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Nutritional and Potential Planting of Date Palm: Review of Recent Trends and Future Prospects in Malaysia

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ABSTRACT

Nutrition present in fruits within a balanced diet plays an indispensable role in maintaining and promoting human health. Fruits such as date palm are rich sources of a balanced nutrition because of the high content of bioactive products. Cultivation of date palm is extremely rare in Malaysia and only available in small-scale farms. There is a potential for Malaysia to cultivate its own dates and not rely on imports in the future. The present review provides information on the nutritional values of dates, as well as recent trends and future prospects in date palm cultivation. Dates may be considered an almost ideal food, providing a wide range of essential nutrients and potential health benefits. This detailed information on nutritional and health promoting components of dates will enhance readers' knowledge and appreciation for the use of dates in their daily diet, and their promising business potential will benefit the economy.

KEYWORDS

Date palm; nutrition; planting; recent trends; future prospects; economics

Introduction

Planting fruit trees provide the richest resource of natural compounds, which are used directly or indirectly for a wide range of applications for the wellbeing of human population and animals (Khanuja, 2012; Swati et al., 2018). The dependence of humans on fruit for their basic requirements like food, medicine, clothes and shelter is as old as mankind itself (Goyal et al., 2007), and still in the modern age the majority of commercial products including pharmaceutical and health care, food and beverages, textiles, cosmetics and aromas are obtained from fruit (Khanuja, 2012; Swati et al., 2018). Therefore, planting fruits is and will remain economically, industrially, environmentally, spiritually, historically and esthetically important for survival, sustenance and prosperity of life on the earth (Arora et al., 2013). Malaysia has a rich growth of agriculture cash crops, which are mainly grown in small-scale farm holdings ranging from 1 to 10 acres (Kamarubahrin et al., 2019). According to Mohd et al. (2007), despite fast developing into an industrial country, Malaysia is still

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basically an agricultural country. As such, diversification of fruit tree plantations, including date palm, is a possible avenue in Malaysia.

In Malaysia, date palm (*Pheonix dactylifera L.*) is still an extremely rare plant (Kamarubahrin et al., 2018). Increased popularity of date palm cultivation has opened up an opportunity for commercialization. Since there is an opportunity to create a new economic supply chain through date palm, several projects have been conducted in Malaysia, such as at Kelantan, Johore and Terengganu (Hosnam, 2011). However, they are still in the early stage of mass plantation. Scientifically and practically, date palm can be planted in Malaysia (Hosnam, 2011). Practically, there is only small production for individual consumption and as ornamental trees. Through its cultivation, Malaysia can produce dates and more importantly can reduce its dependence on imports. In addition, local production of dates creates a new value chain to support sustainable economic development in the country (Haris et al., 2019).

Date palm is rich in minerals and vitamins, and an important species in terms of commercial value and human consumption. While the tree is called "*nakhl*," the fruit is called "*tamr*" in Arabic. Date palm is among the main top fruit crops of the Middle East (Haris et al., 2017). Date palm belongs to the family *Arecaceae* (*syn. Palmaceae*), and the genus *Phoenix* contains 12 species. It is a flowering plant species in the palm family, cultivated for its edible sweet fruit. Date palm can be grown in a wide range of soil types, but deep sandy soils with a good moisture supply are best (Abul-Soad, 2011). Good drainage and aeration are the main soil requirements for ideal production. Date palm will grow in heavier soils, but care must be taken not to waterlog these soils. It will grow in soils that are high in alkali and salt content, but growth and productivity will be affected. More sandy soils with great drainage require more fertilization, as fertilizers are more easily leached out by irrigation (Kamarubahrin et al., 2018).

Date palm (*Pheonix dactylifera L.*) is abundant in dietary fiber, various vitamins and minerals, phytosterols, carotenoids and polyphenols (Al-Farsi and Lee, 2012). A review of preclinical tests indicates that the fruit has multiple medicinal benefits; it is antioxidant and anti-inflammatory and provides protection to the liver, stomach and kidney (Al-Orf et al., 2012). This fruit, therefore, can be consumed as a nutritional supplement to fulfill the recommended daily nutrient intake outlined by the Ministry of Health Malaysia. In addition to their high nutritional contents, dates are also economically important. This review focuses on the important nutritional benefits of date palm and the potential of planting this high-value tree in Malaysia. This paper begins with an introduction and continues with methodology. Following them is a detailed discussion on the nutritional values. Next, the article discusses recent trends of date palm planting and its future prospects. The article ends with the conclusion of the study.

