

PROXIMATE, PHYTOCHEMICAL AND NUTRIENT COMPOSITION OF DATE PITS FROM KARBLAIN, HALAWI AND AJWA DATES: A POTENTIAL FOOD BY-PRODUCT

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ABSTRACT: *Change in dietary pattern, sedentary lifestyle and increasing stresses are contributing factors to high prevalence of hyperglycemia and diabetes mellitus. Date seeds from three native date fruit (*Phoenix dactylifera* L) varieties i.e. Karblain, Halawi and Ajwa were evaluated for their proximate, phytochemical, and nutrient compositions. The data exposed the crude fiber (CF) was 15.84-19.9g 100g⁻¹, moisture 4.554-8.259%, crude protein (CP) 4.309-6.144%, ash 1.097-1.3% and crude fat 5.662-6.972% respectively. Among the minerals potassium (K), magnesium (Mg), and calcium (Ca) were the predominant of macro elements and iron (Fe) was the predominance of microelements. The antioxidant of date seeds assessed using three assays varied between 10.966-22.86 mmol Trolox equivalent 100g⁻¹ dry weight (DW), 4.807-8.021mmol Trolox equivalent 100g⁻¹ DW, and 0.166-0.112g l⁻¹ for the ferric reducing ability of plasma (FRAP), 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS) and IC₅₀ of 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) respectively. The phenolic and the flavonoid contents of date seeds found changed between 2697-5342mg gallic acid equivalent 100g⁻¹ and 1224-1844 mg Rutin equivalent 100g⁻¹ respectively. This mini-review depicts that date seeds especially Ajwa can be used as an ingredient to enhance the nutritional value of some functional foods for human consumption.*

Keywords: Date seeds, Date Genotypes, Minerals, Bioactivity, Functional ingredients.

1. INTRODUCTION

Very imperative connotations have been recognized among health and human nutrition, which in turn are rerouting the demand for natural products of plant origin owing to the treatment of diverse diseases. Communities with high population ratios as compared to their low income are being diverted towards the diet-based regimen because of the high cost of medication in addition to their health-promoting benefits [40]. Natural products like dates and date seed by-products are vital in this background due to their soothing availability, safety, health claims, and squat cost [19]. Date (*Phoenix dactylifera* L.) is believed to be the oldest food crop consumed by mankind for more than 6,000 years [26], belongs to *Palmae* family and is under cultivation across the globe because of its popularity among the masses and its wide acceptability to an extensive range of ecological regions including arid to semiarid regions [5]. Dates are being cultivated throughout the world in almost 35 countries with an estimated production of exceeding 7.5 million tons which means seed produce of about approximately 750 thousand tons, whether they are being consumed fresh, dried, or in the processed form [21]. Accordingly, data seed was considered the waste material and was used traditionally with a very limited convention in animal feed or as a caffeine-free coffee

substitute either in its plain form or in a mixture with traditional coffee, by roasting and grinding the date seeds into smaller size particles [33], which was commercialized by Arabic countries [6].

Polyphenols are the secondary metabolites and the most significant polyphenols in dates include phenolics and flavonoids on a dry weight basis, further subdivided into 6 classes including flavones, isoflavones, flavanols, flavonones, anthocyanins, and flavonols [18]. Date pericarp consists of Eight (8) phenolic compounds and the flavonoids present in date fruit are mainly comprised of Apegenin, Quercetin, luteolin, and glycosides, on the other hand, date seed is comprised of five (5) phenolics compounds [1]. As compared with date fruit date pits/seeds are comprised of high levels of phenolic compounds and antioxidants [4].

2. Composition of Date Seeds

Dates are composed of delicious fruit and seed in a noticeable proportion on a weight basis. Date seed is a dissipated by-product that remains after different processing operations of different industries involved in data processing. Up till now very limited use of date seeds and their constituents including date seed and its oil have been reported in foods due to a lack of research work on this potential by-product except their usage as an ingredient in the feed of poultry and animals [33].

