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A comparative study for some physical fruit characteristics, seed chemical composition of two date palm (Phoenix dactylifera L.) cultivars

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Abstract

This experiment was done at the centre of Date Palm Research, Basrah University, during the 2018 growing season to study some physical fruit characteristics, seed chemical composition of date palm Phoenix dactylifera L. cv. Hillawi and Barhi at Tamer stage in an experiment designed with C.R.D. Results showed significant difference in fruit length, fruit diameter, seed length, seed diameter, fresh and dry weights of fruit and flesh and seeds fresh weight. A significant differences between seeds of the two cultivars in some biochemical composition took part such as moisture, protein and lipids as Hillawi recorded the higher value in lipids content. At the same time, Barhi was significantly greater in its moisture and protein contents.

Keywords: Barhi, protein, lipid, seed, fresh weight

Introduction

The date palm (Phoenix dactylifera L.) is one of humanity's oldest cultivated plants. It has been used as food for 6000 years as in Iraq; there are about 370 different varieties of dates (Amer, 1994; Simozrag et al., 2016). It could be used for generations to come due to its remarkable nutritional, health, and economic value, in addition to its aesthetic and environmental benefits. Every part of the date palm is useful. Dates offer reasonable prospects for fighting hunger and diseases (Abdel Moneim et al., 2012 Phoenix spp. are diploid, perennial, dioecious, and monocotyledonous with unique biological and developmental features that necessitate special propagation, culture, and management techniques mostly adapted to arid environments as the fruit of date palm is often called date, while the whole date palm plant has been referred to as "tree of life" in the holy Bible, perhaps for its nutritional value, productivity and longevity (Chao and Kruger, 2007; United Nations, 2003). More than 2000 different varieties of date palm known worldwide but only a few of them have been used for their agricultural productivity and fruit quality (Mrabet et al., 2008). Tamer is the last stage of ripening, and the date appears dehydrated. Also the semi-dry and dry dates will have nearly 50% each of sucrose and reducing sugars. On a bunch, the fruits ripen over a month and not simultaneously. In most varieties, the skin adheres to the soft flesh and wrinkles as the inner flesh shrinks. The skin and the underlying flesh colors darken with time (Ahmed et al., 1995; Al Noimi and Al-Amir, 1980; Fadel et al., 2006; Zaid, 1999).
Date fruit is a pivotal crop that is extensively farmed in the Middle East and Africa. All fruits, seeds, and byproducts can be regarded as a promising medicinal fruit owing to its therapeutic, nutritive, and bioactivity potentials; it can function as a cheap source of natural diet (Assirey, 2015; Idowu et al., 2020). Twenty-three different amino acids were found in date's proteins, many of which are not found in the most popular fruits, on the other hand, Baliga et. al. (2011) mentioned that, Preclinical studies have shown that the date fruits possess free radical scavenging, antioxidant, antimutagenic, antimicrobial, anti-inflammatory, gastroprotective, hepatoprotective, nephroprotective, anticancer and immunostimulant activities. Meanwhile, numerous beneficial health effects have long been associated with date fruit, including antioxidant, anti-mutagenic and anti-inflammatory activity, and the protection of the gastric mucosa against damaging effects of stomach acid (Tang et al., 2013). Date seeds, also called stones or pits, are form parts of the integral date fruit; approximately 825,000 tons of date seeds are produced annually, and date fruit, which is composed of a fleshy pericarp and seed that constitutes between 10% and 15% of the date fruit's weight, depending on the variety and quality (Hussein et al., 1998; FAO, 2009). Recently, date pit powders are also marketed and are a source of choice to people; date pits are rich in protein (5.1 g/100 g), fat (9.0 g/100 g), dietary fiber (73.1 g/100 g), phenolics (3942 mg/100 g), and antioxidants (80,400 μmol/100 g) and may be of use in enhancing the nutritional value of incorporated food products 100 g of the flesh can provide 314 kcal of energy. (Hussein et al., 1998; Al-

Showiman, 1998; Al-Farsi et al., 2005; Al Farsi and Lee, 2008; Habib and Ibrahim, 2009). For some plants, seeds are an important primary role in producing the next generation of plants. . Usu, a seed comprises proteins, carbohydrates, and lipids, which is either in wax, fat, or oil form. Among these three components, the oil content is the most important for seed germination. The oil can supply twice the germination process energy than proteins and carbohydrates (Baud and Lepiniec, 2010) .

