

# Date Seed and Its Components, Nutrition and Biological Activities

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## ABSTRACT:

Millions of people in the Middle East eat the fruit of the date palm (*Phoenix dactylifera* L) which is a vital crop in most countries. The date seeds, which are a waste product from the date fruit processing sector, are feed to domestic farm animals. In addition to being a rich source of protein, dietary fibre, oil, carbs date seeds also contain bioactive phenolic chemicals that may have biologically significant effects. Furthermore, date seeds rich chemical makeup qualifies them for usage in the production of food products, cosmetics and pharmaceutical supplements. The purpose of this review is to discuss the nutritional worth of date seeds in the light of their potential as a nutritional therapeutic agent for chronic diseases and further the most recent information on their cytotoxicity against cancer cell lines, ability to fight diabetes, antioxidant potential, antibacterial action and anti-inflammatory activity will be presented along their usage as oil and powder.

**KEYWORDS:** Date seeds, *Phoenix dactylifera* L, anti-inflammatory, antidiabetic, anticancer, antioxidant, antimicrobial.

## INTRODUCTION

In tropical and subtropical areas, particularly in the Middle East and North Africa, date palms (*Phoenix dactylifera* L) are extensively grown [1]. Since the 20th century, the gross output value of date fruit has increased significantly Worldwide in 2020, it reached its greatest value of almost US \$14 billion [2]. The economic and social facets of date-producing Nations are fuelled by date palm trees and their fruit [3,4]. Since the time of Prophet Mohammed (Peace Be Upon Him) Muslims have commonly broken their fasts during the holy month of Ramadan by eating dates because of its

nutritional and therapeutic benefits as stated in the Holy Quran [5].

Date seeds, as a by-product of the manufacture of date fruit, are typically thrown away, used as animal feed or processed as trash. On the other hand, date seeds, which are high in phenolic compounds, make up to 10–15% of the fresh weight of date fruit [6]. Numerous investigations have been conducted about the pharmacological effects of date seeds, including their antiviral, antibacterial, antidiabetic, anti-inflammatory and antioxidant qualities [7, 8].

Because of their health benefits date seeds have great promise as a nutritional treatment agent for a number of chronic disorders [9].

This article examines the nutritional

Common Name	Date pits, Date stones
Kingdom	Plantae
Order	Arecales
Family	Arecaceae
Genus	Phoenix
Species	<i>P. dactylifera</i>
Synonyms	Palma dactylifera (L) , Mill

value, biological activity and applications of date seeds in medicine and other unconventional fields.

## BOTANICAL DESCRIPTION: [10]

**Table 1:** Botanical description of *Phoenix dactylifera* L



**Figure 1:** Date seeds



**Figure 2:** Date palm

## THE NUTRITIONAL VALUE OF DATE SEEDS:

### 1. Fatty Acids

The five main fatty acids found in date seed oils are oleic, lauric, myristic, linoleic and palmitic [11]. Biglar and colleagues (2012) used Gas Chromatography to determine that

### 2. Phenolic Substances

Compared to other fruits, including grapes, nut seeds and even their flesh, date seeds have been reported to have higher quantities of total polyphenols [12]. Date seeds are known to contain seven distinct phenolic

the main fatty acid was oleic-lauric oil, which had a concentration of 33.38% to 51.40%. Lauric acid, on the other hand, had a level of 18.78% to 31.61%. According to reports, myristic acid ranks third among main fatty acids, after linoleic and palmitic acids.

acids, with p-coumaric acid having the greatest amount, ranging from 109.87 to 141.72 mg/100 g, followed by caffeic acid, chlorogenic acid, p-coumaric acid, ferulic acid, gallic acid, syringic acid and vanillic acid [13]. Furthermore according to HPLC

analysis using a diode-array detector (DAD) data, the most prevalent flavonoid in date seeds is rutin, which ranges from 71.74 to 86.32 mg/100 g. Quercetin, which comes in second place with 23.73–34.06 mg/100 g and luteolin which comes in third position with 9.17–13.24 mg/100 g.

### 3. The Amino Acids

Depending on the stage development of date seeds the amino acid content varies. Glutamic acid (16.44 g/100 g), phenylalanine (5.93 g/100 g) and leucine (6.10 g/100 g) are the three main amino acids found in date seeds [14]. Shina and colleagues (2013) after using an Automatic Amino Acid Analyser found that leucine (1.7 g/100 g), lysine (1.1 g/100 g) and phenylalanine (1.08 g/100 g) are the major essential amino acids, while aspartic acid (1.72 g/100 g), alanine (1.2 g/100 g) and tyrosine (1.2 g/100 g) are the major non-essential amino acids [15]. Non-proteogenic amino acids such as  $\gamma$ -amino-n-butyric acid and 1-aminocyclopropane-1-carboxylic acid, can also interact with antibodies to eliminate harmful substances in the liver, create T-cells and lower the body's creatinine levels [16,17].

