

# Potential Health Benefits of Dates: A Mini-Review

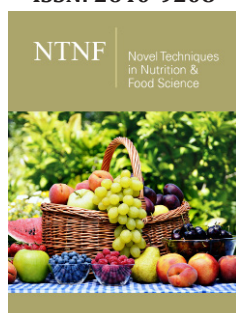
Harpreet Singh<sup>1\*</sup>, Rajwinder Kaur<sup>2\*</sup> and Martha Verghese<sup>3</sup>

<sup>1</sup>Student- Nutritional Biochemistry, USA

<sup>2</sup>Nutritional Biochemistry, Research Scientist, USA

<sup>3</sup>Department of Food Science, Nutritional Biochemistry, Alabama A&M University, USA

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**\*Corresponding author:** Harpreet Singh, Student, Nutritional Biochemistry and Rajwinder Kaur, Research Scientist, Nutritional Biochemistry, USA

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## Abstract

Phenolic compounds, mainly dates, are known for their potent antioxidant properties, which protect cells from harm and help prevent various age-related ailments. Dates are rich in phenolic compounds and flavonoid components, which may have antioxidant and free radical scavenging properties. They contain significant amounts of lutein,  $\beta$ -carotene, zeaxanthin, and neoxanthin carotenoids. Date palm (*Phoenix dactylifera L. Arecaceae*) fruits are a staple food in many regions of the world and have been used in traditional medicines to treat cancer and infectious diseases by modulating the immune system. Dates are known to have neuroprotective properties, with studies showing that date extracts reduce oxidative stress and upregulate nuclear factor erythroid 2-related factor 2 (Nrf2) and heme oxygenase-1 (HO-1), Sirt-1 (silent mating-type information regulation 2 homolog-1), and LC3 (Light Chain 3) expression while downregulating caspase-3 and improve autistic-like behaviors in rats induced by Valproic acid.

Additionally, dates have been researched to have antibacterial properties against six strains of human pathogenic bacteria, including *Escherichia coli*. Dates also have immunomodulatory effects, stimulating the cellular immune system in mice by increasing IFN- $\gamma$  (Interferon-gamma) mRNA expression. They also have antihyperlipidemic properties, with dates positively affecting serum triacylglycerol and oxidative stress without adverse effects on blood sugar levels or lipid/lipoprotein patterns. Dates have been found to have protective effects against hepatotoxicity, nephroprotection and anticancer activity. They have been found to alleviate liver damage, lower plasma creatinine and urea concentrations and inhibit tumor cell growth, like commonly used anticancer medications. In conclusion, Date fruit offers numerous medicinal properties, including antioxidant and immune-modulatory benefits, and its bioavailability and metabolism should be investigated for potential value-added food products and supplements.

**Keywords:** Dates; Antioxidant; Health benefits; Phytochemicals; Oxidative stress

## Introduction

Fruits and vegetables have health benefits and the phenolic compounds have drawn attention because of their potent antioxidant properties [1,2]. Phenolic chemicals are renowned antioxidants that protect cells from harm. They are known to protect against free radicals and help avoid various age-related ailments [3]. The redox characteristics of phenolic compounds, which can help absorb and neutralize free radicals, quench singlet and triplet oxygen, or break down peroxides, cause their antioxidant activity (Suh et al., 2011). In many regions worldwide, people regularly consume date palm (*Phoenix dactylifera L. Arecaceae*) fruits, a staple food in most Arabian nations. The date fruit has a history of use in traditional medicines to treat cancer and several infectious diseases and to modulate the immune system [4]. Nutrients such as phosphorus, iron, potassium, and a sizable amount of calcium and carbohydrates are all found in dates, good energy sources, and vitamins. In addition to being nutritious, dates contain many phenolic compounds that may have antioxidant and free radical scavenging properties [5].

