STUDY OF SUSTENANCE PROPERTIES OF DATES

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ABSTRACT
Date fruits are very popular around the world due to richness in high profile nutrients and health promoting properties. Date palm (*Phoenix dactylifera*L.) is a multipurpose tree providing, fiber, carbohydrates, minerals and vitamins besides having certain medicinal properties. Here, in this review we have tried briefly outline the nutritive value of constituents present in it throughout the sections of the fruit like pericarp. The good nutritional value of date seeds is also based on their dietary fibre content, which makes them suitable for the preparation of fibre-based foods and dietary supplements. Dietary fibre has important therapeutic implications for certain conditions such as diabetes, hyperlipidaemia, and obesity and may exhibit a protective effect against hypertension, coronary heart disease (CHD), cholesterol, colorectal and prostate cancers, and intestinal disorders.

Index terms: *Phoenix dactylifera*, pericarp, hyperlipidaemia, coronary heart disease (CHD)

INTRODUCTION
Date palm (*Phoenix dactylifera)* contains about 200 genera with around 3,000 species(Barreveld WH, 2015)belongs to the *Arecaceae* family; its leaves, barks, pits, fruits and pollens have antioxidant, anticancer, hepatoprotective, neuroprotective, nephroprotective, gastrointestinal protective, antidiabetic, antihyperlipidemic, sexual improvement and antimicrobial potentials (Ali Hafez et al.2016). Date palm (*Phoenix dactylifera*L.) is a monocotyledon plant that goes through the stages of hababauk, kimri, khalal, rutab, and tamer during ripening. The main constituents of date include water, sugar, protein, fat, pectin, ash, crude fiber, and polyphenols.
Some herbs are recommended as a remedy for some diseases by the Prophet Mohammed(Peace Be upon Him) (Marwat SK et al.2009) as he said dates cure several disorders. The importance of dates has been documented in the Qur'an in Surah Maryam, at the point when Mary brought forth the Christ Jesus (Peace Be upon Him) under a palm tree, she heard a voice advising her: "Shake the trunk of the palm tree towards thee: it will drop new, ready dates upon thee. Eat, then, and drink, and let thine eye be cheered!" (Qur'an 19:25-26) (Rahmani AH et al. 2014).The health benefit of Ajwa dates has been documented in hadith as Saud (R.A) narrated that I heard Allah's Apostle saying, "If Somebody takes seven Ajwa dates in the morning, neither magic nor poison will hurt him that day" (Al-Bukhari et al.1976).
Today, the scenario of pharmaceutical drug delivery is changing from conventional dosage form to new drug delivery system with main objective of patient compliance. Combination formulation of two or more active ingredients, are being designed to combat many clinical conditions like cardiovascular diseases.(Vogel GH),(Newton J.M. 1999), (Salve et al.2016).Since patient with coronary artery diseases have to take multiple medications for long period of time. Thus todaypharmaceutical industries are diverting more towards developing the combination formulation for diseases with multiple manifestations. (Athyros VG et al.2005)
It has been shown that natural products possess minimal adverse effects and multiple targets, while clinical drugs (fibrates, statins, bile acid sequestrants, etc.) have potential adverse effects and great drug dependence.
(AL sheikh-Ali AA et al.2004),(Chattopadhyaya R et al.1996),(Srikanth J.et al.2009),(Shobana, G et al.2012).
Pain is distinguished as two types, peripheral or neurogenic pain may involve the following pathological states: peripheral nociceptive afferent neurons which are activated by noxious stimuli and central mechanism which is activated by afferent inputs stain sensation.(Rang HP et al.2005)

Nutritional constituents
The fruit is composed of a fleshy pericarp and seed which constitutes between 10% and 15% of date fruit weight (Hussein, Alhadrami, & Khalil, 1998).Chemical and nutritional constituents of date seeds were reported by Besbes, Blecker, Deroanne, Drira, and Attia(2004), Aldhaheri, Alhadrami, Aboalnaga, Wasfi and Elridi (2004), Hamada, Hashim, and Sharif (2002); as well as Sawaya, Khalil, and Safi (1984). Their reported composition was3.1–7.1% moisture, 2.3–6.4% protein, 5.0–13.2 fat, 0.9–1.8% ash and 22.5–80.2% dietary fibre. Also, seeds contain high levels of phenolic (3102–4430 mg Gallic acid equivalents/100 g), antioxidants (580–929 lm trolox equivalents/g) and dietary fibre (78–80 g/100 g)(Al-Farsi et al., 2007).
The good nutritional value of date seeds is also based on their dietary fibre content, which makes them suitable for the preparation of fibre-based foods and dietary supplements. Dietary fibre has important therapeutic implications for certain conditions such as diabetes, hyperlipidaemia, and obesity and may exhibit a protective effect against hypertension, coronary heart disease (CHD), cholesterol, colorectal and prostate cancers, and intestinal disorders (Johnson & Southgate, 1994; Kritchevsky, 1988; Tariq et al., 2000).

