

## REVIEW ARTICLE

### Nutritive Value, and Pharmacological Effects of Dates (*Phoenix dactylifera* L.): A Mini Review

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#### Abstract

Dates (*Phoenix dactylifera* L.) are among the famous fruits in Egypt and other parts of the world, particularly in Arab countries. Dates are regarded as one of the fruits with high nutritive values and rich in carotenoids and flavonoids which have several pharmacological activities. This mini review highlights the contents of the different nutrients in the dates. In addition, recent studies related to the medicinal effects of dates, date seeds or their extracts were also reported. Based on the fresh weight, dates had high moisture content (15% in Tamer to 85% in Kimri stage), fiber (7.5-8%), and sugar (43.4%-64.1%) contents, particularly glucose, and fructose. In addition, dates have considerable concentrations of vitamins and minerals. However, they have relatively low concentrations of protein (1.5% -2.5%), and lipids (0.14%-0.38%). Several reports investigated the pharmacological activities of dates, date seeds, and their extracts. For instances, significant antioxidant activities, neuroprotective effects, healthy urogenital functions and hemopoietic system have been reported. Furthermore, anti-diabetic, antimicrobial, anti-inflammatory, antitoxic, and anticancer activities of date seeds, or their extracts have been additionally reported. Such beneficial healthy effects were mainly attributed to the high content of polyphenols in dates or date seeds and their extracts. Therefore, it is highly recommended to consume dates on a regular basis.

**Keywords:** Dates (*Phoenix dactylifera* L.); nutritive value; pharmacological activities; health effects

#### Introduction

Dates (*Phoenix dactylifera* L.) are among the most famous and oldest known fruits in the Middle East and Arab countries, particularly in Egypt. Dates have been cultivated in certain countries such as Iraq at least 5000 years ago, then the culture of dates' cultivation was spread into Arabian Peninsula, and Egypt. By the expansion of Islam, the culture of dates cultivation was spread into Europe as in Southern Spain, and to central Asia as in Pakistan [1, 2].

Dates are playing important roles as part of the food menu in many Arabian countries.

In addition, they represent important sources of the national income in many countries such as Iraq, Tunisia, Algeria, Morocco, Iran, United Arab Emirates, Saudi Arabia, and Egypt [3]. Dates production in the Middle east represents about 70% of the total dates production around the world [4]. There is a continuous advancement in the dates production around the world increasing from 1.8 million ton in 1961 to 5.4 million ton in 2001 [5]. Surprisingly, the global production of dates had increased to more than 8.6 million ton in 2016 [6].

Dates are a highly nutritious fruit rich in several classes of nutrients as they are rich in easily absorbed carbohydrates (70–80%) because most of the carbohydrates content in the dates are in the form of fructose and glucose [7, 8]. Dates are additionally very rich in fiber and mineral contents. They have adequate amounts of iron, calcium, phosphorus, magnesium, potassium, selenium, zinc, and manganese [9]. Therefore, dates are regarded as one of the folk medicines that used in the manipulation of various malnutrition-related diseases, immune deficiency, and cancers [10].

The pharmacological activities of dates and date seeds depend mainly on their content of polyphenols such as flavonoids and carotenoids. In general, there is no significant differences in the polyphenol profiles in the different dates' varieties. However, the quantitative concentrations might show little variation. For instances, in a study conducted

in Algeria, the phenolic profiles were similar in 8 dates cultivars, but their concentrations showed notable variations. The main phenol detected was catechin (22.04 to 24.92 mg/kg) followed by vanillin (10.67 to 23.98 mg/kg), vanillic acid (2.04 to 4.94 mg/kg), luteolin (2.76 to 3.45 mg/kg), tyrosol (1.23 to 2.39 mg/kg), and oleuropein (0.37 to 1.38 mg/kg). Such concentrations are regarded to be enough as bioactive compounds [11].

In this mini review we would like to highlight the nutritive values and the potential pharmacological effects of dates (*Phoenix dactylifera*), date seeds, and their extracts.