## Health benefits of dates

**Dates** (*Phoenix dactylifera*): The edible fruit of the date palm is flavorful and nutrient-dense [6]. In addition to being nutritionally superior to other main fruits that people often

consume, Date Fruit is unique and distinguished by several distinctive qualities [7]. The most common date palm cultivars in the US are Reglet Noor and Medjool, which were introduced from Algeria and Morocco. There are more than 600 date kinds, including cultivars, farmed worldwide. Around a quarter of a million trees are on 600 acres in the BARD region in Yuma, Arizona, and 7,000 acres in the Coachella Valley, California. Around 16,662 metric tons of D.F. were produced annually in the U.S. in 2003 [8-12].

### Chemical composition of dates

Simple sugars and soft, easily digested flesh comprise the fresh date's composition. Chemically, dates contain sugars (8-88%, primarily fructose, glucose, and sucrose), dietary fiber (5-8.5%), a minor amount of protein, fat and ash and significant amounts of phenols [13]. Date fruits are high in phenolic compounds and flavonoid components, which may have antioxidant and free radical scavenging properties. Date fruit contains significant amounts of lutein,  $\beta$ -carotene, zeaxanthin and neoxanthin carotenoids [14]. TProtocatechuic acid (protocatechuic acid, vanillic acid, syringic acid and ferulic acid) and bound (gallic acid, protocatechuic acid, p-hydroxybenzoic acid, vanillic acid, caffeic acid, syringic acid, p-coumaric acid and coumaric acid) phenolic acids varies depending on the type of dates and the level of ripening [15,16].

### Neuroprotective properties

In a study by Hussein et al. [17], the effects of palm date Aqueous Fruit Extracts (AFE) on autistic-like behaviors were investigated. The study concluded that date extracts reduce oxidative stress, upregulate Nrf2 and HO-1, Sirt-1, and LC3 expression while downregulating caspase-3, and thus improve autistic-like symptoms in rats induced by Valproic acid. Edobor et al. [18] investigated the neuroprotective effects of date fruit extracts on PQ- induced (paraquat) cortico-nigral neurotoxicity in rats. Results from the research have shown an increase in Superoxide Dismutase (SOD) & Glutathione (GSH) activity, indicating potential neuroprotective properties of dates against PQ-induced pathological changes in cortico-nigral structures of Wistar rats. Selvaraju et al. [19] conducted a study to examine the neuroprotective effects of date, fig and walnut extract against 1-Methyl-4-Phenyl-1,2,3,6-Tetrahydropyridin (MPTP) and Quinolinic Acid (QUIN)-induced excitotoxicity in human neurons. They found that walnut extract and to a lesser extent date and fig extract, had an inhibitory effect on specific QUIN- induced excitotoxic processes such as calcium influx, Neuronal Nitric Oxide Synthase (nNOS) activity, DNA (Deoxy Ribonucleic Acid) damage, NAD<sup>+</sup> (Nicotinamide Adenosine Diphosphate), and ATP (Adenosine Triphosphate) depletion, providing evidence for the beneficial health effects of natural extracts against neurodegeneration.

### Dates and their antibacterial properties

Three Saudi Arabian date varieties were analyzed for antibacterial activity against six strains of human pathogenic bacteria and the results showed that these dates have immense potential to be utilized as a treatment for mineral deficiency, which

can be researched for the development of antibacterial agents [20]. Due to the abundance of phytochemicals in the seeds, Phoenix dactylifera seed extract exhibits promising antibacterial effect against Escherichia coli. In managing gastrointestinal infections caused by E. coli, date seed can be beneficial [21].

### Dates and their immunomodulatory effects

The immunomodulatory effects of date fruit were compared to those of prunes and fig fruit in mice. It was discovered that the polyphenols and polysaccharides in date fruit stimulate the cellular immune system in mice by significantly increasing IFN- $\gamma$  mRNA expression in mouse Peyer's patch cell cultures [22]. Dates effect on Hemoglobin Levels- Iron and calcium, two essential components for developing bone marrow and blood, are present in dates. After including Ajwa dates in teenage girl's diets, their hemoglobin levels (0.357g/dl) increased [23].