Materials and Method

A thorough and critical survey of the literature related to date palm research was conducted. Various online and offline resources were taken into consideration. The primary source of data collection for the review included research papers and review articles published by reputed publishers such as Springer, Elsevier, Routledge and Taylor & Francis. Online databases including Scopus and Science Direct were also referred to collect the data on dates. Literature search was conducted using the following keywords: *Dates; Date palm; Date fruit; Dates nutritional*; and *Date palm planting*. The commercial importance of the date palm was reviewed by surveying different marketplaces and online stores for the availability of products. In this review, the challenges associated with the current production of date palm in Malaysia with the scope of interventions of growth are discussed.

Nutritional Value

Date fruit has been identified as a highly nutritious food with many functional benefits to human health (Haris and Kamarubahrin, 2016). Dates have been studied for their proximate, mineral and phytochemical compositions, and several authors have reviewed the value of date fruits as an emerging "healthy" food (Al-Farsi and Lee, 2012; Vayalil, 2012). Date fruit is rich in several vitamins, minerals and fiber. It contains oil, calcium, sulfur, iron, potassium, phosphorus, manganese, copper and magnesium. Date fruit consumption can also provide relief from constipation, intestinal disorders, heart problems, anemia, diarrhea, abdominal cancer and many other conditions (Assadi et al., 2018; El-Mergawi et al., 2018). It is also identified as having antioxidant and anti-mutagenic properties and reduce heart disease (Ismail et al., 2006).

The date fruit (*Phoenix dactylifera L.*) contains a high percentage of carbohydrate (total sugars, 44–88%), fat (0.2–0.5%), 15 salts and minerals, protein (2.3–5.6%), vitamins and a high percentage of dietary fiber (6.4–11.5%). The flesh of dates contains 0.2–0.5% oil, whereas the seed contains 7.7–9.7% oil. The weight of the seed is 5.6–14.2% of the date. The fatty acids occur in both flesh and seed as a range of saturated and unsaturated acids, the seeds containing 14 types of fatty acids, but only eight of these fatty acids occur in very low concentration in the flesh. Unsaturated fatty acids include palmitoleic, oleic, linoleic and linolenic acids. The oleic acid content of the seeds varies from 41.1% to 58.8%, which suggests that the seeds of date could be used as a source of oleic acid. 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 (Al-Shahib and Marshall, 2003).

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 aluminum, cadmium, chloride, lead and sulfur in various proportions. 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. 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. Dates contain at least six vitamins including a small amount of vitamin C, and vitamins B (1) thiamine, B (2) riboflavin, nicotinic acid (niacin) and vitamin A. The dietary fiber of 14 varieties of dates has been shown 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 (Al-Shahib and Marshall, 2003).

Medicinal Value

Date fruit (*Phoenix dactylifera L.*) is believed to have many medicinal properties such as to provide strength, fitness and relief against a number of ailments and pains including fever, stomach disorders, memory disturbances, nervous disorders, as well as aphrodisiac and to boost the immunity. They are also considered to protect against many chronic diseases including cancer and heart diseases (Duke, 1982; Lambiote, 1982; Vyawahare et al., 2009) as they have been shown to contain antioxidant and antimutagenic properties (Al-Farsi et al., 2005b; Vayalil, 2002; Allaith, 2008). Aqueous extracts of dates have also been shown to inhibit the lipid peroxidation and protein oxidation as well as exhibit a potent superoxide and hydroxyl radical scavenging activity (Allaith, 2005). Panahi and Asadi (2009) reported that extract of date fruit was useful in controlling the blood cholesterol levels and also protected the CA1 neurons against oxidative injury. Methanolic and aqueous extracts of date flesh and seeds have also been shown to exhibit anti-inflammatory properties and suppressed the swelling in the foot and adjuvant arthritis (Mohammed and Al-Okbi, 2004). Dates are loaded with various nutrients with medicinal importance for the ailment of certain diseases. Because of 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 a rich source of hydroxyl pope folic acid; therefore, eating dates can increase the body's immunity and resistance to cancers. Ishruda and John (2005) observed that the preparations made from the extracted polysaccharides (glucans) from Lybian dates exhibited a dose-dependent anticancer activity by suppressing the growth of Sarcoma 180 tumor cells in female mice. It is a common belief in the Middle East that the consumption of dates, particularly in the morning on an empty stomach, can reverse the actions of any toxic