#### Nutritive value of *Phoenix dactylifera*

Several reports investigated the nutritional composition of dates *Phoenix dactylifera* as reported in **Table 1**. Here we summarize the nutritive value of dates as following:

##### Moisture content

**Table 1: A summary of the nutritional composition of *Phoenix dactylifera***

Nutrient	Reported concentrations or percentage	Reference
<b>Moisture</b>	59.2% to 64.5% in fresh dates	[12, 13]
<b>Fiber</b>	7.5% (fresh) - 8.0% (dried)	[16]
<b>Protein</b>	1.5% (fresh) - 2.5% (dried)	[18]
<b>Lipid</b>	0.14% (fresh) - 0.38% (dried)	[15]
<b>Carbohydrate</b>	43.4% (fresh) - 64.1% (dried)	[15]
<b>Minerals in dried dates</b>	mg/100 g	[24, 25]
Selenium	0.24-0.4	
Copper	0.01-0.8	
Potassium	382-1287	
Magnesium	31-150	
Sodium	1.0-169	
Manganese	0.01-0.4	
Iron	0.1-1.5	
Phosphorus	39-63	
Calcium	5.1-206	
<b>Vitamins in dried dates</b>	µg/ 100 g	[1, 19]
Riboflavin	116.5	
Niacin	1442	
Pyridoxal	207	
Folate	53.75	
Thiamin	78.67	
Vitamin C	3900	
Vitamin A	23.85	

Fresh refers to fresh dates; dried refers to dried dates

*Phoenix dactylifera* (PD) is generally rich in its moisture content as it is ranged between 59.2% to 64.5% based on the wet weight. Moisture content in PD varies greatly depending on several factors such as stage of development, season of cultivation, breed, type, physical condition (whole, semi dried, or dried), storage period, storage condition and temperature, and packaging type [12, 13]. Generally, dates pass four stages of development in the following order Kimri, Khalaal, Rutab, and Tamer (Arabic names). The moisture content in the Kimri stage is about 85% (date is red or yellow color). Moisture content falls into about 60% in the second stage Khalaal (date starts to be browning). Then moisture content decreases into 35% in the Rutab stage (date is black, soft, and palatable). Lastly, dates are dried by physical means or by sun drying and the moisture content falls to about 15% in the Tamer stage [1, 14]. In Egyptian Rutab, moisture content recorded an average of 13.8% [15].

#### *Fiber content*

Dates either fresh or dried are regarded as very rich sources of dietary fibers (soluble and insoluble) including cellulose, hemicelluloses, pectin, and lignin. Total fiber content in date is about 7.5% in the Kimri stage and increase into 8% in the dried type (Tamer stage) because of water loss in the later type [16]. In a study conducted in Egypt, the average crude fiber content in Egyptian date was 5.2% [15]. In general, dates can supply a part (32%) of the daily intake (25 g/day) of total fibers recommended to maintain a healthy adult [17]. Because of the high fiber content in the date, it gives the satiety sense, and acts as a natural laxative. Furthermore, it is highly recommended in the treatment of irritable bowel syndrome and in the reduction of the gastric and intestinal cancers [1].

#### *Protein content*

Generally, PD is poor in the protein content. Date contains small concentrations of protein ranged between 1.5% in the fresh dates to 2.5% in the dried ones [18]. Despite having low protein content, dates contain considerable

levels of the essential amino acids that are needed to maintain normal physiological functions and homeostasis of the body. The major amino acids in the dates are aspartic, glutamic, glycine, and leucine. Fresh dates are specifically rich in lysine, while dried dates are rich in proline [18, 19]. It notes worthy to mention that the recorded average protein content in the Egyptian dates is 3% with high content of aspartic acid, proline, glycine, histidine, valine, leucine, and arginine, respectively [15]. In a recent study that examined the chemical composition of Moroccan dates revealed that their protein content is at low concentration (1.09-2.80%) [20].

#### *Lipid content*

Dates are regarded as healthy food, particularly because they have minute concentrations of lipids as they contain 0.14% in the fresh type which increase into 0.38% in the dry type [1]. In Egyptian dates, lipid content recorded an average of 2.9% [15]. In addition, Boukouada *et al.* [21] reported that the flesh of PD contains 0.2-0.5% saponifiable oil, while the seeds contain 7.7-9.7% oil. They added that the major saturated fatty acids that occur in the flesh and seed PD include lauric (24.7%), myristic (11.8%), palmitic (8.6%), arachidic (0.5%), capric (0.5%), margaric (0.3%), and stearic (0.1%) fatty acids. While the unsaturated fatty acids contents include oleic (48.5%), linoleic (3.3%), linolenic acids (0.4%), and palmitoleic (0.1) fatty acids. Recently, lipid content in dates of Morocco was recorded to be as low as (0.16-0.39%) [20].