Due to the lack of previous studies on date palm seeds, which can be considered as tones of valuable wastes and to shed light on their chemical composition and the amount of calories in these seeds, we decided to conduct this research, To find mathematical relationships that serve environmental studies in addition to a specific look at date seeds.

Materials and Methods

This experiment was conducted at the centre of Date Palm Researches University of Basrah during the 2018 to study the physical characteristics and to estimate the biochemical composition of date palm Phoenix dactylifera L. fruits flesh and seeds of Hillawi and Barhi cultivars fruits at Tamer stage selected from trees grown at Abul-Khaseeb region, in a private nursery at Basrah city.

Harmonized, healthy, and free from injuries date palm fruits of each cultivar were gathered at Tamer stage as three replicates were used (25 fruits per replicate) and were selected from each tree as randomized .

Vernier Caliper was used to measure fruit length and fruit diameter. Fruits were cleaned and dried carefully, then dissected into the flesh and the parts of the seed (plate 1) as data on seed length, seed diameter, seed fresh weight, fresh flesh weight, and fresh fruit weight were tabulated. Samples were dried in an oven at 70 ˚C then dry weights were recorded when weight was constant, the the percentage of seed fresh weight to fruit fresh weight and percentage of seed dry weight to dry fruit weight were calculated .

The chemical analysis took place as follow:

protein (%): nitrogen was estimated using Micro Khildal as described by Jackson (1958), then protein was evaluated according to the reported procedures in A.O.A.C. (1970) by the equation: (Protein = N % X 6.25).

Lipids were determined by the chloroform-methanol extraction method as in (Folch et al., 1957(. The Ash contents were estimated by combustion in a muffle furnace at 550 ˚ C for 3-4 hr (AOAC, 1990).

Plate (1): The two main parts of the date palm Phoenix dactylifera L. cultivars fruit as 1 Hillawi and 2 Barhi flesh and seeds

Total carbohydrate were calculated by differences as total percentage values using the following formula :

$$carbohydrates(\%) = 100 - moisture\% + ash\% + protein\% + lipid\%$$

according to (Nehdi et al, 2010).

Statistical analysis: The experiment was established as a completely randomized design, and the reported data were subjected to analysis of variance. Significant differences between means were assessed with revised least significant differences at 0.05 significance level using SPSS V.11 for windows.

Results and Discussion

Data in Table (1) revealed significant differences between the two cultivars in the fruit length and diameter as the maximum fruit length (3.72 cm) was recorded in Hillawi cultivar. In contrast Barhi cultivar significantly recorded the highest fruit diameter (2.80 cm). In addition to that, there were significant differences between the cultivars in seed length and diameter as Hillawi seeds recorded the highest value (2.23 cm) and Barhi cultivar seed diameter (1.24 cm) was more significant

The two cultivars were significantly differ in fresh weights of fruit, flesh, and seed as Barhi cultivar gave the highest fresh weight of flesh (5.480 g) while Hillawi recorded 4.540 g. For fresh seed weight, Barhi cultivar recorded the lower value (0.631g) whereas Hillawi gave 0.960 g. Dry weights of fruit, flesh, and seeds were higher in Barhi cultivar; these results are in (Table 2).

Table (1): Physical characteristics of date palm (*Phoenix dactylifera* L.) cultivars fruit (flesh and seeds).