material that the subject may have been exposed to (Vyawahare et al., 2009). Date palm extracts have been reported to inhibit the benzopyrene-induced mutagenicity in Salmonella tester strains with metabolic activation (Vayalil, 2002). It has also been suggested that the extracts of date flesh and pits can reverse the carbon tetrachloride induced liver damages in rats (Al-Qarawi et al., 2004). The date extracts have also been shown to reduce the oxidative stress by normalizing the increased hepatic levels of malondialdehyde (MDA) and by increasing the hepatic glutathione levels (Mohammed et al., 2008). Date palm extracts and products can also be used prophylactically as a dynamic liver support and can counteract the alcohol intoxication. A number of herbal formulations are available in the markets, which have been shown to reduce or prevent the alcohol-induced hangover symptoms in human volunteers as well as protection against liver disorders in acute and chronic alcoholics (Thornfeldt et al., 2006). It is also believed that consuming seven dates daily can protect the children from anxiety and nervous disorders.

Commercial Value

The considerable medicinal potential and delicious has led to the development of various commercial formulations such as pharmaceutical, foods, juices and healthcare products. The date palm parts such as seeds, leaves, pollen, fruits and trunk provide a remedy to a lot of ailments and nutritional value to human (Abdullahi and Garko, 2012). The whole part of dates is useful, and also the by-products arising from date processing can be used for different purposes (Othmani et al., 2019). Dates are also used as food preparations like sweets, snacks, confectionary, baking products, institutional feeding and healthy foods. There wholesome savory taste of all-natural sugar invites the most culinary creativity. As an ingredient to any recipe, dates provide the perfect natural alternative to added sugar (Sultana et al., 2015).

Besides that, dried date fruit is used as snacks and low-quality fruits are used in feeding animals (Dada et al., 2012). Dried dates are fed to camels, horses, goats and dogs in the Sahara Desert (Al-Suwaiegh, 2016). According to Morton (1987), dry or soft dates are eaten out-of-hand, or may be seeded and stuffed, or chopped and used in a great variety of ways: on cereal, in pudding, bread, cakes, cookies, ice cream, or candy bars. Pitting may be done in factories either by crushing and sieving the fruits or, with more sophistication, by piercing the seed out, leaving the fruit whole. The calyces may be mechanically removed as well. Surplus dates are made into cubes, paste, spread, powder (date sugar), jam, jelly, juice, syrup, vinegar or alcohol. Decolored and filtered date juice yields clear invert sugar solutions. Libya is the leading producer of date syrup and alcohol (Morton, 1987). Cull fruits are dehydrated, ground and mixed with grain to form a very nutritious stock feed.

Table 1. Total import and export of Malaysia dates.

Import and Export (Thousand tons)	2010	2011	2012	2013	Total
Import	17,980	16,236	20,394	19,421	**74,031**
Export	4,268	3,906	2,430	1,654	**12,258**

Source: DOS (2014); FAO (2015)

The First International Date Conference was held in Tripoli, Libya in 1959 and led to the development of a special program under the Food and Agriculture Organization of the United Nations to promote the commercial utilization of substandard or physically defective dates. Young leaves are cooked and eaten as a vegetable, as is the terminal bud or heart, though its removal kills the palm. In India, date seeds are roasted, ground and used to adulterate coffee. The finely ground seeds are mixed with flour to make bread in times of scarcity. In North Africa, Ghana and the Ivory Coast date palms are tapped for the sweet sap which is converted into palm sugar, molasses or alcoholic beverages, but each palm should not be tapped more than 2 or 3 times (Mahmoudi et al., 2008). Tapping the edible date palm interferes with fruit production and it is wiser to tap *P. sylvestris*, which is not valued for its fruit, or some other of the 20 well-known palm species exploited for sugar. When the terminal bud is cut out for eating, the cavity fills with a thick, sweet fluid (called *lagbi* in India) that is drunk for refreshment but is slightly purgative (Morton, 2006). It ferments in a few hours and is highly intoxicating. Fresh spathes, by distillation, yield an aromatic fluid enjoyed by the Arabian people (Dada et al., 2012).