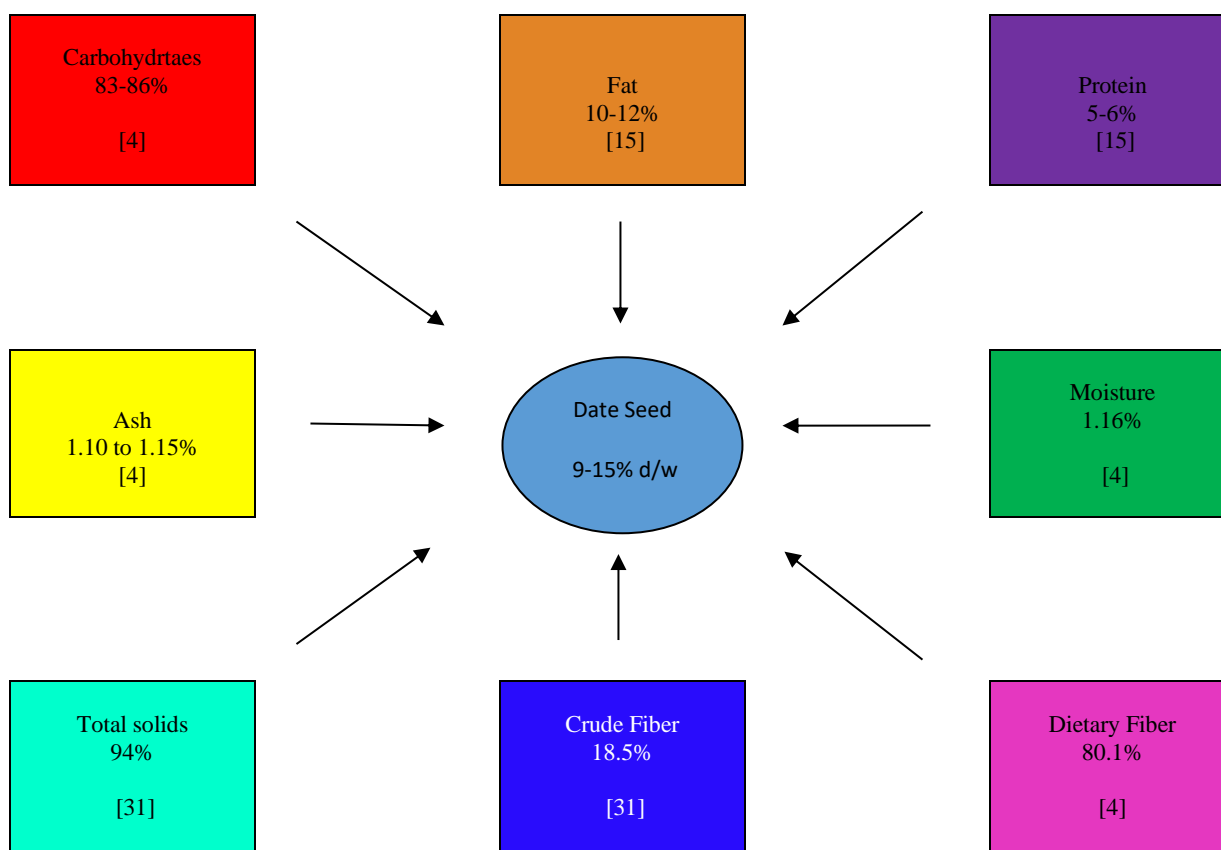


Fig 1. Proximate composition of date seeds.

2.1. Proximate profile of date seeds

With reference to the chemical profile of date seeds [15] that were analyzed from two cultivars namely Deglet-Nour and Allig for their proximate profile on a DW basis. Deglet-Nour variety comprises mainly DM, protein, fat, carbohydrates, and ash as 90.60%, 5.56%, 10.19%, 83.1%, and 1.15% while, the Allig variety showed values as 91.40% dry matter, 5.17% protein, 12.67% fat, 81.00% carbohydrates, and 1.12% Ash accordingly. Similarly, [33] described the chemical profile of date pits that were roasted and found fat 8.08%, protein 7.08%, ash 0.98%, crude fiber 21.35%, and carbohydrates 62.31% on a dry weight basis individually. Besides, [4] a comparison of three date seed varieties i.e., Shahal, Um-sellah and Mabseeli from Oman for their proximate composition and reported the findings in respect of increasing trends in the different constituents. It was found that carbohydrate was the predominant constituent ranging from 83.14% in Um-sellah to 86.89% in Mabseeli variety followed by protein, fat, moisture and ash contents, the values obtained for fat, protein, ash and moisture contents were as 5.09% and 5.40%, 2.29% and 5.40%, 0.89% and 1.16% for Shahal and Um-sellah respectively, 3.14% and 5.19% for Mabseeli and Shahal accordingly. Additionally, weight of date pits of Mabseeli and Um-sellah was ranging from 7.8% & 14.8% respectively.