Cultivars / characteristics	Hillawi	Barhi	R.L.S.D. 0.05
Fruit length cm.	3.72*	2.85	0.4198
Fruit diameter cm.	2.04	2.80	0.2267
Seed length cm.	2.23	1.50	0.3749
Seed diameter cm.	0.79	1.24	0.2090

Values given are the means of three replicates

Date seed weight ranges from 0.5 to 4 g, the length from 1.2 to 3.6 cm, and the width from 0.6 to 1.3 cm. The seed is usually oblong, ventrally grooved, with a small embryo, and a hard endosperm made of a cellulose deposit inside the cell walls (Zaid, 2002).

Table (2): Fresh and dry weights (g.) of date palm (*Phoenix dactylifera* L.) cultivars fruit (flesh and seeds)

cultivars / weights g.	Hillawi	Barhi	R.L.S.D. 0.05
Flesh F. Wt. (g)	4.540	5.480	0.3889
Flesh D. Wt. (g)	1.987	1.253	0.2767
Seed F. Wt. (g)	0.960	0.631	0.1705
Seed D. Wt. (g)	0.159	0.132	N S
Fruit F. wt. (g)	5.500	6.111	0.5235
Fruit D. wt. (g)	2.146	1.385	0.3304
Seed fresh wt./ Fruit fresh wt. *100	17.46	10.29	2.254
Seed dry wt. / Fruit dry wt. *100	7.4	9.4	N S

Values given are the means of three replicates

Figure (1) shows the significant linear relationship between fruit length and wet fruit weight as R = 0.873 ($P \geq 0.05$). Also, Figure (2) clarified the relationship between fruit length and fruit dry weight represented as a linear model where R = 0.7 ($P \geq 0.05$). Figure (3) shows the significant relationship between fruit length and flesh wet weight, which follows the linear model as R = 0.945 ($P \geq 0.05$). In contrast, Figure (4) shows the significant relationship between fruit length and flesh dry weight, which follows the linear model as R = 0.873 ($P \geq 0.05$). Also, Figure (5) clarified the

relationship between seed length and seed fresh weight represented as a linear model were R =0.846, And Figure (6) shows the significant relationship between seed length and dry seed weight, which follows the linear model as R = 0.746 (P ≥ 0.05).

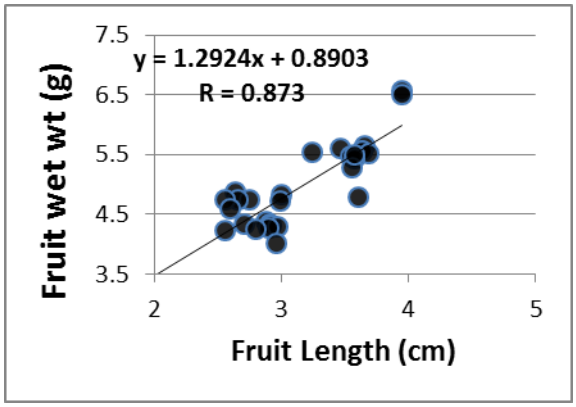

Fig. (1) The relationship between fruit length (cm) and wet fruit weight (g)

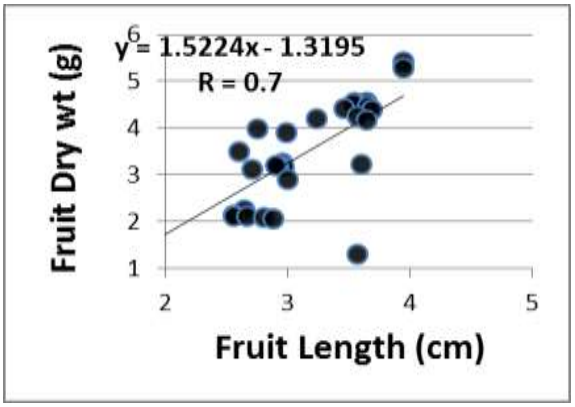

Fig. (2) The relationship between fruit length (cm) and dry fruit weight (g)