#### *Carbohydrate content:*

Dates are considered as rich sources of carbohydrates. They can be considered as ideal sources of energy supply to humans. Carbohydrate content in dates ranged between 43.4% in the fresh dates to 64.1% in the dried type. The only sugars detected in dates are fructose, glucose, and sucrose with average content of 19.4%, 22.8%, and 4.03% respectively in the fresh type. Such percentages are elevated in the dried type to 29.4%, 30.4%, and 11.6%, respectively. In

Egypt, the average recorded average carbohydrate content is 73% [15]. While chemical analysis of Moroccan dates revealed that sugar content in such types is high as 51.80-87.98% [20]. Fructose and glucose are the major sugar types in the different date varieties. Presence of high content of glucose in the dates, which is readily absorbed during digestion leading to rapid elevation of blood sugars [22]. In addition, the high content of fructose which is twice as sweet as glucose leads to the induction of the feeling of satiety [1, 8].

#### Minerals' content

Analytical studies revealed that dates are rich sources of the essential trace elements and minerals (mg/100 g) such as selenium (0.24-0.4), copper (0.01-0.8), potassium (382-1287), and magnesium (31-150), with low content of sodium (1.0-169) making it ideal nutrients for people suffering from hypertension [23]. In addition, dates contain moderate concentrations of manganese (0.01-0.4), iron (0.1-1.5), phosphorus (39-63), and calcium (5.1-206) [24, 25]. In a study conducted in Egypt, trace element levels in the Egyptian dates were recorded to be 65, 521, 20, 72, 2.69, 0.34 mg/100 g for calcium, potassium, magnesium, phosphorus, iron, and

selenium, respectively [15]. While the predominant mineral in the Moroccan dates is potassium (1055.26-1604.10 mg/100 g DW) [20]. Therefore, dates can supply adequate part of the human daily needs of minerals and trace elements.

#### Vitamins' content

Dates contain moderate average concentrations ( $\mu\text{g}/100\text{ g}$ ) of vitamin B group including vitamin B2, (riboflavin) (116.5), B3 (niacin) (1442), B6 (pyridoxal) (207), and B9 (folate) (53.75), vitamin C (ascorbic acid) (3900), with low content of vitamin B1 (thiamin) (78.67) and vitamin A (retinol) (23.85), respectively [1, 19]. Egyptian dates contained retinol, thiamin, and riboflavin at 40, 80. And 50  $\mu\text{g}/100\text{ g}$ , respectively [15]. Thus, dates can provide humans with part of their needs of vitamins.

#### Pharmacological effects of *Phoenix dactylifera*

*Phoenix dactylifera* was thought to have several therapeutic effects and therefore regarded as one of the folk medicines, particularly in Arab and Islamic countries. We here highlight the potential pharmacological effects of PD as indicated in **Table 2**.

**Table 2: A summary of the therapeutic effects of *Phoenix dactylifera* (PD)**

Therapeutic effects	Summarized finding	Reference
Antioxidant effects	PD could inhibit iron-induced lipid peroxidation in the rat brain homogenate	[34]
	PD upregulated mRNA expression of antioxidant enzymes and genes including SOD2, CAT, Nrf2, and GPX	[35]
Anti-cancer effects	PD had anti-carcinogenic effects against breast cancer in human breast cancer (MCF7) cells	[36, 37, 40]
	PD could inhibit diethyl nitrosamine-induced hepatocellular carcinoma in rats	[39]
	PD had cytotoxic effects against CaCo3, and Hela cell lines	[40]
	PD could induce apoptosis in human triple-negative breast cancer (MDA-MB-231) cells	[41]
Anti-diabetic effects	PD caused a significant reduction in the significantly plasma glucose and significantly increased the mean plasma insulin in diabetic rats	[43]
Urogenital effects	PD improved the renal functions in rats suffered from gentamicin-induced nephrotoxicity and ameliorated the proximal tubular damage	[46]
	PD had clear ameliorative effects against aflatoxin B1- induced toxicity on the renal	[47]

