that high amounts of phytoesterogens contained in DF may potentially help to maintain normal glucose metabolism in both healthy populations as well as in diabetic patients [32, 33]. Another potential factor that may help to prevent the development of diabetes or its progression is the dietary fiber, which is present in large amounts in DF compared to any other commonly consumed fruits. Therefore, consumption of DF rich in dietary fiber would contribute to a number of metabolic effects, which include improvement of insulin sensitivity, modulation of the secretion of certain gut hormones, and effects on various metabolic and inflammatory markers that are associated with the metabolic syndrome [34].

DF may play a significant role in blocking the events that occur during the initiation and progression of cerebro-vascular diseases primarily by reducing hypertension, hypercholesterolemia, and oxidation of lipoproteins, enhancing serum antioxidant status, alleviating the harmful effects of oxidative stress and probably inflammation on the vascular system. Renin-angiotensin system is an important regulatory mechanism that governs blood pressure in the human body. Renin is released by the kidney in response to hypotension, decreased sodium concentration in the distal tubule, decreased blood volume or renal sympathetic nerve stimulation. Renin cleaves the liver-derived angiotensinogen into angiotensin I. Angiotensin I is then converted to angiotensin II by the angiotensin-converting enzyme (ACE) in the pulmonary circulation as well as in the endothelium of blood vessels in many parts of the body. Thus, blocking the formation of angiotensin II through ACE inhibition is an important treatment strategy to reduce blood pressure and many ACE inhibitory agents are currently being used to treat hypertension. In a recent study, DF sugars have been reported to have potent ACE inhibitory activity. The total phenolic content and antioxidant activity was found to be proportional to the ACE inhibitory activity of DF and also the inhibition of ACE strongly correlated with the α-amylase and α-glucosidase inhibitory activities. Among the palm sugars tested DF sugar had the highest ACE inhibitory activity. ACE inhibitory activity of leaf extracts of other date palm species has also been demonstrated [35]. Dietary minerals play an important role in maintaining the blood pressure. High sodium together with a low potassium intake causes a rise in blood pressure and increases the risk of cardio- and cerebro-vascular disease, renal disease, and bone demineralization. Sodium retention decreases the synthesis of nitric oxide, an arteriolar vasodilator, and increases the plasma level of dimethyl-L-arginine, an endogenous inhibitor of nitric oxide production. The best way of increasing potassium intake is to increase the consumption of fruit and vegetables, which in itself have other beneficial effects on health (antioxidants, folic acid, other minerals like Mg, Ca, etc.) independent of potassium intake [36]. A diet rich in potassium increases in serum potassium as well, even within the physiologic range, causing endothelium-dependent vasodilatation by hyperpolarizing the endothelial cell through stimulation of the sodium pump and opening potassium channels [37]. DF is an excellent dietary source of potassium with very low sodium content. Consumption of ten dates would provide more than 700 mg of potassium which corresponds to 15–20% of daily RDA/AI. Regular consumption of DF would thus provide sufficient amounts of potassium needed to maintain the electrolyte balance within the body and may prevent the development and progression of hypertension. Other major elements that have been shown to protect from hypertension are Mg and Ca. These two minerals occur in DF at very high concentrations. Magnesium may lower BP by acting like a natural calcium channel blocker. Magnesium is also a cofactor for the Δ-6-desaturase enzyme, which is the rate-limiting step for the conversion of linoleic acid, a precursor of prostaglandin E. Prostaglandin is a vasodilator and platelet inhibitor. Magnesium also regulates blood pressure by regulating intracellular calcium, sodium, potassium, and pH as well as left ventricular mass, insulin sensitivity, and arterial compliance. Calcium works in combination with other ions such as sodium, potassium, and magnesium to provide an ionic balance to the vascular membrane, vasodilatation, and resulting reduced BP.