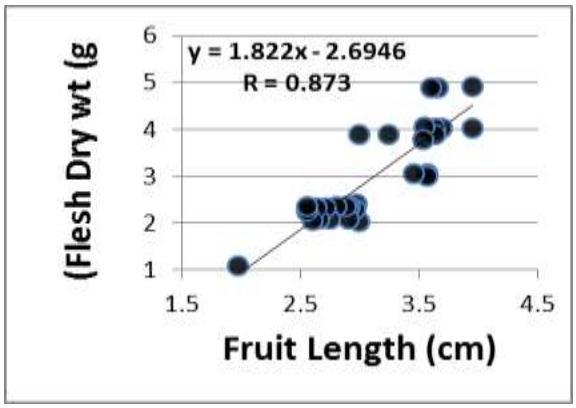

Fig. (3) The relationship between fruit length (cm) and flesh wet weight (g)

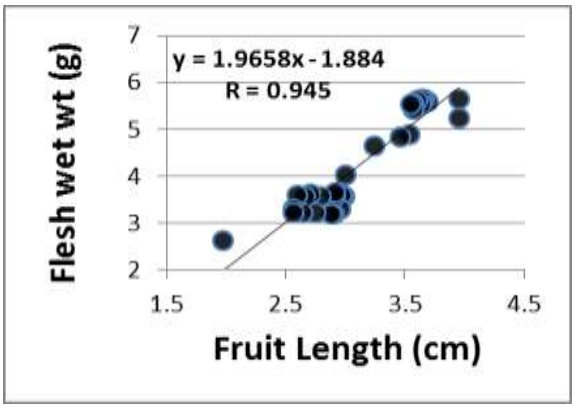

Fig. (4) The relationship between fruit length (cm) and flesh dry weight (g)

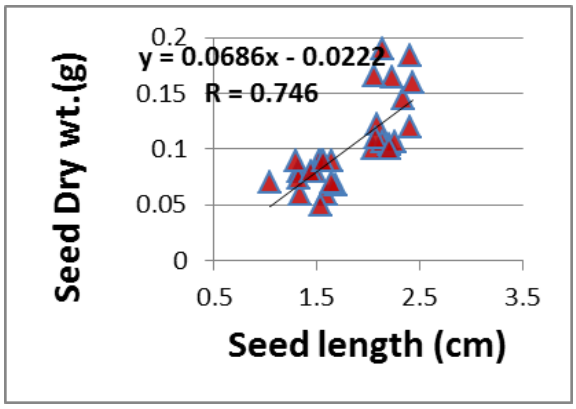

Fig. (5) The relationship between seed seed length (cm) and wet seed weight (g)

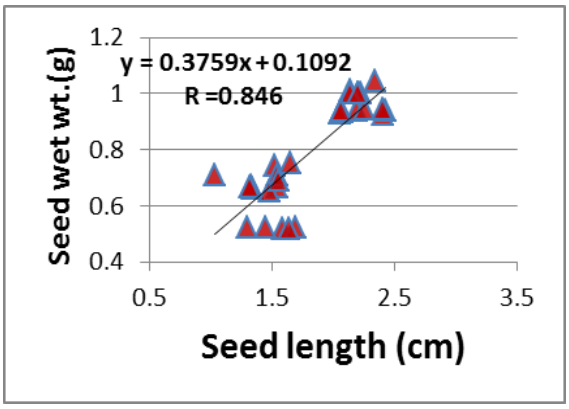

Fig. (6) The relationship between length (cm) and dry seed weight (g)

The date is considered a nutritious fruit as results have indicated the clear contribution of dates to human health when consumed with other food constituents. Dates contain sufficient quantities of minerals and vitamins to prevent deficiency (Al-Farsi et. al., 2007). Also date fruit consists of 73-79% carbohydrates, 14-18% total dietary fibers, 2.5% ash, 2.1-3.0 % protein and 2.0-3.2% fat (Elleuch et al., 2008; Al-Farsi et al., 2007). Statistical analysis revealed that a significant difference in the most chemical composition of seeds exists between the two cultivars in this study as Hillawi recorded the higher value in lipids content and recorded 11.30 %. At the same time, Barhi was significantly greater in its moisture and protein contents and recorded 10.53% and 5.20 % respectively (Table 3).

