

## Date

*Phoenix dactylifera*  
Arecaceae



<http://4.bp.blogspot.com/-dMqhUt4xb1w/UbY6GxSRv8I/AAAAAAAAAN8/Th1n2KRnyJA/s1600/Medjool-dates-010.jpg>

### INTRODUCTION

The date palm is one of the oldest known food plants and has been cultivated for over 5,000 years. Its long history of being a cultivated food plant has made the exact origin of the date palm difficult to pinpoint.<sup>1</sup> Dates have been harvested for centuries in the Middle East, Northern Africa, and the Arabian Peninsula and has played a large role in the economy of countries where the date palm natively grows.<sup>1,2</sup>

The date palm is a medium sized palm tree, about 49-82 feet tall.<sup>1</sup> The palm leaf lengths vary from 1.5 inches long to 11.5 inches long.<sup>1</sup> Around the trunk of the date tree, the palm branches are arranged in a spiral pattern.<sup>2</sup> The branches are much more dense at the top of the tree and form a crown with hundreds of leaves that are greyish in color.<sup>2,3</sup> The leaves possess a needle-sharp point at their tips to deter predators.<sup>2</sup> Flowers that form on the palm are small in size and white to yellow in color.<sup>2,3</sup> The date palm is dioecious and therefore one male date palm is grown for every 50 female date palm trees, which produce the date fruit.<sup>3,4</sup> The date fruits grow in clumps at the base of the palm branches and the bunches of fruit can weigh up to twenty pounds.<sup>1,4</sup>

Date fruit is oval in shape and are typically 1-2.5 inches long and between 0.87-2.75 inches in diameter and can vary in color from bright yellow to bright red.<sup>1</sup> Each fruit contains a seed pit that is  $\frac{3}{4}$ -1 inch long and  $\frac{1}{4}$ - $\frac{1}{3}$  inches thick that also contains many vitamins and minerals.<sup>1,5</sup> The date fruit ripens in five stages, each with its specific name as well as flavor profile. The five stages of maturity for the date fruit include “habahouk” where the fruit is pea-sized and fully layered, “kimri” where the fruit is green and its shape is small and oblong, “khalal” or “besser” where the fruit changes from green to yellow to red and reaches maximum weight and size, “rutab” where the flesh becomes softer and turns darker, and the final stage of “tamar” where the fruit is fully ripe and becomes dehydrated.<sup>5,6</sup> Date palms must have hot and dry conditions while still having a water supply to the roots in order to produce a high quality fruit.<sup>3</sup> As the date fruit ripens, the sugar content of the fruit increases while the protein content decreases.<sup>6</sup> The dates are sold in three varieties: hard, soft, and semidry.<sup>4</sup> The semidry form is most popular and is easily transported due to the dried nature of the fruit.<sup>4</sup>

### HISTORY OF USE

Traditional indications for using date fruit as a medicine included uses of leprosy, thirst, asthma, bronchitis, fatigue, tuberculosis, abdominal complaints, fever, vomiting, and loss of consciousness.<sup>1</sup> It is also used in Ayurvedic medicine for its cooling, anti-inflammatory properties.<sup>1</sup> While the meat of the fruit is most commonly consumed, the leaves, flower, gum, and seed pit and have historically been utilized and appear to provide additional health benefits.<sup>1</sup> The leaves of the date palm are traditionally used as an aphrodisiac and to support liver health.<sup>1</sup> The flower of the date palm is used as a liver tonic, expectorant, and for fever and blood complaints.<sup>1</sup> The gum of the date palm has traditionally been used as a diarrhea remedy.<sup>1</sup> The seed or pit of the date fruit is traditionally used to reduce inflammation, heal wounds, move the bowels and to treat asthma and gonorrhea.<sup>1</sup>

Roasted date pits have a long history of use as a caffeine-free coffee substitute in the Middle East. Roasted date pit tea has traditionally been used to stabilize blood glucose levels, increase memory, and prevent chronic diseases.<sup>7</sup> In modern times, studies suggest the beneficial use of dates to combat elevated blood sugar, tumor formation, male and female infertility, neuron and cellular damage, and demonstrates antifungal and antibacterial properties.<sup>1,8,9</sup>

## NUTRIENTS AND BIOACTIVE COMPOUNDS

The date fruit contains 70% digestible sugar including glucose, fructose, and sucrose.<sup>1</sup> Date fruits also contain significant amounts of fiber and small amounts of fat and protein (2.5-6.5 grams/100 grams of fruit).<sup>1,9</sup> There are 23 amino acids present in the date fruit and 17 in the date pit, which include all 9 essential amino acids.<sup>8,10</sup>