	cortex of adult male Albino rats	
	PD improved sperm parameters and increased the plasma levels of estradiol and testosterone	[48]
	PD fruit extract could improve spermatogenesis, and ischemia, and testicular tissue damage	[50]
<b>Antimicrobial and anti-inflammatory effects</b>	PD had inhibitory effects on lipid peroxidation-cyclooxygenase enzymes (COX-1 and COX-2)	[52]
	Silver nanoparticles from palm dates extract with significant anti-methicillin resistant <i>Staphylococcus aureus</i>	[38]
	Silver nanoparticles synthesized from palm date seed extracts had <i>in vitro</i> antibacterial activities, against <i>Bacillus subtilis</i> , <i>Escherichia coli</i> , <i>Staphylococcus aureus</i> , <i>methicillin-resistant Staphylococcus aureus</i> and <i>Streptococcus pneumoniae</i>	[53]
	PD extract loaded chitosan nanoparticles had significant antimicrobial activities against both Gram's negative and positive bacteria	[40]
<b>Neuroprotective effects</b>	PD had neuroprotective effects on mice experimentally exposed to ischemia	[50]
<b>Antitoxic effects of drugs and xenobiotics</b>	PD methanolic extracts had protective effects against paracetamol induced toxicities in rats	[56, 57]
	PD seeds extract could improve carbon tetrachloride-induced hepatic damage in Wistar rats.	[58]
	PD could reduce adrimycin induced cardiotoxicity and nephrotoxicity in rats	[59]
	PD extract loaded chitosan nanoparticles had significant ameliorative effects against doxorubicin cardiotoxicity and nephrotoxicity in a rat model.	[40]
	PD extract ameliorated isoproterenol-induced cardiomyopathy through downregulation of oxidative, inflammatory, and apoptotic molecules in rodent model.	[60]
	PD fruit extract ameliorated the testicular toxicity induced by formaldehyde in adult NMRI male mice	[61]
	PD pollen extract recovered cadmium-induced testicular damage in rats	[62]
	PD extract recovered the hepatic tissue from mercuric chloride-induced changes	[63]
	PD fruit extract could protect liver against dimethoate-induced damage	[64]
		PD could reduce obesity
<b>Other pharmacological activities</b>	PD could improve the blood health	[66]
	PD could improve anemia in pregnant women	[68]
	PD could improve gastric ulcers	[70]
	PD could improve the taste impairment caused by COVID-19	[71]
	PD protects teeth against decay	[74]

### Antioxidant effects

Dates are rich in phytochemicals and bioactive compounds such as carotenoids, flavonoids, and polyphenolic compounds that are well-known for their antioxidant potentials [26]. For instances, dates are rich in phenolic compounds including the non-flavonoids such as benzoic acid and cinnamic acid derivatives, and flavonoids such as flavones, flavonols, isoflavones and anthocyanidins [27, 28]. In particular, dates are rich in apigenin, chrysoeriol, isorhamnetin, 3-methylisorhamnetin, luteolin, quercetin, malonyl derivatives, and kaempferol [29]. In addition, dates have considerable concentrations of condensed tannins [30]. The latter is responsible for the astringent taste of some breeds of dates [31]. Carotenoids are contributing to the antioxidant effects of dates; they constitute a major part of the phytochemicals found in the lipid part of the dates [32]. Carotenoids are the precursor of vitamin A and have major contribution to keep the integrity of the human skin, vision, and spermatogenesis and have well documented antioxidant effects [33]. The aqueous extract of dates seed extract was confirmed to be a potent scavenger of superoxide and hydroxyl radicals. In addition, it can inhibit iron-induced lipid peroxidation in the rat brain homogenate in a concentration-dependent manner [34]. Furthermore, in a recent clinical control study, receiving PD for 30 consecutive days led to upregulation of mRNA expression of antioxidant enzymes and genes including SOD2, CAT, NrF2, and GPX. This significantly correlated with an improvement in semen parameters including count, motility, and morphology of sperm in fertile and infertile men [35].