Date fruits are verypopular in Islamic countries due to rich in high profile nutrients and health promoting properties. Date palm (Phoenix *dactylifera* L.) is a multipurpose tree providing, fiber, carbohydrates, minerals and vitamins besides having certain medicinal properties (Vayalil et al.2002M. Al-Farsi et al. 2005).Date fruits are the products of date palm tree, belonging to the family of *Arecaceae*. It is one of the oldest cultivated plants in the world (Al-Shahib et al. 2003, Al-Shahib et all. 2003). Its high nutritional value and its long life the date palm has been mentioned as the 'tree of life' (Augstburger et al.2002). Dates are one of the most popular fruits packed with an impressive list of essential nutrients, vitamins and minerals that are required for normal growth, development and overall well-being. Dates may contribute to the human diet with high quality of some essential amino acids (Salem and Hegazi Salem et al.1971).The protein in dates contains 23 types of amino acids, some of which are not present in the most popular fruits such as oranges, apples and bananas (Al-Shahib et al. 2003, Al-Shahib et all. 2003). The chemical properties of date are considered important in grading, preservation, storage and processing of dates.

Dates are not a good source of protein (Al-Hooti et al.1995), it may contribute to the human diet with high quality of some essential amino acids(Salem and Hegazi Salem et al.1971).Dates have been reported to contain at least 15 minerals (Al-Shahib et al. 2003, Al-Shahib et all. 2003). Dates are also a good source of trace elements such as zinc, manganese, copper, chromium, selenium and low content of sodium in mg/100 gm. Overall analysis of minerals revealed that dates were relatively rich in potassium and low in sodium was also found by Agboola (Omowunmi et al. 2013).

Phenolic of powerful antioxidants have been isolated from *P. dactylifera* such as ferulic, Gallic, catechin, chlorogenic, caffeic, coumaric, resorcinol, protocatechuic, dactyliferic, 3-O-caffeoylshikimic, sinapic, p-hydroxybenzoic, vanillic, syringic, procyanidin and isochlorogenic acids (Hamad I et al.2015,Mansouri A et al.2005, Hammouda H et al.2013). The anthocyanin's, apigenin, isoquercetrin, quercetin, quercetrin, procyanidins, luteolin and rutin constitute the flavonoid content of *P. dactylifera*. Moreover, *P. dactylifera* contains considerable amounts of antioxidant vitamins C, A and E (Al-Shahib W et al.2003, Benmeddour Z et al.2013, Mohamed RM et al.2014).

The flesh of the fruits (dates) of the date palm, *Phoenix dactylifera* L. contains very low percentage of oil (0.2–0.5%), whereas the seeds contain 7.7–9.7% oil (Al-Hooti et al.1998). The weight of the seed is 5.6–14.2% of the date and as such represents a potential source of edible oil. A range of saturated and unsaturated fatty acids are present in the flesh and seeds of dates. The saturated fatty acids include capric, lauric, myristic, palmitic, stearic, margaric, arachidic, heneicosanoic, behenic and tricosanoic acids. Unsaturated fatty acids include palmitoleic, oleic, linoleic and linolenic acids.

There are at least 15 minerals in dates. The percentage of each mineral in dried dates varies from 0.1 to 916 mg/100 g date depending on the type of mineral. In many varieties, potassium can be found at a concentration as high as 0.9% in the flesh while it is as high as 0.5% in some seeds. Other minerals and salts that are found in various proportions include boron, calcium, cobalt, copper, fluorine, iron, magnesium, manganese, potassium, phosphorous, sodium and zinc. Additionally, the seeds contain aluminium, cadmium, chloride, lead and sulphur. Dates contain elemental fluorine that is useful in protecting teeth against decay. Selenium, another element believed to help prevent cancer and important in immune function, is also found in dates. Dates contain at least six vitamins including asmall amount of vitamin C, and vitamins B1 thiamine, B2 riboflavin, nicotinicacid (niacin) and vitamin A. The dietary fibre of 14 varieties of dates has beenshown to be as high as 6.4 11.5% depending on variety and degree of ripeness. Dates contain 0.5 - 3.9% pectin, which may have important health benefits(Walid Al-Shahibet al.2003)