Date fruits are rich sources of minerals. A 100-gram serving offers 0.5-6mg of iron, 71 mg of calcium, 64mg magnesium, 864mg potassium and 0.5mg zinc.<sup>1,9</sup> In addition, date fruits contain trace amounts of sulfur, cobalt, phosphorus, copper, manganese, fluorine, boron, and selenium.<sup>1,9</sup> The elemental fluorine available in the date fruit can help fight teeth decay.<sup>1</sup>

Table 1. Medjool Date Fruit Macro and Micronutrient List<sup>11</sup>

<b>Nutrient</b>	<b>Per 1 date, pitted</b>	<b>Per 100 grams of dates</b>
<b>Calories</b>	66	277
<b>Protein (grams)</b>	0.43	1.81
<b>Total Fat (grams)</b>	0.04	0.15
<b>Fiber (grams)</b>	1.6	6.7
<b>Total Sugar (grams)</b>	15.95	66.47
<i>Sucrose</i>	0.13	0.53
<i>Glucose</i>	8.08	33.68
<i>Fructose</i>	7.67	31.95
Calcium (mg)	15	64
Iron (mg)	0.22	0.90
Magnesium (mg)	13	54
Phosphorus (mg)	15	62
Potassium (mg)	167	696
Sodium (mg)	0	1
Zinc (mg)	0.11	0.44
Copper (mg)	0.087	0.362
Manganese (mg)	0.071	0.296
Vitamin C (mg)	0.0	0.0
Thiamin (mg)	0.012	0.050
Riboflavin (mg)	0.014	0.060
Niacin (mg)	0.386	1.610
Pantothenic Acid (mg)	0.193	0.805
Vitamin B6 (mg)	0.060	0.249
Total Folate (ug)	4	15
Vitamin A (ug)	2	7
Vitamin K (ug)	0.6	2.7
Vitamin D (ug)	0.0	0.0

The date pits contain more fiber than its fruit as well as a variety of fatty acids including lauric, myrsitic, palmitic, and stearic acids.<sup>9,7</sup> The predominant monounsaturated fatty acids are palmitoleic and oleic acids while linolenic and linoleic are the predominant polyunsaturated fatty acids present in date pits.<sup>7</sup> Research indicates that oleic fatty acid has the potential to reduce LDL cholesterol in the body and linolenic acid is important for human skin health.<sup>7</sup> Pressed oil from date pits is shown to have a higher total tocopherol content than that of olive oil and a higher antioxidant content than that of coconut oil, however these values can vary with the origin of the date pit.<sup>5</sup> While date pit oil is unique in its fatty acid profile and tocopherol composition, the oil content in the pit is low and therefore less available for use.<sup>7</sup> In vitro research has demonstrated that date seed oil spares the depletion of important protective enzymes which further reduces oxidative damage to cellular membranes.<sup>11</sup>

Table 2. Mineral Content in Various Date Seed Varieties<sup>5</sup>

Minerals	Concentration (mg/100 g sample)					
	Roasted date pits *(1)	Deglet Nour seed *(2)	Allig seed *(2)	<i>P. canariensis</i> seed *(3)	18 date pit varieties *(4)	Bahraini dates seed *(5)
Sodium (Na)	16.5	10.4	10.25	8.8	7.2-15.4	21.7-26.1
Potassium (K)	254.1	229.0	293.0	255.4	175.0-240.5	459.9-542.2
Calcium (Ca)	19.2	38.8	28.9	48.6	13.4-34.0	6.5-11.3
Iron (Fe)	2.13	2.3	2.21	3.2	1.3-5.0	2.9-6.0
Copper (Cu)	0.5	-	-	-	0.1-0.6	0.4-0.6
Magnesium (Mg)	78.9	51.7	58.4	62.8	58.8-89.7	61.3-69.6
Manganese (Mn)	0.6	-	-	-	0.6-1.3	1.3-1.7
Zinc (Zn)	0.2	-	-	-	1.0-1.6	1.0-1.5
Phosphorus (P)	130.0	68.3	83.6	41.3	110.1-146.8	-

<sup>(1)</sup> Rahman et al., 2007; <sup>(2)</sup> Besbes et al., 2004a; <sup>(3)</sup> Nehdi et al., 2010; <sup>(4)</sup> Habib and Ibrahim, 2009; <sup>(5)</sup> Ali-Mohamed and Khamis, 2004