### Anti-cancer effects

The anti-cancer effects of *Phoenix dactylifera* attracted the attention of the scientific audience as one of the alternative and natural medicine. In this regard, Ajwa-dates-extract showed beneficial anti-carcinogenic effects against breast cancer in human breast cancer (MCF7) cells [36]. Likely, a methanolic extract of PD had

significant antiproliferative effects on an *in vitro* study using MCF7 cells in a concentration-dependent fashion [37]. In addition, silver nanoparticles made from palm dates extract exhibited significant anti-cancer activities against MCF7 cells via induction of cytotoxicity and apoptosis. The anti-cancer effects of dates were attributed to its high content of sugars and antioxidants [38]. Besides, aqueous extracts of Ajwa dates could inhibit diethyl nitrosamine-induced hepatocellular carcinoma in rats. As the aqueous extracts of the Ajwa dates reversed the damaged liver towards normal and restored the gene expressions and the enzyme activities of the antioxidant enzymes, liver enzymes, and cytokines to the normal level [39]. In addition, Sahyon and Al-Harbi [40] presented a new heart of PD extract loaded chitosan nanoparticles with anticarcinogenic activities as evaluated by their cytotoxic effects on MCF7, CaCo3, and Hela cell lines. In a recent report, Khan *et al.* [41] reported that Ajwa dates pulp extract is rich in phytochemicals that have the ability to induce apoptosis in human triple-negative breast cancer (MDA-MB-231) cells. They added that the possible mechanism for such effects involves inhibiting AKT/mTOR pathway and modulating Bcl-2 family proteins. In general, anticancer effects of dates, date seeds, or their extracts are potentially attributed to their high contents of polyphenols which act as antioxidants with free radicals scavenging abilities which were related to the decreased inflammation and reducing tumors by obstructing proinflammatory mediators [11, 41, 42].

### Anti-diabetic effects:

Several studies investigated the potential anti-diabetic effects of dates, dates seeds, or their extracts. For instances, an aqueous extract of the Egyptian desert dates reduced the mean plasma glucose significantly increased the mean plasma insulin in diabetic rat groups compared to the diabetic control group. An obvious increase in the weight of the pancreas and the size of the islets of Langerhans and improvement in the histoarchitecture were evident in the treated

groups compared to untreated ones [43]. Furthermore, Abiola *et al.* [44] reported that the ethanolic extracts of the seeds of the dates had significant antidiabetic effects in alloxan-induced diabetic rats. In addition, Saryono [45] concluded that drinking of palm seed extracts can restore insulin production, reduce blood glucose levels in hyperglycemic patients with no change the glycemic index in normal people. It notes worthy to mention that all anti-diabetic effect of dates is related to dates seeds and their extracts not the fruit itself as the fruit is very rich in glucose and can directly elevate blood glucose level.

#### *Urogenital effects*

Several reports investigated the beneficial urogenital effects of dates. For instances, Al-Qarawi *et al.* [46] mentioned that the extracts of the flesh and pits of PD improved the renal functions in rats suffered from gentamicin-induced nephrotoxicity and ameliorated the proximal tubular damage. Besides, date has clear ameliorative effects against aflatoxin B1- induced toxicity on the renal cortex of adult male Albino rats [47]. In addition, Fallahi *et al.* [48] reported that dates are rich in estrone, sterols, and other agents that positively impact male fertility, in terms of sperm parameters and increasing the plasma levels of estradiol and testosterone. Likely, dates have supporting action on the female reproductive process [49]. Jahromi *et al.* [50] additionally reported that PD fruit extract could improve spermatogenesis, and ischemia, and testicular tissue damage caused by testicular torsion or detorsion in Sprague Dawley rats via improvement of the antioxidant status in the testicular tissue.

#### *Antimicrobial and anti-inflammatory effects*

Dates had significant anti-inflammatory effects possibly via modulation of cytokines' expressions [51], and inhibition of lipid peroxidation-cyclooxygenase enzymes (COX-1 and COX-2) [52]. Recent biotechnology approaches had developed silver nanoparticles from palm dates extract with significant anti-methicillin resistant *Staphylococcus aureus* [38]. Furthermore, Aldayel *et al.* [53] reported *in vitro* antibacterial activities, against *Bacillus*

*subtilis*, *Escherichia coli*, *Staphylococcus aureus*, methicillin-resistant *Staphylococcus aureus* and *Streptococcus pneumoniae* of silver nanoparticles synthesized from palm date seed extracts. Furthermore, PD extract loaded chitosan nanoparticles had significant antimicrobial activities against both Gram's negative and positive bacteria [40].

