DATE FRUIT (PHOENIX DACTYLIFERA LINN) – A REVIEW ON NUTRITIONAL VALUES, PHYTOCHEMICALS AND PHARMACOLOGICAL ACTIONS

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ABSTRACT

Facing today's challenges, review is helpful in cherishing knowledge and exerting intelligent efforts in the rational practices in herbal medicine. Date is delicious fruit enjoyed by all since antiquity. It is valuable food and medicine stated by systems of medicine like Ayurveda, Siddha, Unani medicines and secured valuable status in many formulations. In Ayurved, it is presented that date should be consumed daily. Date is a potent nutritive, aphrodisiac, tonic, laxative fruit. It is effective remedy in various diseases like fever, cancer, pittaja disorders, etc. Intensive attention is payed now a days to study it's various nutrients, phytoconstituents and pharmacological actions to understand the efficacy in treating broad spectrum of diseases. Date's assuring preventive potential is hidden in high nutritional values as well as it's antioxidant, anti-inflammatory, antibacterial, anticancer actions. The review bring to light all the hiddent facts about the dignified place of Kharjur fruit in human life.

KEYWORDS: date fruit, nutritional values, phytoconstituents, pharmacological actions.

INTRODUCTION

Todays lifestyle is the gift of various lifestyle disorders, chronic disorders. Consciousness, awareness and hard work of todays generation is enlightening and ensuring the healthy future of mankind. The roll of diet is pivotal in overcoming ailments. Fruits are the natural dietary sources. Interest in research regarding medicinal and nutritional values of this natural source is increasing in this era. Potentials of defeating various ailments are found in fruits. Thus
fruits are rewarded as important source for preserving health. Date fruit is the wonderfull package of deliciousness and nutrition liked by everyone. Due to rich nutritional values, this fruit is consumed in higher percentages. In this review, some important facts of Kharjur fruit regarding health are highlighted with the available literature.

**Classification**

**Kingdom** – Plantae  
**Subkingdom** – Tracheobionta  
**Superdivision** – Spermatophyta  
**Division** – Magnoliophyta  
**Class** – Liliopsida  
**Subclass** - Arecidae  
**Order** - Arecales  
**Family** – Arecaceae  
**Genus** – Phoenix  
**Species** – dactylifer

**Vernacular names**


**Origin and geographical distribution:** In the legend, the date was the tree of knowledge of good and evil. The exact origin of date plant is not known. But it is cultivated before 4000 B.C. It was used for construction of Moon God temple near southern Iraq – Mesopotamia (Popenone, 1913, 1973). Its antiquity is also found in Egypt’s Nile Valley where it was used as symbol of year in Egyptian hieroglyphics and its frond as symbol of month. (Dowson, 1982).  

Since long time it is cultivated in North Africa, Arabian Peninsula and Middle East. It is now cultivated in Iran, Iraq, USA, Pakistan, Saudi Arabia, Egypt, UAE, Sudan, South Sudan, Algeria, Tunisia, India, Spain, Mauritiana, Morokko, Mali, Oman, Tanzania, Australia, Libya, etc. countries.
Botanical description – Tall tree upto 36 m in height, occasionally found cultivated or self grown in India. Trunks covered with persistant bases of petioles, the base usually surrounded by a mass of offshoots or sudcen; leaves in poen crown, pinnate 20-40 cm long, linear, keeled lower pinnae modified into spines; flowers in branched spadices, small; fruit an oblong berry 2.5 – 7.5 cm long, reddish or yellowish brown when ripe; seed cylindric, hard with a longitudinal furrow.[2]

Part used – Fruit.

Varieties – There are more than 1500 varieties of dates in the world. Some popular varieties are ajwa, Abel, al-khunaizi, barakawi, bireir, dabbas, empress, khalas, khodri, rathana, sukkary, sefri, segae, munifi, hilali, barhi, dayri, degletnoor, khadrawy, medjool, thoory, zahidi, assel, dakhki, hallavi, dora, ruchdi, ftimi, kentichi,[3] etc. As per one opinion, assel, dakhki, hallavi, dora are safe to eat.

Nutritional values – As per USDA, nutritional values of date fruit (Phoenix dactylifera Linn – medjool variety) per 100 gm are as follows[4]