Other Uses

Morton (1987) reported that date seeds can be soaked in water until soft and then fed to horses, cattle, camels, sheep and goats. Dried and ground up, they are now included in chicken feed. They contain 7.17–9% moisture, 1.82–5.2% protein, 6.8–9.32% fat, 65.5% carbohydrates, 6.4–13 6% fiber, 0.89–1.57% ash, also sterols and estrone and an alkali-soluble polysaccharide. The seeds contain 6% to 8% of yellow-green, nondrying oil suitable for use in soap and cosmetic products. The fatty acids of the oil are lauric, 8%; myristic, 4%; palmitic, 25%; stearic, 10%, oleic, 45%, linoleic, 10%; plus, some caprylic and capric acid (Morton, 1987). Date seeds may also be processed chemically as a source of oxalic acid, the yield amounting to 65%. In addition, the seeds are burned to make charcoal for silversmiths, and they are often strung in necklaces. In Italy, there are some groves of date palms maintained solely to supply the young leaves for religious use on Palm Sunday (Morton, 1987). In Spain, only the leaves of male palms are utilized for this purpose. In North Africa, the leaves have been commonly used for making huts. Mature leaves are made into mats, screens, baskets, crates and fans (Morton, 1987). The processed

leaflets, combined with ground-upp peanut shells and corn cobs, are used for making insulating board (Morton, 1987). The leaf petioles have been found to be a good source of cellulose pulp.

Dried, they are used as walking sticks, brooms, fishing floats and fuel. The midribs are made into baskets. The leaf sheaths have been prized for their scent. Fiber from the old leaf sheaths is used for various purposes including packsaddles, rope, coarse cloth and large hats (Othmani et al., 2019). It has been tested as material for filtering drainage pipes in Iraq, as a substitute for imported filters. Analyses of the leaves show 0.4–0.66% nitrogen; 0.025 0.062% phosphorus; 0.33–0.66% potassium; 10–16.4% ash. There is some coumarin in the leaves and leaf sheaths. The stripped fruit clusters are used as brooms. The fruit stalks contain 0.28–0.42% nitrogen, 0.017–0.04% phosphorus; 3.46–-4.94% potassium; 7.7–9.88% ash. In Pakistan, a viscous, thick syrup made from the ripe fruits, is employed as a coating for leather bags and pipes to prevent leaking Posts and rafters for huts are fashioned of the wood from the trunk of the date palm, though this wood is lighter than that of the coconut. It is soft in the center and not very durable. That of male trees and old, unproductive females is readily available and used for aqueducts, bridges and various kinds of construction, also parts of dhows. All leftover parts of the trunk are burned for fuel (Morton, 1987).

Recent Trends

Date palm cultivation was introduced into Malaysia in late 2010 (Hosnam, 2011). Several privately owned farms have been established in the Eastern Coast (Terengganu and Kelantan) and the Northern Territory (Johor) of Malaysia (Hazrol, 2016). However, the date farming sector in Malaysia is still in the preliminary stages. Currently, based on preliminary (observation) and secondary (search engine and previous literature) data findings, Malaysia still does not have a commercial date palm farm. Most of the farmers are still in the early stage, which is in the process of cultivation date palm seed. Thus, date palm production in Malaysia is still extremely rare.

Many farms and nurseries cultivate date seeds for commercial purpose without promising whether they can bear fruits. These are sold as gifts due to their small size. The price of a date palm tree or seed bag depends on the types, ranging from RM65 to RM100 (Syful, 2018). Although there is a demand for dates, current date palm planting in Malaysia is still far from commercialization. Despite this fact, date planting is believed to have a big potential in the farming industry and a potentially profitable venture (Kamarubahrin et al., 2018).

Based on statistics on imported and exported dates in Malaysia presented in Table 1 (see Table 1) previously, it shows that there are 61,773 ton gaps between date import as compared to date export between 2010 and 2013

(DOS, 2014). In terms of value, imported dates exceeded exported dates by RM140.11 million in 2013 (FAMA, 2014). Thus, it proves there is a high demand among Malaysian toward dates itself. However, on the supply side, there is limited to no local date production, and consumers have to rely mostly on imports, even for secondary date products.

Malaysia's climate is categorized as equatorial (*khatulistiwa*), being hot and humid throughout the year. The average annual rainfall is 250 cm and the average temperature is 27°C (80.6°F) (Hock, 2007). In addition, Malaysia faces two monsoon wind seasons, the Southwest Monsoon from April to September, and the Northeast Monsoon from October to March. The Northeast Monsoon brings in more rainfall compared to the Southwest Monsoon, originating in China and the north Pacific. The southwest monsoon originates from the deserts of Australia. March and October form transitions between the two monsoons (Marshall, 2007).

Although Malaysia's climate having sufficient number of days with suitably high temperatures to fully mature dates, continuous rainfall during the period of fruit maturation will affect the date growth. This climate condition makes date farmers in South Asian date-growing countries such as Pakistan and India and even Indonesia and Thailand elect to plant early bearing cultivars which ripen before the annual monsoon rains or cooler weather, and/or the fruits are harvested at *khalal* or *rutab* stages and artificially ripened; the latter involving extra labor costs (Kamarubahrin et al., 2018).