Hypercholesterolemia is a major risk factor for the development of CCVD. Recently, hypocholesterolemic effects of DF has been reported [38]. DF supplementation may potentially modulate cholesterol absorption or metabolism and prevent the onset of atherosclerosis and coronary heart disease (CHD). There may be several mechanisms to explain the hypocholesterolemic effects of DF. First, DF contains very low amounts of fat. Second, as DF is a fiber rich diet, it may have significant hypocholesterolemic activity by three potential mechanisms: a) dietary fiber reduces the absorption of cholesterol and reabsorption of bile acids in the intestinal lumen, b) dietary fiber is associated with reduced insulin secretion because of its low glycemic effect on blood glucose, and c) fermentation of dietary fiber produces a series of short-chain fatty acids that may inhibit hepatic cholesterol biosynthesis. Third, the phytochemicals such as phytosterols and phytoestrogens present in DF might significantly reduce

hypercholesterolemia. They also inhibit intestinal cholesterol absorption by displacing cholesterol from micellar binding and thereby lowering the cholesterol levels [39]. As DF is rich in betaine and choline, it may be helpful in reducing or preventing vascular complication due to improper homocysteine metabolism. The decoction of DF or DF in combination with other herbs has been used in the folk-lore to treat bronchitis, cough, and other infections. The antimicrobial effect of DF can be explained based on the *in vitro* and in vivo data available in the scientific literature. DF has been to shown to have direct antibacterial effects on *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, and *Pseudomonas aeruginosa* [40]. DF also neutralized the hemolytic activity of the streptococcal exotoxin, streptolysin O. The erythrocytes taken from DF fed volunteers showed resistance to hemolytic activity of streptolysin O; however, date intake did not affect the titer of antistreptolysin O antibodies. It was suggested that the inhibitory substance may be steroidal in nature and the neutralization property occurs through erythrocyte membrane stabilization and inhibition of streptolysin O enzyme.

The laxative property of DF has been demonstrated by quantifying their effect on gastrointestinal transit in mice. Compared with the control, the animals that received DF extracts emptied more of their gastrointestinal content which ranged from 4 to 22% [41].

Recently, the neuro-protective effect of aqueous extract of DF in rats has been investigated. Pretreatment of the animals with DF at a dose of 250 mg/kg significantly decreased neural death of CA1 hippocampal neurons induced by focal cerebral ischemia compared to the control group [42].

DF was also tested for its beneficial effects in a rat model of ethanol-induced gastric ulceration. Aqueous and ethanolic extracts of DF ameliorated the severity of gastric ulceration and decreased ethanol-induced plasma gastrin levels and the concentrations of histamine and mucin in gastric mucosa [43].

CONCLUSION

DF is a fruit of high nutrient value compared to any other fruits commonly consumed. Diets in developing countries generally lack many nutrients, including energy due to inadequate intake of food. Mineral and vitamin deficiencies are also very common in the developing world due to reduced intake or lack of a nutritious diet. From the nutritional point of view, DF is an energy rich food and a source of a variety of nutrients that are essential to maintain human health. Many qualities associated with DF also make them an appropriate food source for the people living in the poverty-stricken parts of the world. It is an energy-rich food containing high concentrations of carbohydrates and several essential nutrients (minerals, amino acids, and vitamins) required to maintain human health. Moreover, DF is considered as a staple food like wheat, rice, etc., which are mainly consumed to meet the daily energy requirement. Consumption of DF would contribute significantly to the daily requirement of many of these components such as carbohydrates and minerals (Fe, Mg, Ca, Zn, P, Cu, Se, I, etc.) and a reasonable source of vitamins (niacin, B6, folate, etc). Therefore, daily consumption DF may be a good alternative for the treatment of deficiency related diseases such as anemia, goiter, rickets, osteomalacia, etc. and a good alternative for the malnourished infants and adults for their basic nutritional requirements and to fight against deficiency related diseases and infections which is an endemic in the poor nations of the world. Moreover, DF will be a nutritional therapy for osteoporosis, arthritis, and other diseases related to bone metabolism, multiple sclerosis, cancer, cataracts, age spots, etc., by supplementing minerals such as Ca, Cu, Se, P, etc., for the body's needs. DF consumption may serve as a single food source providing the benefits of both fruit and cereals to meet the daily nutritional requirements. The data presented in this review show that dates may be considered as a nutritious food and can play a major role in human nutrition and health because of their wide range of nutritional functional components as well as serving as an important healthy food in the human diet. Also, date seeds are rich sources of dietary fiber and natural antioxidative compounds that could potentially be used as a supplement of fiber and antioxidants in nutraceutical, pharmaceutical, and medicine industries.

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