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## Review

## A review on chemistry and pharmacology of Ajwa date fruit and pit

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## ABSTRACT

**Background:** *Phoenix dactylifera* is an instinctive plant, cultivated worldwide especially in Arab regions being an edible nutritious fruit. For this plant, **Ajwa** date fruit variety is distinguished among all varieties due to its richness of sugar, dietary fiber, essential mineral and vitamin contents. The unique phytochemical profile of Ajwa dates have potential to cure different diseases.

**Scope and Approach:** This manuscript provides an overview on pharmacological and nutritional aspects exclusively for Ajwa dates. The excellent **phytochemicals** profile placed Ajwa dates at top among other date varieties. Recently, new *in vitro* and *in vivo* studies prove the effectiveness of Ajwa dates. However, quantitative studies are need to understand the protective actions of Ajwa dates.

**Key Findings and Conclusions:** Ajwa fruit pits are also enriched with **dietary fibers**, lipids, minerals, and proteins. Ajwa dates are consumed not only for dietary purposes but also used for their medicinal effects against different ailments. Phytochemical studies have showed that Ajwa **flesh** and **pits** are enriched with certain phenolic and **flavonoids**, which have multiple effects on human health due to their strong antioxidant properties. Preclinical studies revealed that Ajwa dates have strong **antioxidant**, anti-inflammatory, anti-mutagenic, hepato-protective, **nephroprotective** and anti-cancer activities.

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## 1. Introduction

Traditionally fruits constitute a major part of human diet from ancient time. Certain fruits acquire a special attention in daily routine of certain population owing to their religious practices. Fruits and vegetables have been recommended strongly by WHO and other nutritional societies around the world for improving general health and wellness of masses. In the wake of health and wellness awareness from last two decades a significant progress has been made on the studies of bioactive compounds in plants foods to find their direct effects on human health and wellbeing (Vayalil, 2012). In this regard date fruit is well-regarded for its nutraceutical properties in Middle East and Africa. However, its

significance in Western countries has not been explored yet owing different culture and eating habits. Scientific community now has realized its nutritional value in diet and has started to explore more avenues for development in this category of fruits.

Date palm commonly known as *Phoenix dactylifera* is one of the oldest (5500–3000 BCE) cultivated variety of date palm trees having nutritional, environmental, economic and ornamental, benefits (Barrevel, 1993). Cultivation of date palm is thought to be merged with cultural, environmental, religious and social development of people living in hot and arid areas especially in Middle East and Africa (Terral et al., 2012). Therefore, till now date palm is a major cultivating crop of above described areas and these regions are leading producers and exporters of date products worldwide (Assirey, 2015). Date palm is monocotyledon tree that can grow to an altitude of 1500 m in well-drained soils. Currently, date palm tree is being cultivated mainly in areas of Iraq, Iran, Saudi Arabia, Algeria, Egypt, Libya, Pakistan, Morocco, Sudan and Oman (FAO, 2003). One of the major characteristics of date fruit is to be

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consumed as staple dietary food in different regions of the world such as Arabian, Asian and some African countries (Barrevel, 1993). Another distinguishing characteristic of date fruit is that it can be consumed at three different maturity stages such as Khalal, Rutab and Tamar. However, newly ripened fresh dates are preferred in many date producing countries. Dates are also commercially available in dehydrated form, but dehydrated dates are prepared by drying processing techniques to increase their shelf life but it reduces the nutritional value of these dates (Abdul-Hamid, Abbas, Ismail, Shaari, & Lajis, 2015). Taste, nutritional and phytochemical properties of the dates vary depending upon its maturity stage and the variety of dates. There are approximately 5000 date varieties that are grown in different regions of the world. The most common ones are Aseel, Zahidi, Majdool, Mabrook, Dhakki, Halawi, Lasht, Degla and Bamy (Eid, Al-Awadi, Vauzour, Oruna-Concha, & Spencer, J. P., 2013; Eid, Al-Awadi, Vauzour, Oruna-Concha, & Spencer, J. P.E., 2013).

Ajwa date fruits (Fig. 1) are soft and dry and this date fruit is cultivated in the Al Madinah region of western Saudi Arabia. The Ajwa date variety has great medicinal properties. The old testaments, “Hadith” and Islamic literature pointed the beneficial properties of this date variety and it is believed that eating this date variety will cure many chronic diseases and ailments. The Ajwa date the most popular and expensive fruit that belongs only to the holy city of Al Madinah Al Munawara and its adjoining areas in Saudi Arabia (Zhang, Adosari, Vidyasagar, P. S. P. V., Nair, & Nair, 2013; Zhang, Aldosari, Vidyasagar, P. S., Nair, & Nair, 2013). Ajwa dates contain ample amount of dietary fiber and have potential to correct the digestion problems. Ajwa date works as natural roughage to the body and stimulate the bowl movement and provide effective relief from constipation (Al-Shahib & Marshall, 2003). Similarly, these dates contain high amounts of potassium and plays an effective role in muscle contraction. The Ajwa fruit shape is ovoid elongated and medium in size. The color is dark red in the rutab stage and turns to dark brown in the tamer stage with wrinkles (Fig. 1). The weights of Ajwa flesh and seed increase during the rutab stage and then decrease during the tamer stage (Gasim, 1994). Ajwa date has a sugar content of 77% (0.5% sucrose, 34.5% glucose and 25.6% fructose) and high proportion of minerals (3%) compared to other varieties of dates (1.5–2.7%), especially calcium (1.22 g/100 g dry matter) (Gasim, 1994).