Date palm planting is relatively in small scale of plantation, added with limited research conducted on date palm in Malaysia, it is believed that date palm planting scarce of expertise either in date palm research and practice. Due to this reason, date palm planting in Malaysia is yet to be carried out in a large scale (Kamarubahrin et al., 2018).

Conclusion and Future Prospects

In recent years, great emphasis has been laid on the utilization of date palm as a source of food, medicine and waste management. Based on import-export data on dates in Malaysia, it is undeniable that Malaysia is highly dependent on imported dates. Besides, the supply chain for date products in Malaysia either as primary or secondary products is already established, and date producers are highly needed in order to strengthen this supply chain. Therefore, efforts must be made to establish large-scale date palm plantations to meet domestic demand.

Malaysia is known as a country with a high soil fertility level. Statistics show that Malaysia is among the countries with large-scale commodity plantation such as rubber and palm oil. These commodity plantations are normally established with mass production, whose primary concern is to meet the global export demand. Besides, rubber and palm oil produced in Malaysia is high in

quality. This is thanks to elite cultivars developed by Malaysian farmers. Therefore, it is believed that large-scale date palm plantations would benefit the quality of dates. This is because for elite cultivars, seedling dates often exhibit greater tolerance to biotic and abiotic stresses; therefore, they may harbor genetic resources of value to plant breeders and for that reason merit scientific assessment (Johnson et al., 2013).

Artificial date palm planting in a large-scale farm needs to be carried out throughout the country to produce appropriate date palm plantation. Centers for scientific and practical agricultural guidance for date palm cultivation should be established, and farmers should be encouraged to start such farms. The advantages of such a center, according to Shri and Dennis (2015), include the following:

(a) Avoid expensive duplication of effort in addressing major pest and disease problems.
(b) Enhance opportunities for collaborative research both at the bilateral and international levels.
(c) Develop and disseminate information on best practices in date cultivation, harvesting, postharvest handling and marketing by developing an interactive website. An excellent model for date palm exists in the Coconut Timeline (http://cocos.arecaceae.com/).
(d) Develop international industry descriptors and standards for fruit quality and packaging and marketing.
(e) Maintain a database of world date palm cultivars and their conservation status.
(f) Maintain information on date palm genetic diversity, genetic erosion, conservation and utilization of germplasm.
(g) Develop programs on the health benefits of dates and various commercial food products.
(h) Develop date palm functional genomics for studying useful genes leading to genetic improvement of date palm growing under climate change, enhanced fruit quality and industrial products.

Based on the available evidence from the literature, researchers are beginning to learn and admire the potential health benefits of date palm. Date palm is a fruit of high nutrient value. Date palm is not only beneficial to the people of industrialized nations, but also for the people living in the poverty-stricken parts of the world due to several reasons. First, date palm is comparatively inexpensive to produce and store, because, unlike other fruits, it can be stored for months after harvest without further preservation. Second, it is an energy-rich food containing high concentrations of carbohydrates and several essential nutrients (minerals, amino acids and vitamins) required to maintain human health. Moreover, date palm is considered as a staple food like

wheat, rice, etc., which are mainly consumed to meet the daily energy requirement. Therefore, date palm may be considered as a gift of nature to the people not only living in the hot arid regions but also in other parts of the world. Market conditions and limitations on date palm production may limit shifts to the dynamic profit-maximizing land allocation.

Finally, the researchers have several suggestions for future research. First, there is a demand from policymakers to develop a holistic sustainability measure which incorporates date palm planting in a rigorous way (Frederic et al., 2018). Understanding the trade-offs between inputs, outputs and date palm planting is essential to this end (Frederic et al., 2018). This study has explicitly separated date palm planting from production technology. There could be other ways to realistically model date palm planting using production technology. Second, the study can be augmented by considering spatial heterogeneity, which occurs due to different environmental circumstances and market conditions (Nelson et al., 2009; Polasky et al., 2008). Third, this study can be extended by accounting for risk along the lines of Chavas and Di Falco (2012), since date palm planting is an important mechanism of risk reduction, potentially at the expense of expected profits. In fact, the contribution of Malaysian agricultural sector to the national economy is remarkable particularly in creating employment, alleviating rural poverty and reducing net export deficit. The Ministry of Agriculture of Malaysia is expected to implement more specific policies and strategies to further expedite the transformation of the agriculture sector especially for date palm plantation into a modern, dynamic and competitive sector with respect to Agro-based processing activities and agricultural entrepreneur development.

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