<table>
<thead>
<tr>
<th>Principle</th>
<th>Nutrient value</th>
<th>Percentage of RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>277 Kcal</td>
<td>14%</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>74.97 g</td>
<td>58 %</td>
</tr>
<tr>
<td>Proteins</td>
<td>1.81 g</td>
<td>3 %</td>
</tr>
<tr>
<td>Total fat</td>
<td>0.15 g</td>
<td>&lt; 1 %</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0 mg</td>
<td>0 %</td>
</tr>
<tr>
<td>Dietary fiber</td>
<td>6.7 gm</td>
<td>18 %</td>
</tr>
<tr>
<td>Folate</td>
<td>15 µg</td>
<td>4 %</td>
</tr>
<tr>
<td>Niacin</td>
<td>1.610 mg</td>
<td>10 %</td>
</tr>
<tr>
<td>Pantothenic acid</td>
<td>0.805 mg</td>
<td>16 %</td>
</tr>
<tr>
<td>Pyridoxine</td>
<td>0.249 mg</td>
<td>19 %</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>0.060 mg</td>
<td>4.5 %</td>
</tr>
<tr>
<td>Thiamin</td>
<td>0.050 mg</td>
<td>4 %</td>
</tr>
<tr>
<td>Vit A</td>
<td>149 IU</td>
<td>5 %</td>
</tr>
<tr>
<td>Vit C</td>
<td>0 mg</td>
<td>0 %</td>
</tr>
<tr>
<td>Vit K</td>
<td>2.7 µg</td>
<td>2 %</td>
</tr>
<tr>
<td>Sodium</td>
<td>1 mg</td>
<td>0 %</td>
</tr>
<tr>
<td>Potassium</td>
<td>696 mg</td>
<td>16 %</td>
</tr>
<tr>
<td>Calcium</td>
<td>64 mg</td>
<td>6.5 %</td>
</tr>
<tr>
<td>Copper</td>
<td>0.362 mg</td>
<td>40 %</td>
</tr>
<tr>
<td>Iron</td>
<td>0.90 mg</td>
<td>11 %</td>
</tr>
<tr>
<td>Magnesium</td>
<td>54 mg</td>
<td>13 %</td>
</tr>
</tbody>
</table>
Manganese | 0.296 mg | 13 %
Phosphorus  | 62 mg    | 9 %
Zinc        | 0.44 mg  | 4 %

Phytonutrients
Carotene –β | 89 µg    | --
Crypto-xanthin-β | 0 µg | --
Lutein zeaxanthin | 23 µg | --

**Phytochemistry** – In the review of published data, it is found that whole plant contains various constituents.

Flavonoid glycosides – luteolin, methyl luteiolin, quercetin, methyl quercetin.

Flavanols – catechin, epicatechin.

Cinnamic acids – ferulic acid, sinapic acid, coumaric acid and their derivatives 5-o-caffeoylshikimic acid or dactylyferic acid.

Free phenolic acid – protocatechuic acid, vanillic acid, caffeic acid, syringic acid, p-coumaric acid, ferulic acid, o-coumaric acid.

Steroids – cholesterol, stigmasterol, campestrol, α-sitosterol.

Enzymes – phytase, invertase, peroxidase.

Anthocyanins – in fresh dates.

Carbohydrates - glucose, fructose, mannose, maltose, sucrose, starch, cellulose.

**Experimental and preclinical studies**

1. **Antiinflammatory action in IBD** – Date fruit was given before modelling to experimental animals did not show colitis after modelling. [5]

2. **Antulcer activity** - Pretreatment with ethanolic and aqueous extract of date fruit at the dose 4 ml/kg for 14 days markedly ameliorated ulcer index, histological indices like necrosis, haemorrhage, congestion, oedema in stomach sections and biochemical levels of some enzymes like gastrin in plasma, histamin and mucin in stomach mucosae of ethanol induced gastric ulceration in rats.

3. **Antioxidant action** – Various studies invivo and invitro are carried in various regions. Aqueous extract was found to inhibit significantly lipid peroxidation and protein oxidation and also exhibited potent superoxide and hydroxyl radical scavenging activity in dose dependent manner in invitro study.

4. **Antiinflammatory action** – Oral administration of methanolic and aqueous extracts of flesh of date suppressed the swelling of foot significantly by 67.8% and 61.3% respectively.
5. Hepatoprotective activity – Pre and post treatment with date aqueous extract significantly reduced CCl4 induced plasma activities of AST, ALP, ALT enzymes and bilirubin concentration and ameliorated morphological and histological liver damage in rats.

6. Nephroprotective action – flesh and pit extracts were studied in gentamycin induced nephrotoxicity where extracts significantly reduced serum creatinine and urea concentration and reduced proximal tubular damage.

7. Haemopoitic activity – Aqueous and methanol extracts of Phoenix dactylifera Linn fruit increased levels of RBC, Hb, PCV, Platelets, Reticulocytes. (Onuh et al., 2012).

8. Efficacy against lead induced haematotoxicity – Ethanolic extract of date fruit prevented the lead induced haemototoxicity. (Wahab et al., 2010).

9. Antihaemolytic activity – Phoenix dactylifera fruit extract 5%, 10% dilution when incubated with Streptococcus pyogens for 24 h slowed effectively growth of S. pyogens 30.8%, 64.7% and 88.5% respectively. Date extract neutralised haemolytic activity of Streptococcal exotoxin streptolysin O and 96% inhibition was obtained at a low concentration (1:262144 DE).