Ajwa dates are effective for lactating women, since they assist in enriching breast milk with many effective nutrients. Furthermore, several studies have shown that kids of mothers who eat Ajwa dates regularly are less susceptible to diseases and infections (Al-Farsi & Lee, 2008). The other huge advantage of consuming Ajwa dates is that they comprise of high iron content. Iron is vital in red blood cell production and they may also assist to treat and prevent anemia (N. S. Hasan et al., 2010). Ajwa dates due to its high nutritional and health benefit properties can be considered as a potential

bioactive ingredient for developing health oriented food products (Al-Farsi & Lee, 2008). Therefore, this review is focused on summarizing the current research studies on nutritional importance, phytochemical composition and health benefits of Ajwa dates.

## 2. Nutritional significance of Ajwa date fruit parts

It was suggested in the second American Institute for Cancer Research (AICR) and World Cancer Research Fund International (WCRF) expert committee report that people should overcome their nutritional requirements through routine diet rather than using dietary supplements for preventing cancer and other chronic diseases (Stewart & Wild, 2015). Ajwa date fruit being a staple food has provided nutrition to millions of people worldwide since ancient times till now. Therefore, it is important to characterize the nutritional profile of Ajwa dates in order to enhance its consumption for preventing the onset of various diet related diseases. The nutritional composition of Ajwa date flesh and pit has been reported by various researchers (Assirey, 2015; Hamad et al., 2015). It was found that Ajwa flesh contains 80% reducing sugars (Assirey, 2015; Khalid, Ahmad, Masud, Asad, & Sandhu, 2016) along with other amino acids (Assirey, 2015), proteins and fats. While, Ajwa date pits have higher percentage of proteins, crude fat and crude fiber in comparison to Ajwa flesh (Khalid et al., 2016). Recently, Khalid, et al. (2016) studied the proximate composition of Ajwa date flesh and pits (Table 1) and pointed richness of Ajwa flesh in moisture, ash, glucose, fructose, galactose and maltose. While, the Ajwa pits are enriched with crude fat and fiber and protein (Khalid et al., 2016). Moreover, their study showed a positive correlation (0.90 and 0.94) between crude fiber and fat with crude protein in Ajwa pits. Ajwa dates are also enriched with variety of minerals especially potassium together with zinc and calcium (Assirey, 2015; Gasim, 1994; Khalid et al., 2016). In this section, we briefly highlight the nutrient composition of Ajwa dates.

### 2.1. Sugars

Ajwa date flesh is a high-energy food due to rich sugar contents that varies between 33.2 and 74.2%. Glucose and fructose (Table 2) are the major reducing sugars, while sucrose as non-reducing share the minor percentage in composition. The Ajwa pits contain low amount of sugars varying between 7.2 and 7.6% (Assirey, 2015; Khalid et al., 2016; C-R.; Zhang, Aldosari, Vidyasagar, Shukla, & Nair, 2015). The detail sugar contents of Ajwa flesh and pit is presented in Table 1. The bulk of the soluble compounds in Ajwa date fruit comprises of sugars both in aqueous and organic extracts. Recently, proton and carbon NMR studies showed different monosaccharides as mixture of  $\beta$ -D- and  $\alpha$ -D-glucopyranose, and as well as mixtures of  $\beta$ -D-fructopyranose and  $\beta$ -D-fructofuranose. These different monosaccharides were identified both in aqueous



Fig. 1. Ajwa date fruit together with different ripening stages. The picture is obtained with permission from Eid, Al-Awadi, Vauzour, Oruna-Concha, & Spencer, J. P. (2013); Eid, Al-Awadi, Vauzour, Oruna-Concha, & Spencer, J. P.E. (2013). Copyright by ACS © 2013 America Chemical Society.

Table 1

Carbohydrate found in Ajwa date flesh and pits. The values are reported as %age dry matter.

Ajwa date fruit	Sugars	Assirey, 2015	Khalid et al., 2016	Gasim, 1994
Flesh	Glucose	51.3	54.5	51.2
	Fructose	48.5	52.0	48.7
	Maltose	–	22.5	–
	Galactose	–	12.2	–
	Sucrose	3.2	–	3.1
	Pits	Glucose	–	20.1
	Fructose	–	16.1	–
	Maltose	–	6.1	–
	Galactose	–	3.4	–
	Sucrose	–	2.8	–

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