### 4. Vitamins and Minerals

Methods like Gas Chromatography and High Performance Liquid Chromatography (HPLC) have demonstrated that date seeds contain various minerals, the most common of which is potassium as well as vitamins A, According to studies dates are higher in dietary fibre than grains [25]. Date seeds include functional dietary fibres such as lignin, pectin, tannin and hemicellulose components. As per Attia and Associates (2021), date seeds have more fibre than barley and yellow corn [26]. Hemicellulose

B<sub>1</sub> (thiamine), B<sub>2</sub> (riboflavin), C, E, K and folate [18,19]. Zinc, sodium, fluorine, phosphorus, calcium, cobalt, copper, iron, magnesium, boron and selenium are more minerals [20]. Among these minerals, potassium, phosphorus and iron are found in greater amounts. Hence it is advised to the individuals with hypertension consume date seeds due to their low sodium ratio. Hinkaew and associates (2021) found that date seeds cultivated in cell culture had greater angiotensin-converting enzyme inhibitory (ACEI) action than date meat. All things considered, date seeds showed 58.69–61.36% inhibition of the important enzyme that controls hypertension. Furthermore, date seeds can help to prevent tooth decay because of their high fluorine concentration [21].

Vitamins and amino acids included in date oil, which is derived from the seeds, can greatly encourage hair growth [22]. Date seeds oil minerals have the ability to produce energy and restore riboflavin development and cellular function [23]. According to a study conducted in the United Arab Emirates (UAE) several vitamins were found to be considerably present in 18 different types of date seed oils including Khalas, Lulu, Fard, Raziz and Sokkery, [24]. High levels of  $\alpha$ -tocopherol,  $\alpha$ -tocopheryl acetate,  $\gamma$ -tocopherol and vitamin K<sub>1</sub> were discovered in the majority of date seed oils.

### 5. Dietary Fibre

ranges from 12.0% to 17.5%, cellulose from 26.1% to 42.5%, lignin from 7.21% to 11.0% and acid detergent fibre (cellulose + lignin) ranges from 39.6% to 57.5%.

### 6. Sugars

According to UV-Visible

Spectrophotometry, the soluble sugars in date seeds are 3.5 g/kg of glucose, 3.8 g/kg of fructose, 3.7 g/kg of stachyose, 3.5 g/kg of sucrose and 2.2 g/kg of galactose [27]. Date seed sugar has the beneficial ability to produce powdered insulin, which can assist diabetics control their blood sugar levels. [28]. El Fouhil and colleagues reported that date seeds extract (DSE)-treated

**Table 2:** An extremely useful and of data seeds.

COMPONENT	CONTENT (%)
Fat	5.0-13.2
Phenolics	5.072
Protein	2.3-6.4
Ash	0.82-1.14
Carbohydrate	2.43-4.65
Dietary Fiber	22.5-80.5
Magnesium	0.058-0.090
Calcium	0.014-0.034
Phosphorus	0.110-0.134
Potassium	0.175-0.240
Sodium	0.008-0.013

### PHYTOCHEMISTRY OF DATE SEEDS

Phenolics, sterols, carotenoids, anthocyanins, procyanidins and flavonoids are among the many phytochemicals found in date fruit. The fruit type, fruit picking stage, location and soil conditions all affect the ratio and concentrations of these components. The fruit nutritional and organoleptic qualities are also influenced by these phytochemicals [33, 34]. Since these bioactive compounds are frequently utilized in the pharmaceutical, cosmetic, nutraceutical, food additive and functional food industries, it is desirable to extract and purify antioxidants from natural sources [35]. The extraction process and solvent have an impact on the extraction yield [36]. For extraction water, ethanol, methanol,

diabetic rats had higher levels of serum c-peptide than insulin-treated diabetic rats alone (2013) and documented the possible hypoglycaemic effectiveness of date seeds [29]. As demonstrated by a compensatory  $\beta$

-cell hypertrophy observed by Immunohistochemical Analysis, this implied an increase in endogenous insulin secretion.

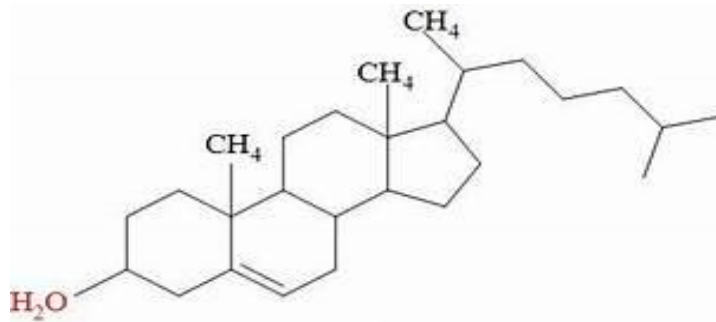
overview of the extractable elements [30,31,32]

acetone and their aqueous mixes are frequently utilized [37, 38].