Table 3. Fatty Acid Composition of Date Seed Oil<sup>5</sup>

Fatty acid	Date seed oil						
	Deglet Nour *(1)	Heat treated Deglet Nour *(2)	Allig *(1)	Heat treated Allig *(2)	Tamirraq *(3)	<i>Phoenix canariensis</i> *(4)	Roasted date seed *(5)
Capric (C10:0)	0.8	0.7	0.1	0.8	0.0	0.1	0.35
Lauric (C12:0)	17.8	31.7	5.8	34.2	13.1	10.2	38.8
Myristic (C14:0)	9.8	14.0	3.1	15.7	11.0	7.5	-
Palmitic (16:0)	10.9	10.6	15.0	13.8	11.8	9.8	15.1
Stearic (18:0)	5.7	3.9	3.0	4.24	2.8	1.7	-
Oleic (18:1)	41.3	34.5	47.7	26.3	52.2	50.1	36.5
Linoleic (18:2)	12.2	3.3	21.0	0.3	7.1	19.2	9.2
Linolenic (18:3)	1.7	0.7	0.8	1.9	-	0.1	-

<sup>(1)</sup> Besbes et al., 2004a; <sup>(2)</sup> Besbes et al., 2005; <sup>(3)</sup> Al-Shahib and Marshall, 2003b; <sup>(4)</sup> Nehdi et al., 2010; <sup>(5)</sup> Rahman et al., 2007

Dates are rich in polyphenols including lignans, carotenoids, anthocyanins, procyanidins, and flavonoids.<sup>1</sup> Research indicates that a majority of the health benefits from date fruit can be associated with the polyphenol content which have synergistic effects, amplifying health benefits.<sup>12</sup> Carotenoids and flavonoids in the date fruit as well as the date seed act as potent antioxidants that help protect the cells of the body from free radicals that can damage and destroy cells.<sup>1,8</sup> However, carotenoids and anthocyanins are most

prevalent in the fresh fruit with lower levels detected in dried dates.<sup>12,6</sup> Procyanidins, a type of condensed tannin with powerful antioxidant properties, are present in date fruits in varying amounts based on ripeness.<sup>1,9</sup> Research indicates that as the date fruit completely ripens, levels of potentially harmful tannins significantly decrease.<sup>9</sup> The beta glucans available in the date fruit and date palm pollen have also been correlated with antitumor and anticancer activity.<sup>1,8</sup> Beta glucans are polysaccharides naturally occurring in some foods and fungi.<sup>13</sup> Beta glucans have been shown to increase immune defense and enhance macrophage activity as well as other natural cell protection mechanisms.<sup>13</sup> The enhancement of protective cellular mechanisms is linked with tumor cell inhibition.<sup>13</sup> There is also evidence that beta glucans can combat the negative side effects of Diabetes Mellitus, including lowering blood cholesterol and elevated blood pressure.<sup>14</sup>

## MODERN RESEARCH

### Oxidative damage and Inflammation

Research has been shown that daily consumption of 100g of dates daily for four weeks resulted in significantly reduced oxidative stress.<sup>12</sup> However, the antioxidant activity of dates is higher when dates are consumed dried versus fresh.<sup>15</sup> Dried fruits have been shown to have many phytochemicals and antioxidants for desired health benefits.<sup>15</sup> Dates are the third richest food source of carotenoids behind dried apricots and peaches.<sup>15</sup>

Table 4. Comparison of Macro Nutrient Composition Between Date Fruits and Other Fruits<sup>16</sup>

Components	Units/100g	Apple	Dates, <i>Deglet Noor</i>	Dates, <i>Medjool</i>	Navel Oranges	Blue Berries	Cranberry
Energy	kcal	52.00	<b>282.00</b>	<b>277.00</b>	49.00	57.00	46.00
Protein	g	0.26	<b>2.45</b>	<b>1.81</b>	0.91	0.74	0.39
Total lipid (fat)	g	0.17	<b>0.39</b>	0.15	0.15	0.33	0.13
Fiber, total dietary	g	2.40	<b>8.00</b>	<b>6.70</b>	2.20	2.40	4.60
Sugars, total	g	10.39	<b>63.35</b>	<b>66.47</b>	8.50	9.96	4.04
Sucrose	g	2.07	<b>23.84</b>	0.53	4.28	0.11	0.13
Glucose (dextrose)	g	2.43	<b>19.87</b>	<b>33.68</b>	1.97	4.88	3.28
Fructose	g	5.90	<b>19.56</b>	<b>31.95</b>	2.25	4.97	0.63
Maltose	g	0.00	<b>0.12</b>	<b>0.30</b>	0.00	0.00	0.00

Modified from USDA national Nutrient Database for Standard Reference, Release 21 accessed in September 2008. The numbers represented in bold are the highest value among the group.