Moreover, [31] proximate analysis of *Phoenix canariensis* L. concluded that the proximate constituents were in the following order carbohydrates 72.59% > fat 10.36% >

moisture 10.20% > protein 5.67% > ash contents 1.18%. Furthermore, [24] on analysis of date pits it was found that the following fractions for MC 5.39%, TS 94.59%, AC 0.95%, CP 5.64%, CF 8.14%, Cf 18.5% and TC 62.71%. Meanwhile, [35] it was revealed that date seeds on analysis have shown the following values for carbohydrates, Vitamin C, energy, CP, CF, Ash, Cf and MC as 79.50%, 100.32µg/100g, 344.05kJ/100g, 12.6%, 4.50%, 2.00%, 1.50% and 4.03% correspondingly. Later, [37] by evaluating the powder from the seeds of dates after freeze drying it was found 46.1% carbohydrates, 5.3% CP, 0.4% AC, 10.4% CF, 33.9% Cf and 3.9% starch. Furthermore, [30] on analysis of date seeds from Ajwa date variety concluded that similar findings were obtained as described by the earlier researchers and are in strong agreement with the findings of [31].

2.2. Dietary fiber

Dietary fiber contents (DF) of date seeds are directly related to good nutritional values and dietary fiber-enriched foods along with their supplementation in different forms makes it a super fit for its incorporation into new formulations. Dietary fiber is believed to be the most effective naturally occurring plant material having proven protection history against curtailing hyperglycemia, diabetes, obesity, hypertension, hypercholesterolemia, CVD, cancer, and intestinal disorders [38].

On analyzing different date varieties namely Um-sellah, Shahal and Mabseeli for their DF contents and it was found in

the following order: highest dietary fiber contents were evaluated in Um-sellah (80.15%) followed by Mabseeli (79.84%) trailed by Shahal (77.75%) [4]. Later, it was revealed that the total dietary fiber obtained was 57.87g/100g including soluble and insoluble dietary fiber fractions of 5.17g/100g and 52.70g/100g respectively under optimum conditions of extraction [8]. Likewise, [16] evaluated two Tunisian date seed varieties namely, Alig and Deglet-Nour for their total dietary fiber contents and it was found as 87.97% and 86.87% accordingly.

In another study conducted by [2] on date seeds found that the DF content was most of insoluble origin comprising cellulose, hemicellulose and lignins that account for more than 53% out of 58% of total dietary fiber. Furthermore, [23] suggested that the concentration of phytic acid in the dietary fiber of date seed was in very minute quantities as compared with the cereals and other commercial oil crops. Similarly, [3] analyzed the roasted date seed powders of Ajwa cultivar and found that it contained a total dietary fiber of 79.2% including 72.1% of insoluble nature and 7.0% of soluble nature.

2.3. Minerals

A study for the comparison of the mineral concentrations between barley, coffee, and date seeds was carried out and provoked that the highest mineral concentration was found in the following order: coffee < barley < date seeds. They concluded about the superiority of date seed mineral ions being in the permissible ranges and believed to be fit for human consumption, additionally, the absence of nickel makes it too superior to barley and coffee [10]. Date seeds were found to be rich in minerals and on analysis of two varieties of date seeds namely Alig and Deglet-Nour for mineral analysis it was reported 6 minerals [15]. Alig and Deglet-Nour varieties showed the following mineral contents on a dry weight basis: potassium, phosphorus, magnesium, calcium, sodium, and iron as 293mg/100g and 229mg/100g, 83.6mg/100g, and 68.3mg/100g, 58.4mg/100g and 51.7mg/100g, 28.9mg/100g and 38.8mg/100g, 10.25mg/100g and 10.4mg/100g, 2.21mg/100g and 2.30mg/100g respectively.