10. Effect on gastrointestinal transit – Date flesh and pit at doses of 0.01, 0.02 and 0.04 mg/kg showed dose dependent increase in gastrointestinal transit time. Water extract from dialysed date flesh extract induced a dose dependent decrease in gastrointestinal transit time. [7]

11. Antimutagenic activity – Date fruit produced dose dependent inhibition of benzopyrene-induced mutagenicity on salmonella tester strains TA-98 and TA-100 with metabolic activation. Extract from 3mg / plate and 4.3mg/plate was found required for 50% inhibition of His+ revertent formation in TA-98 and TA-100. In another study, aqueous extract of Barhee date fruit showed antimutagenic action against UV, Mytomycin, EMS mutagens in E. coli and human lymphoblast celllines. [9]

12. Antihypertensive action – In one in-vitro study, date sugar showed angiotensin-1 converting enzyme inhibition activity. [8]

13. Antidiabetic and Antiobesity activity – Kentichi fruit pit showed highest inhibitory against α-amylase and Pancreatic lypase enzymes. [10]


15. Antiatherogenic action – pomegranate, date fruit and date seed extract combination had shown antiatherogenic action on E0 mice serum, macrophages and aortas. [12]
16. Anticancer action – The polysaccharides (glucans) prepared from grape fruits exhibited dose dependent anticancer activity with an optimum activity at 1 mg/kg in tumor induced by subcutaneously transplanting allogenic solid sarcoma-180 tumor cells into the right side of female CD1 mice. In another study, Date fruit extracts showed antiangiogenic, antiproliferative and antioxidant actions in different cellline studies.\[13\]

17. Acute toxicity study – In one acute toxicity study in Nigeria, no mortality or signs of toxicity were found on oral administration of 5000 mg/kg aqueous extract of Phoenix dactylifera Linn. fruit.\[14\]

18. Hepatoprotective action against paracetamol induced hepatotoxicity – Aqueous extract of dried date fruit ameliorated the hepatotoxicity induced by paracetamol in Wistar albino rats.\[15\]

19. Immunomodulatory action – the number of IFN-γ^+CD4^+, IFN-γ^+CD49b^+ was highest in the mice given date extract added diet. 70% ethanol extract of matured date fruit treated with trypsin increased number of IFN-γ^+CD49b^+ and IL-12^+CD11b^+ cells significantly. Date fruit stimulates cellular immune system in mice. Date extract stimulated IFN-γ mRNA in mouse Payer's patch cell culture.\[16\]

20. Neurobehavioural effect – Phoenix dactylifera fruit has shown analgesic, antipsychotic, nootropic and anxiolytic action in Swiss Albino mice.\[18\]

**Clinical studies**

1. Effect on cytokine in allergic rhinitis – Immunotherapy with date fruit increased levels of serum and nasal IL-10 in patients with allergic rhinitis. (Boghjadi et al., 2012).

2. Effect on labour parameters and delivery outcomes in pregnancy – In a study on 69 pregnant ladies, effect of Phoenix dactylifera Linn was evaluated on labor parameter and delivery outcome. Date fruits were given in 6 gm/day for 4 weeks. Need of labor induction was less than the group not consuming date fruits. (Al-Kuran et al., 2011)

3. In one clinical study of assessing efficacy of Trikatryadiloha in Pandurogaw.s.r to Iron Deficiency Anaemia, Kharjur fruit is given as Pathya dravya.\[7\]

4. In one randomised comparative clinical trial, Rasayana avaleha 12 gm was given to 15 pregnant women twice daily with milk as anupan in 6th and 7th month of pregnancy. Significant increase was seen in biparietal diameter, immunoglobulin G level and foetal birth weight in the trial drug group comparative to the control group which received calcium carbonate 500 mg and ferrous sulphate once daily. Date fruit was an ingredient of Rasayana avaleha.\[17\]
As excipient – dried date powder can be used as binder in tablet manufacturing. It is better than acacia and tragacanth in all aspects. (Ngwuluka et al., 2010)

**Traditional uses:** In Ayurved, date fruit is designated as nutritious, aphrodisiac, tonic mainly consumed in debilitating conditions like Rajayakshma and Pittaja disorders like Raktapitta, Visarpa, etc. It is the remedy for alcohol induced damage and detoxifies its illeffects. Many formulations are mentioned to cure a broad spectrum of diseases.

In Siddha medicine (G. D. Naidu, Siddha research pharmacopoeia), formulations like Dengue Influenza Cure Powder is popular medicine for Dengue fever. Date is one of the ingredient acts due to its immunomodulatoy and antioxidant action.\footnote{Effects of overusage}

**Effects of overusage**

Dates contain phytates, tannins, calcium oxalate. These nutrients of date cause serious health effects / complications. Consumption of tannins dates in excess causes kidney bowel stomach irritation, GIT pain, liver damage, mineral and iron deficiency. Phytates consumption causes mineral deficiency. Calcium oxalate being insoluble can cause kidney stone.

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