The aqueous dried, ground pit extract has also shown to have protective effects on the liver and as well as anti-inflammatory activity.<sup>10</sup> This evidence supports the traditional use of date pit decoctions as a daily beverage in the Middle East, consumed much like coffee is to Americans

### Fiber and Digestive Health

Aqueous date flesh extracts also significantly decreased gastric transit time as well as significantly decreased number of ulcers, gastrin, and histamine in the stomach.<sup>12</sup> Additionally, dates combat diarrhea and enhance immune functions.<sup>1,8</sup>

### Diabetes

Diabetes Mellitus is characterized in the body by high blood glucose levels.<sup>14</sup> These high blood glucose levels can cause excessive thirst, urination, hunger, and weight loss (DM1) or as a product of excessive weight gain (DM2).<sup>14</sup> Prolonged exposure to high

blood glucose levels can also cause neuropathy, damage to the eyes, and inflammation of the body systems.<sup>14</sup> Animal studies using date leaf extract has been shown to have antihyperglycemic effects while the date pit extract has been shown to lower blood glucose levels in rats and can improve insulin resistance with its high fiber content.<sup>8,7</sup> Date fruit aqueous extract has shown to improve neuropathy related to diabetes as well.<sup>8</sup> The fruit and seeds have also been shown to reduce inflammation in the body, lower triglyceride and cholesterol levels.<sup>1,8</sup>

### **Future Outlook**

Two areas of research that merit further investigation clinically include the use of date palm pollen for fertility, date fruit's potential for tumor inhibition and neuroprotective nature of the date seed and fruit. Traditionally, date palm pollen was used as an aphrodisiac and to increase fertility in both men and women. A recent animal study demonstrated an increase in sperm count, serum testosterone, and spermatogenesis in male rats while increasing testosterone, estrogen, and progesterone in female mice.<sup>17</sup> Both the date fruit pollen as well as the fruit itself contains immune-stimulating beta glucans. When mice were given date fruit extract to combat tumor growth, doses of 0.2mg/kg and 5mg/kg, while an intermediate dose of 1mg/kg of body weight did not have a significant effect.<sup>12</sup> Additionally, the seed extract and date fruit have been shown *in vivo* to significantly reduce damage to neurons and oxidative stress in the brain.<sup>8</sup>

### **CONSUMER CONSIDERATIONS**

The current countries now producing dates include Southern Africa, South America, Australia, India and Pakistan, Mexico, and the United States<sup>1</sup> The top ten countries that are producing dates are "Iraq, Egypt, Saudi Arabia, Tunisia, Algeria, UAE, Oman, Libya Arab Jamahiriya, Pakistan, Sudan, Europe, and USA."<sup>8</sup>

The date varieties Sukhari, Saggae, Rotana, Kholasi, Rashoodia, and Nabtat Ali have shown the potential for fungus to grow on their seeds.<sup>5</sup> Consumption should be cautioned when working with these types of date seeds.

Consumers need to be aware of the tannin, phytate, and oxalate levels present in date fruit and the potential damage to the stomach, kidneys, and liver as well as potential mineral deficiencies.<sup>8,9</sup> Tannins are polyphenols that can interfere with the absorption of nutrients in the body.<sup>9</sup> However, the levels of tannin in the ripe fruit decrease as the fruit ripens and is the lowest in the ripe stage and its consumption should not cause any adverse effects on nutrient absorption.<sup>9</sup> Additionally, it has been shown that dates in general, and especially four varieties of dates (including Aseel, Dhakki, Hallavi, and Dora), are safe to consume as part of a regular diet without this potential for health complications due to low levels of anti-nutrients.<sup>8,18</sup>

The date fruit can also be utilized as a sugar source comparable with cane sugar or beet sugar.<sup>19</sup> The date fruit yield is very high and can therefore have the potential to out produce cane sugar and beet sugar both.<sup>19</sup> Date sugar could be a widely available, sustainable production form of sugar, however the labor to process the date sugar could be a barrier to its production.<sup>19</sup>

The versatility of the date palm has also made its appearance in bioremediation and other ecological applications. The powder of date pits, or date-pit ash, can be used to filter waste water or contaminated water due to its water absorption strengths.<sup>7,20</sup> Date

pits have also been traditionally used for compost preparation, animal feed, and an antimicrobial agent while there oil has been used as cosmetics and a potential biodiesel product.<sup>7,5</sup>

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