Similarly, [33] derived that the date seeds are very rich in minerals, especially Na, K, Ca, Fe, Mg, Mn and Zn in profound quantities. Likewise, [16] evaluated the minerals from two Tunisian date seed cultivars: Alig and Deglet-Nour and deduced the following mineral contents in noticeable quantities: potassium, phosphorus, magnesium, calcium, sodium, zinc, copper, manganese, and iron as 0.289 and 0.238mg/100g, 0.070 and 0.058mg/100g, 0.048 and 0.048mg/100g, 0.026 and 0.034mg/100g, 10.370 and 9.573mg/100g, 1.363 and 1.177mg/100g, 1.123 and 1.040mg/100g, 0.273mg/100g and 0.353mg/100g, 1.763 and 1.887mg/100g respectively. Later, [31] analyzed the mineral profile of *Phoenix canariensis* L. and reported the following composition of the mineral contents in descending order: K (255.43mg/100g) > Mg (62.78mg/100g) > Ca (48.56mg/100g) > P (41.33mg/100g) > Na (8.77mg/100g) > Fe (3.21mg/100g). Likewise, [13] estimated the mineral profile of date seeds and documented that it contains Na (160.00mg/kg), Ca (189.35mg/kg), K (2489.50mg/kg), Fe (19.23mg/kg), Cu (5.02mg/kg), P (1256.23mg/kg), Mg (811.30), Zn (1.67mg/kg) and Mn (7.12mg/kg). Further, [35] proposed that

mineral contents of date pits on analysis were in the following ranges and order of K (106.2mg/100g) > Na (77.23mg/100g) > Ca (54.67mg/100g) > Fe (49.33mg/100g) > Zn (42.80mg/100g) > Mn (9.36mg/100g) > P (8.23mg/kg), Mn (0.429mg/kg) and Mg (4.99mg/g) accordingly.

2.4. Amino Acids

Different studies revealed that non-proteinogenic amino acids are very helpful in the binding of toxic chemicals termed as T-lymphocytes in the liver resulting in a decreased creatinine level in humans and playing a vibrant role in combating the lethal effects of free radicals [9]. Date seeds were analyzed for their amino acid contents and it was revealed that date seeds were comprised of total amino acids including essential amino acids in the following increments of 15.28% and 7.11% respectively [35]. So, it was concluded that date seeds are a good source of essential amino acids. Further, it was documented that the following essential amino acids were detected during his investigation in descending order: leucine (1.70%) > lysine (1.10%) > phenylalanine (1.08%) > valine (0.90%) > histidine (0.80%) > threonine (0.75%) > isoleucine (0.68%) > methionine (0.10%). Some non-essential amino acids were also documented during their study including aspartic acid (1.72%), tyrosine (1.20%), alanine (1.20%), glycine (1.00%), serine (0.90%), glutamic acid (0.80%), arginine (0.65%), cysteine (0.30%) and proline (0.14%). Amino acids analysis conducted by various researchers showed that an upper proportion of essential AA was found in dates including fruits and seeds as compared with non-essential AA [22].

2.5. Sugars

Sugar contents in the date flesh vary from 33.2% to 74.2%, mainly comprised of reducing sugars of glucose and fructose with lower fractions of non-reducing sugars making the date fruit a high-energy food on the other hand date seeds have lesser sugar contents (7.2% to 7.6%) [12].

Furthermore, it was found that reducing sugars keep on increasing with maturity stages from 41.2 at (kimri stage) to 81.1% (Tamer stage) with the same increasing order as in the case of sucrose contents at different stages of maturity [20]. Sugar contents from the seeds of two date cultivars named Alig and Deglet-Nour, it was deduced from his findings that the following quantities of total sugars, reducing sugars and non-reducing sugars were found from Alig and Deglet-Nour varieties, 5.44% and 5.65%, 2.28% and 2.18%, 3.15%, and 3.47% respectively. Similarly, [33] revealed that the reducing sugars were in the noticeable quantity of almost 1.2% on the other hand, there were also 1.87% non-reducing sugars and 2.98% total sugars. Recently, [30] suggested that the presence of almost 66% of monosaccharides that were rich in fructose sugars as compared to glucose which in turn showed less harmful effects as compared to glucose, especially in the case of hyperglycemia. Moreover, the findings of [41] perceived diversified monosaccharides in their α -D and β -D forms including their mixtures through an NMR study in both aqueous and methanolic extracts which showed that these sugars have beneficial health aspects.

2.6. Phenolics and antioxidants in date seeds

Secondary metabolites of plant origin are called polyphenols that were in use commonly because of their biochemical profile that indicates their different health-promoting activities

[29]. There are more than 8,000 different structural types of polyphenols with daily ingestion through diet is almost 1g per day which is greater than other available antioxidants in quantity ranging from 10 to 100 percent [28]. Polyphenols are very effective in the treatment of various diseases due to their high inherent antioxidant ability in addition to the reduction of oxidative stress and support to different biological systems [17]. Now a day's people are more interested and concerned in diet-based interventions based on polyphenols in the treatment of various ailments throughout the World, in this domain polyphenol based nutraceuticals and functional foods have won the scenario due to their safety, low cost, easy access and prolong acceptability [39].