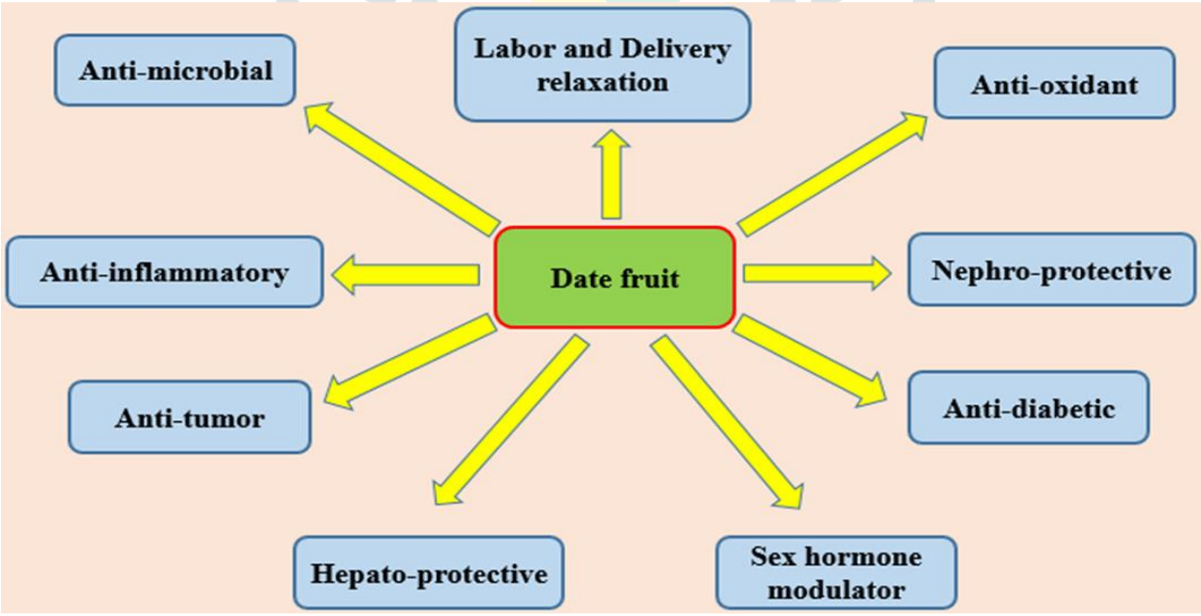

Figure 1: Pharmacological activities of dates fruits in diseases control

STAGES IN THE DEVELOPMENT OF THE FRUIT

Dates pass through four stages of development known by their Arabic names; Kimri, Khalaal, Rutab, and Tamer. Many studies had discussed the physical and chemical development of dates as they pass through these stages (Sawaya et al., 1982; 1983;

Mustafa et al., 1986; Siddiqui and Gupta, 1994; El-Zoghbi, 1994; Ahmed and Ahmed, 1995; Al-Hooti et al., 1997; Myhara et al., 1999; Al-Shahib and Marshall, 2003).

The development of the fruit is classified into four stages using Arabic terms (Fayadh& Al-Showiman, 1990).Before Stage 1 and in the first 4 - 5 weeks of its life, the date is called 'altalaa', in which the date becomes green.

Stage 1: *'Kimri'* stage - Characterised by two phases. In phase one, the date shows the following features:
rapid increase in size and weight;
Increasing rate of accumulating of sugars;
High acidity; and
High moisture content.
In phase two: the date is characterised by:
Continued but reduced rate of increasing size and weight;
Reduced rate of accumulating of sugars;
Slightly reduced acidity; and
Higher moisture content than in phase one.

In the Kimri stage, the average fruit length is 27.5 mm and its diameter is 17.8 mm. The average weight of five varieties of dates is 5.8 g. Dates in this stage contain an average of 5.6% protein, 0.5% fat and 3.7% ash (Al-Hooti etal.1995).

Stage 2: *'Khalal' stage*

The colour of the date changes from green to somewhere between yellow and red depending on the cultivar (3 - 5 weeks). The rate of change of the four features seen in phase two of the Kimri stage continues to decrease. In this stage, the average fruit length increases to 32.5 mm and its diameter increases to 21 mm. The percentages of protein, fat and ash decrease to 2.7%, 0.3% and 2.8%, respectively. The average weight of fruit increases to 8.7% (Al-Hooti et al.1995).

Stage 3*: 'Rutab' stage*

The date begins to soften and lose water (2 - 4 weeks). The protein, fat and ash percentages in this stage decrease to 2.6%, 0.3% and 2.6%, respectively.

Stage 4: *'Tamr' stage*

The date has now dried to a fairly firm consistency with darker colour but there are types of dates that do not develop to this stage.(Figure 1)(Barreveld et al. 1993)

The moisture content of dates decreases as they ripen. In the Kimri stage it averages 83.6%, in the Khalal stage it is about 65.9%, and it continues to decrease through the Rutab stage (43%) to the Tamr stage (24.2%). (Ahmed & Ahmed, 1995)

The total concentration of carbohydrate in dates increases from the Kimri stage through the Khalal and Rutab stages, to the Tamr stage and depends on the type of date. The concentration of total sugars in the Kimri stages varies from 3.4 to 7.7% and the concentration of total sugars in the Khalal stage varies from 18.8 to 31.9% (Ahmed &Ahmed, 1995). The concentration of total sugars in the Rutab stage varies from 43.9 to 50.1% while the concentration of total sugars in Tamr stage varies from 44.3 to 64.1% (Ahmed & Ahmed, 1995). In other varieties of date, the concentration of total sugars is as high as 88% (Shinwari, 1993).