#### *Neuroprotective effects*

The neuroprotective effects of dates attracted much attention. In this regard, Pujari *et al.* [54] confirmed the neuroprotective effect of PD in mice experimentally exposed to ischemia. Furthermore, Tauqeer *et al.* [55] suggested that dates have cerebroprotective effects due to its high content of antioxidants.

#### *Protective effects of Phoenix dactylifera against chemicals'-induced toxicities*

Several reports have investigated the protective effects of PD against xenobiotics' induced toxicities including those produced by drugs and environmental chemicals such as heavy metals, and pesticides. For instances, Salem *et al.* [56] compared the protective effects of PD aqueous and methanolic extracts against paracetamol, a widely used analgesic and antipyretic, induced hepatic damage in rats. They reported that paracetamol could elevate the hepatic damage markers such as alanine aminotransferase (ALT), alkaline phosphatase (ALP), aspartate aminotransferase (AST), gamma glutamyl transferase (GGT), and bilirubin. They recorded significant recovery of the hepatic tissue, in terms of normal liver functions upon the use of either PD aqueous, or methanolic extracts. However, PD methanolic extracts had much protective abilities [56]. Similarly, rats experimentally exposed to paracetamol had developed alterations in the liver function enzymes including AST and ALT, lactate dehydrogenase, total protein, direct bilirubin, and total bilirubin. Such alterations were significantly recovered by exposure of rats to PD seeds extracts at 200 and 400 mg/kg orally in a day-to-day routine for six days. The authors attributed such hepatoprotective effects of PD seeds extracts to their antioxidant activities and their ability to trap free radicals, particularly because of their high

content in caffeic acid, *p*-coumaric acid, quercetin, and rutin [57]. Besides, PD seeds extract could improve the alterations in the liver tissue (vacuolization, and fibroblast proliferation) and liver function enzymes (AST, ALT, ALP, and albumin) induced by carbon tetrachloride in Wistar rats [58]. Adriamycin (ADR) is an anticancer, and antibiotic drug which caused cardiotoxicity and nephrotoxicity in several patient due to abnormal production of reactive oxygen species. In an experimental trial, the ethanolic extract of the heart of PD could successfully reduce the ADR-induced cardiotoxicity and nephrotoxicity in rats [59]. Furthermore, Sahyon and Al-Harbi [40] presented reported that PD extract loaded chitosan nanoparticles had significant ameliorative effects against doxorubicin cardiotoxicity and nephrotoxicity in rat model. Isoproterenol is a medication used for treatment of bradycardia. However, at certain cases, this medication causes cardiomyopathy. Interestingly PD extract ameliorated the cardiac functions and isoproterenol-induced cardiomyopathy through downregulation of oxidative, inflammatory, and apoptotic molecules in rodent model [60].

Formaldehyde is one of the widely used materials in scientific field and in industries. Prolonged exposure to formaldehyde might lead to serious harmful effects on fertility due to the increase of the reactive oxygen species level in the testicular tissue. In this regard, the prophylactic effects of PD fruit extract on the testicular toxicity induced by formaldehyde in adult NMRI male mice were evaluated. Interestingly, administration of PD fruit extract prior to formaldehyde exposure could partially improve the increased sperm morphological anomalies and the reduced the sperm count, viability and motility, and testosterone level [61].

Cadmium is a heavy metal with well-known testicular toxicities. The protective effects of the date palm pollen extract against cadmium induced-testicular damage (decreased sperm count and motility, and increased rates of sperm abnormalities) were evaluated in adult male Wistar rats.

Interestingly, date palm pollen extract attenuated the toxic effects of cadmium and recovered the animals to their normal level. The authors concluded that such protective effects of date palm pollen extract were probably via activation of testicular endocrine and antioxidant systems [62]. Similarly, PD extract could recover the hepatic tissue from mercuric chloride induced-hepatotoxicity, apoptosis, and hepatic injury. PD extract could restore the hepato-pathological changes to the physiological limits in male rats [63].