Plant-based functional foods are getting widespread and have engrossed attention due to their rich phytochemistry which is found helpful in ameliorating various diseases and disorders nevertheless the other possible sources of polyphenols except plants are far away in the comparison [34]. Date seed oils from two varieties Alig and Deglet-Nour were analyzed for their thermal stability by [14] it was found that the DSO from Alig cultivar was found less stable against thermal treatments than the DSO from Deglet-Nour cultivar was highly rich in antioxidants and having less unsaturated fatty acid that is evident from his documented findings of 215 μ g/g and 526 μ g/g of phenolic compounds in Alig and Deglet-Nour cultivar respectively.

Total phenolic contents in the seeds of three sun dried date cultivars Shahal, Mabseeli and Mabseeli were evaluated by [5] and revealed that the total phenolic contents in all three

varieties were in the following order Mabseeli (4430mg of GAE/100g) > Um-sellah (4293mg of GAE/100g) > Shahal (3102mg of GAE/100g). Similarly, seeds of 14 Iranian date cultivars were analyzed for their antioxidant activity and total phenolic contents by [11] moreover; five different organic diluents were used for their extraction. Zehedi cultivar showed maximum antioxidant activity and maximum total phenolic contents in Dimethyl Sulfoxide (DMSO) extract with a direct relationship between Zehedi cultivar and DMSO extract. It was reported that on comparison between seeds and fruit of dates former are superior in their biochemical constituents owing to be enriched in dietary fiber, antioxidant potential, and phenolic acids [5]. These constituents were found in the pericarp and pits in the following increments 8.0 and 73.1g/100g, 6980 and 80400 μ mol/100g, and 239.5 and 3942mg/100g respectively. Likewise, the effects of temperature treatment on flavonoids and caffeine contents in the seeds of dates by using HPLC and HPTLC were carried out by [32]. HPLC results revealed that there were noticeable amounts of flavonoid contents as compared with their standards. Further, on HPTLC analysis of raw and roasted seeds of dates, it was found that caffeine contents were higher in roasted date seeds as compared to raw date seed powder being 34.72mg/g and 26.99mg/g respectively. Recently, a supercritical fluid extraction technique was employed by [27] to prepare extracts from seeds of dates showing that date seeds contain 66.23 to 307.79mg100g⁻¹ total phenolics content on fresh weight basis.

Table 1. Phytochemical and Nutrient Composition of Date Pits

Date seed composition		mg 100 ⁻¹ g of date seeds		Antioxidant potential	
Energy (Cal)	578	Sodium (Na)	16.5	Total phenolic contents (TPC, g/100 g)	1.5-10.3
Carbohydrate (g)	2.4-2.7	Potassium (K)	254.1	Total flavonoids contents (TFC, g/100 g)	0.74-5.4
Fat (g)	5.7-8.8	Iron (Fe)	2.13	2,2-diphenyl-1-picryl-hydrazyl-hydrate DPPH, %)	15-90
Protein (g)	4.8-6.9	Calcium (Ca)	19.2	Rutin (mg kg ⁻¹)	2.2-15
Moisture (%)	8.6-12.5	Magnesium (Mg)	78.9	Catechin (mg kg ⁻¹)	3.0-15
Ash (g)	0.8-1.1	Phosphorus (P)	130.0	Caffeic Acid (CA, mg kg ⁻¹)	1-12.3
Dietary Fiber (g)	67.6-74.2	Zinc (Zn)	0.2	(Saleh et al., 2011) [36]	
(Nehdi et al., 2010) [31]		(Rahman et al., 2007) [33]			

CONCLUSION

Different plant parts or their by-products were in human use since ancient times as a preventive tool against the treatment of various ailments and infections. Recently, it was estimated by the World Health Organization that nearly 80% of the population across the globe use plant-based medications as first aid in their healthcare. These proximate, phytochemical, and Nutrient Compositions of date pits are attributed to the presence of an array of phytochemicals generally derivatives and isomers of different phenolic acids including catechin,

flavones, isoflavones, and flavonols. Date seeds have the potential that could be subjugated for their physico-chemical and phytochemical for their assimilation in different spans of life including food and food products.

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