The increase of the concentration of sugars from stage 1 to stage 4 is related to the decrease in the water content of date during these stages.

Dates contain a higher percentage of protein than other type of fruits. They contain 2.3 - 5.6% protein, whereas apples, oranges, bananas, and grapes contain 0.3%, 0.7%, 1.0% and 1.0%, respectively (Al-Showiman, 1998).

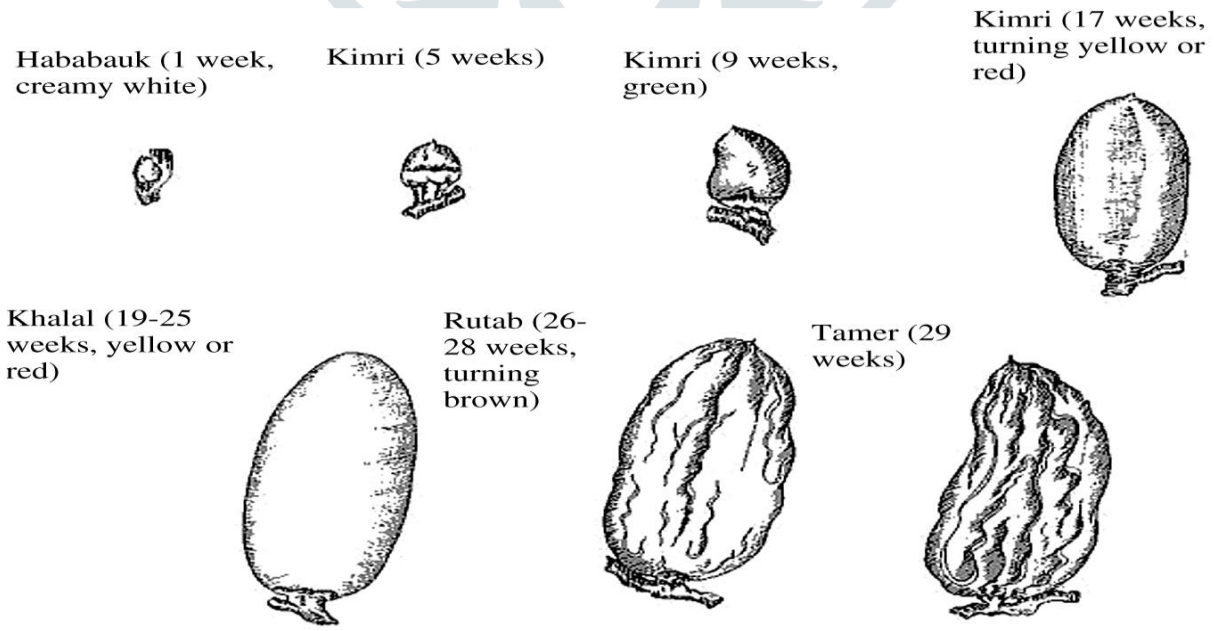

Figure 2: Stages of ripening of date fruit

Main components of date

Constituents Quantity (%)
Water 5–20
Sugar 44–88
Protein1–7
Fat 0.1–0.5
Pectin 1–4
Ash1–2.5
Crude fiber 3–18
Polyphenol 3

(Fadel et al.2001) studied color properties of date fruits and introduced a computer based method for the estimation of sugar content of dates.

THERAPEUTIC USES OF DIFFERENT PARTS OF DATES

Fruit- Sweet, cooling, tonic, fattening, aphrodisiac, useful in leprosy, thirst, asthma, bronchitis, fatigue, tuberculosis, abdominal complaints, fever, vomiting, loss of consciousness
Leaf- Aphrodisiac and good for the liver
Flower- Bitter, purgative, expectorant, tonic to the liver, fever and blood complaints
Seed- Applied to wounds, lesions, inflammation; it is demulcent, expectorant, laxative, nutrient and prescribed in the case of asthma, gonorrhoea
Gum- Useful remedy in diarrhoea and disease of the genitor-urinary system.
Many minerals such as boron, calcium, cobalt, copper, fluorine, iron, magnesium, manganese, potassium, phosphorous, sodium and zinc etc., are found in date fruit(Al Farsi M et al.2005, Khan M et al.2008, Hasnaoui A et al. 2011, Borchani C et al.2010) Of all the minerals in date fruit, potassium concentration may be probably the highest, which can reach up to 0.9 %.

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