### STEROLS

Sterols, also known as steroid alcohols, are amphipathic lipids that belong to the subgroup of steroids that have a hydroxyl group at the A-ring's third position. Sterols, also known as phytosterols, have numerous health advantages [39]. According to Sun and Ho's (2005) analysis, sterols include cholesterol, campesterol, stigmasterol and  $\beta$ -sitosterol. The Deglet-Noor variety's provitamin- A levels marginally increased during the ripening process, where as those of Tantebougte and Hamraya declined [40]. Carotenoids are lost during sun drying, according to an analysis of the total carotenoid levels in fresh and dried Fard, Khasab and Khalas [41].

**Figure 3:** Cholesterol



## PROCYANIDINS

Condensed tannins called procyanidins are the primary building blocks of the red and blue-violet pigments found in fruits, vegetables, nuts, seeds, flowers and barks

[42]. Hong et al. (2006) isolated Procyanidins from the Deglet Noor variety of dates in the Khalal stage of maturation. Higher molecular weight polymers, undecamers, heptadecamers and decamers were all forms of procyanidin [43].

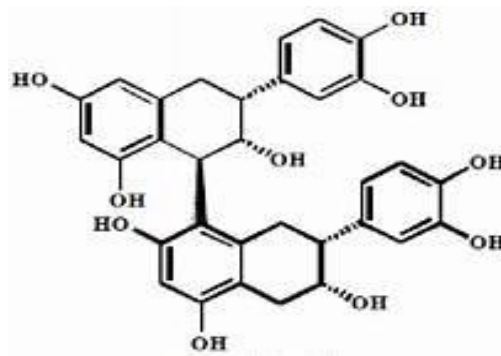


Figure 4: Procyanidin B<sub>2</sub>

## CAROTENOIDS

Carotenoids are a type of naturally occurring pigments that dissolve in fat and give plants their vibrant colours. They are a significant source of vitamin-A and through their

antioxidant properties, shield the cell from the damaging effects of free radicals [44]. According to studies dates also contain carotenoids like lutein, K-carotene and neoxanthin,.

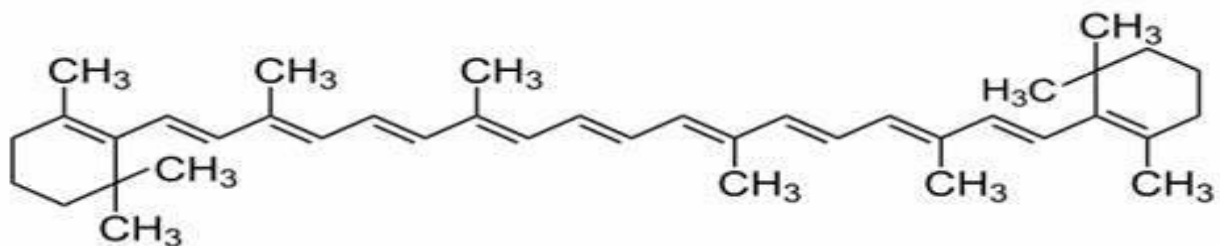


Figure 5: Lutein

## PHARMACOLOGICAL ACTIVITY OF DATE SEED

### 1. Antimicrobial Actions

Due to its ability to penetrate the bacterial cytoplasmic membrane, date seeds have

antibacterial properties [45]. Alrajhi and associates (2019) assessed the bactericidal properties of date seed powder (DSP) extracted with ethyl acetate and hexane [46]. With an inhibition zone of 20 mm in diameter, methicillin-resistant

*Staphylococcus aureus* (MRSA) was shown to have the maximum sensitivity and to be more effective than the common antibiotic gentamycin, which only had a 5 mm inhibition diameter. Only *Proteus mirabilis* demonstrated a significant suppression of DSEs [Date seed extracts] among the gram-negative bacteria that were investigated.