### Mutagenicity of dates

Date Pit Extract (DPE) was evaluated for its antigenotoxic effects on mice mutated by N-Nitroso-N-Methyl Urea (NMU) and it was discovered that DPE produced its inhibitory activity either by desmutagenic or bio antimutagenic manner in pre-and post-treatment regimens by repairing the DNA damage [24].

### Anti-inflammatory properties

According to a study on middle-aged women who consumed steeped date palm seed, IL-1, TGF- $\beta$ , COX-1 and COX-2 expression in women significantly decreased after consuming date palm seed. By reducing the expression of critical proinflammatory mediators, date seeds that had been steeped acted as an anti-inflammatory [25]. Dates (*Phoenix dactylifera L.*) were found to have an ameliorative effect on ethanol-induced gastric ulceration in rats. This effect may be related to the dates' relatively high content of antioxidant substances [26].

### Dates as an anti-hyperlipidemic nutrient

According to a study by Rock et al. [27], dates (especially the Hallawi variety) can be considered an antiatherogenic food because, despite having a high sugar content, they have positive effects on serum triacylglycerol and oxidative stress while having no adverse effects on blood sugar levels or lipid/lipoprotein patterns. A randomized control trial on adults with type II diabetes revealed that the high polyphenol content of dates may positively impact lipid profiles, particularly in lowering total cholesterol and raising HDL. In addition, due to the low glycemic index of dates, a low-moderate intake had no impact on blood sugar levels [28].

### Role of dates in hepatotoxicity

Rats were used to study the protective effects of aqueous extracts of the flesh and pits of dates (*Phoenix dactylifera L.*) against Carbon Tetrachloride (CCl<sub>4</sub>)-induced hepatotoxicity. In addition to ameliorating morphological and histological liver damage in rats, the results demonstrated a significant decrease in CCl<sub>4</sub>-induced elevated levels of plasma enzyme and bilirubin concentration [29].

## Nephro-protective properties

Al-Qarawi et al. [30] investigated the effect of date fruit on Gentamicin (GM) nephrotoxicity in rats and discovered that date flesh and pits were adequate in significantly lowering the increases in plasma creatinine and urea concentrations induced by GM nephrotoxicity and ameliorating the damage to the proximal tubules. The nephroprotection may be due to antioxidants found in dates, such as melatonin, vitamin E, and ascorbic acid.

## Anticancer activity of dates

According to Zhang et al. [31], *in vitro* tests showed that methanolic date extracts (100g/mL) may inhibit the growth of several tumor cell lines, including those from the human gastric, colon, breast, lung and prostate. In rats with mammary cancer that was induced using 7, 12-dimethylbenz ( $\alpha$ ) anthracene, Al-Sayyed et al. [32] reported an anti-cancer effect. In this case, rats getting a diet supplemented with 30% date fruit demonstrated a marked improvement in cancer development, as evidenced by a decrease in tumor size and weight and palpable tumor multiplicity. This anticancer effect resembles the results from commonly used anticancer medications like 17- $\beta$ -estradiol or tamoxifen.

## Conclusion

The date fruit contains plenty of fiber, vitamins, minerals and phytochemicals. Dates have a variety of medicinal properties, including antihyperlipidemic, antibacterial, neuroprotective, anticancer, hepatoprotective and nephroprotective actions, in addition to antioxidant, antimutagenic, and immune-modulatory benefits to health. The observed therapeutic effects of dates are closely associated with its constituents, which include a high concentration of minerals and antioxidants. Investigating the sector of human bioavailability and metabolism of dates is imperative. To further explore the nutritional and medicinal benefits of date fruit, we need to explore the health benefits of date fruit and develop value-added food products and supplements based on its functional compositions.

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