Dimethoate is one of the organophosphorus insecticides that is commonly used as pesticide. Dimethoate has several hepatotoxic effects in experimental studies. In this regard, Saafi *et al.* [64] reported that dimethoate caused hepatotoxicity in a rat model as monitored by the significant rise in the levels of liver function enzymes (ALT, AST, and LDH). Such changes were accompanied by histopathological alterations in the liver tissue as marked by the appearance of vacuolization, congestion, inflammation, necrosis, and enlargement of sinusoids in liver section. They added that pretreatment with date palm fruit extract had significant protective effects as indicated by restoring the normal liver functions, and hepatic tissue integrity. They attribute such protective effects to the rise in the antioxidant systems.

#### *Other pharmacological activities*

There are several other pharmacological activities for PD. For instances, an aqueous extract of PD could reduce obesity [65]. In addition, methanolic extract of PD had significant improvement in the blood health, particularly against lead-induced hematotoxicity [66] and could increase haemopoietic activity [67]. Similarly, consumption of dates could improve mild anemia in pregnant women [68] and improves the vascular health [69]. The pharmacological mechanisms of dates on the hemopoietic system were potentially attributed to the high content of bioactive compounds in dates such as tannin, folic acid, amino acid, ascorbic acids, and phenol. Some of these components may be responsible for the increment of hemoglobin. Components like ascorbic acid,

vitamin C and fructose are known as enhancers of iron absorption [70]. Interestingly, date also had ameliorative effects against ethanol-induced gastric ulcers in rats [71]. Such protective effects against gastric ulcers were proposed to be via increasing gastric mucin and reducing histamine and gastrin [71]. Furthermore, a recent study revealed that consumption of dates could improve the taste impairment caused by COVID-19 [72]. Besides, microporous natural capsules were extracted from *Phoenix dactylifera L.* spore and then coated by natural polymer composite (carboxymethyl cellulose with epichlorohydrin). The *in vitro* studies suggested the use of such capsules as drug carriers [73]. Lastly, PD contains elemental fluorine which is of great value in protecting teeth against decay [74].

### Conclusion

This mini review demonstrates the nutritive values and the pharmacological activities of dates. It was clear from the cited literatures in this study that dates are rich in fibers, and sugars. Dates also contain considerable concentrations of vitamins, and minerals. However, dates contain minute concentrations of protein and lipids. Several literatures documented the pharmacological effects of dates. In particular, dates have clear antioxidant, anti-diabetic, anti-cancer, antitoxic, and anti-inflammatory activities. In addition, dates could improve the neurological functions, urogenital activities and maintain good health of the blood. Therefore, it is highly recommended to consume dates on a regular basis.

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### الملخص العربي

#### القيمة الغذائية والتأثيرات الدوائية للتمر (فونيكس داكلتيفيرا): مقال مرجعي

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التمر هو أحد الفاكهة الشهيرة في مصر وأجزاء أخرى من العالم وخاصة في الدول العربية. يعتبر التمر من الفاكهة الطبيعية ذات القيمة الغذائية العالية وله العديد من التأثيرات العلاجية. تسلط هذه المراجعة المصغرة الضوء على المحتوى الغذائي للتمر. بالإضافة إلى ذلك، تمت مراجعة العديد من الدراسات الحديثة المتعلقة بالآثار الطبية للتمر. وقد أوضحت هذه الدراسات أن التمر يحتوي على نسبة عالية من الرطوبة (15% - 85%) والألياف (7.5% - 8%) ومحتويات السكر (43.4% - 64.1%) وخاصة الجلوكوز والفركتوز. بالإضافة إلى ذلك، يحتوي التمر على تركيزات عالية من الفيتامينات والمعادن. إلا أنه يحتوي على تركيزات منخفضة نسبياً من البروتين (1.5% - 2.5%)، والدهون (0.14% - 0.38%). وقد أجريت العديد من الدراسات لتقصي الأنشطة الدوائية للتمر. ولقد ثبت أن للتمر أنشطة كبيرة مضادة للأكسدة، وتأثيرات واقية للأعصاب، كما أنه يحافظ على وظائف الجهاز البولي التناسلي، ويحافظ على الصحة جيدة لمكونات الدم. علاوة على ذلك، فقد أثبتت العديد من الدراسات التأثيرات الإيجابية للتمر ضد مرض السكري وكمضاد للميكروبات والالتهابات والسرطان.