## 2. Anticancer Activities

Since the date seeds are natural, generally available, easily digested and have fewer side effects and toxicity, phytotherapeutic treatments like plant-based cancer treatment are best [47]. Date seeds can inhibit cancer growth, according to experiments. Hilary and colleagues (2021) found that DSEs can reduce cancer cell viability at high doses (1000 µg/mL or higher) after prolonged exposure and after 48 h of treatment reduced viability in the triple-negative breast cancer cell line (MDA-MB-231), breast cancer cell line (MCF-7) and colon adenocarcinoma cell line (Caco-2). When treated with ≥1000 µg/mL of DSEs after 24 h of treatment, a significant decrease in cell viability was seen for the prostate adenocarcinoma cell line (PC-3) and liver cancer cell line (HepG2)

## 3. Anti diabetic Activity

By scavenging free radicals, mending pancreatic cells, lowering lipid peroxidation and blocking enzymes on intestinal glucose absorption, date seeds active components such polyphenols and phenolics contribute to antidiabetic activity [48]. Shakoor and colleagues (2020) reported with DSEs high phenolic and flavanol content has been influenced glucose homeostasis [49]. Intestinal α-glucosidase and pancreatic α-amylase, two digestive enzymes involved in starch digestion and HepG2 glucose uptake

regulation, were suppressed by DSEs. α-amylase and α-glucosidase showed the highest levels of enzyme inhibition at 400 µg/mL and 900 µg/mL of DSEs. At 40 µg/mL and 100 µg/mL of DSEs, HepG2 cells showed increased glucose absorption in comparison to the insulin-free control.

## 4. Anti- inflammation Activity

The development and progression of chronic diseases, including cardiovascular disorders, are facilitated by oxidative stressors like DNA mutagenesis, lipid peroxidation and protein peroxidation, which increase reactive oxygen species generation and activate inflammatory mediators [50, 51]. A study by Saryono and associates (2020) looked into the anti-inflammatory properties of date seeds in middle-aged women and reported that the expression of cyclooxygenase (COX) and pro-inflammatory cytokines had significantly decreased. Interleukin-1β, transforming growth factor-β, COX-1 and COX-2 levels dropped in middle-aged female individuals after they consumed date seeds.

## 5. Anti-oxidant activity

Recently, Anwar and associates (2022) discovered that methanol extracts from Ajwa date seeds exhibited potent antioxidant activity on par with Ascorbic acid [52]. Additionally, because date seeds are a high source of phenolic compounds, studies have been done to investigate their positive antioxidant properties [53]. According to Salomón-Torres and associates (2019), the polyphenolic content of "Medjool" dates' seeds is 10 times greater than that of their pulp [54]. According to the Shinoda assay, the antioxidant qualities of date seeds were enhanced by the presence of phenolic

substances such as tannins, flavonoids, saponins, anthraquinones and coumarins. This led to a reduced IC<sub>50</sub> of 0.0046 g/L when using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical technique. Date seeds dietary polyphenolics may provide significant antioxidants, enhancing well-being and averting illnesses.

## THE COMMERCIAL USE OF DATE SEEDS AND THEIR INDUSTRIAL VALUE

DSP has been utilized in traditional medicine as well as in the synthesis of protein and citric acid by *Aspergillus oryzae*, *Candida lipolytica* and *Candida utilis* [55]. Lauric and oleic acids are examples of saturated and unsaturated fatty acids found in date seed oil. According to Mrabet and colleagues (2020) date seed oils are beneficial for cooking, frying, or seasoning because of their exceptional stability against oxidative rancidity and high temperatures,. In order to improve the mayonnaise's sensory qualities, date seed oils were also utilized in place of traditional maize oil [56].

Date seeds can shield human skin from UV-B and UV-A rays, which can cause skin damage, because of their multifaceted antioxidant properties. Flavonoids, phenolics and phenolic acids are examples of bioactive components that prevent the generation of free radicals, which harm skin cells [57]. Lecheb and associates (2015) proposed a cosmetic cream utilizing date seed oil and aqueous extract [58]. The created cream's viscosity, rheological behaviours and spreadability were comparable to those of the brand-name cosmetic cream. maintain a healthy scalp, encourage typical hair development and assist the hair follicles' nutritional needs.

Date seed oils containing phytohormones have anti-aging qualities that improve skin suppleness and lessen wrinkles [59]. The oil has been included into body lotions, soaps, hair care products and sunscreens in recent years. Vitamins, carotenes and other elements found in date seed oil support the nutritional needs of hair follicles, encourage healthy hair development and help maintain a healthy scalp. Furthermore, because the oil contains few free fatty acids, it can be utilized to make biodiesel. Future industrial operations and significant economic gains would result from using date seeds as a feedstock [60].

## CONCLUSION

Date seeds contain rich sources of nutritional functional components that may help to combat deficiency-related diseases, infections and disorders related to oxidative stress. Current pharmacological studies have found that DSEs can regulate human health through several biological activities. However, an indepth investigation is required to characterize polyphenols and other unique bioactive compounds, including their mechanism, as well as to establish ideal doses without causing harm. The potential of date seeds as a treatment against chronic diseases brings enormous promises and possibilities for future research.

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