Table (3): Moisture, protein, carbohydrates, lipids, and ash content (%) of date palm (*Phoenix dactylifera* L.) seed.

Cultivars / %	Hillawi	Barhi	R.L.S.D. 0.05
Moisture	7.26	10.53	0.918
Protein	4.10	5.20	1.059
Carbohydrates	78.12	71.90	N S
Lipids	9.67	11.30	0.683
Ash	0.85	1.07	N S

Values given are the means of three replicates.

Elleuch et al., (2008) reported that the date fruit is composed of fleshy pericarp and kernel (pit, seed, stone or pip), in which pit which is a waste product has been used for centuries in the Arab world to make caffeine-free drink constitute between 10 to 15% of date fruit. A previous study reported that date seed oil hasunique fatty acid, high absorbance of UV light, and other desirable physicochemical characteristics that indicate potentials in the cosmetic industries (Nehdi et al., 2010). According to Buckeridge (2010), storage polysaccharides are present in many seeds as mannan, glucomannan, or galactomannan, with the mannans being important in date palm seeds. Recently, date pit powders are also marketed and are a source of choice to people; date pits are rich in protein (5.1 g/100 g), fat (9.0 g/100 g), dietary fiber (73.1 g/100 g), phenolics (3942 mg/100 g), and antioxidants (80,400 μmol/100 g) and may be of use in enhancing the nutritional value of incorporated food products 100 g of the flesh can provide 314 kcal of energy. (Hussein et al., 1998; Al- Showiman, 1998; Al-Farsi et al., 2005; Al Farsi and Lee, 2008; Habib and Ibrahim, 2009).

Consumers of dates often discard the seeds. However, these seeds have high nutritional content similar to the date, which is of considerable nutritional importance to humans. According to a report, date seed oils could be easily conserved due to their high oxidative stability (Besbes et al., 2004). Fatty acids include oleic, linoleic,

palmitic, myristic, and lauric, with oleic acid being the most abundant in date seed oil (Besbes et al., 2004; Boukouada, and Yousfi, 2009). Nehdi et. al. (2010) mentioned that oleic fatty acid function is critical in nervous cell construction related to vessel level and blood coagulation and has a fundamental role in cardiovascular disease prevention. Date fruits are considered a complete diet and an essential item of food with plenty of vitamins and minerals; dates have 25% more potassium than bananas while being free from fat, sodium, and cholesterol (Foroogh, 2009). Also, date seed constitutes between 10% to 15% of date fruit weight (Almana and Mahmoud, 1994; Hussein et al., 1998). Date seeds contain valuable bioactive compounds. The utilization of this by-product is highly desirable for the date industry. The seed characteristics also vary greatly according to variety, and environmental and growing conditions (Zaid, 2002). Date seeds may have extractible high value-added components. However, very little use is made of these components: they are discarded or used in animal feed. Little research has been undertaken on date seeds; this has focused mainly on their chemical (El-Rahman and Al-Mulhemsi, 2017).

The authors reported that the date's chemical composition has 3.1-7.1% moisture, 2.3-6.4% protein, 5.0-13.2% fat, and 0.9-1.8% ash. Seed also contains the highest levels of phenolic (3,102-4,430 mg Gallic acid equivalent /100 g), antioxidant (580-929 μm Trolox equivalent/g), and dietary fiber (78-80 g/100 g) (Al-Farsi et al., 2007). Phenolic compounds have been shown to possess such benefits as antioxidant, anticarcinogenic, antimicrobial, and anti-inflammatory (Rania et al., 2014).

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دراسة مقارنة لبعض الخصائص الفيزيائية للثمار والتركيب الكيميائي للبذور في صنفين من نخيل التمر (Phoenix dactylifera L.)

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الخلاصة

أجريت هذه التجربة في مركز ابحاث النخيل جامعة البصرة خلال موسم النمو 2018 لدراسة بعض الخصائص الفيزيائية للثمار والتركيب الكيميائي لبذور نخلة التمر *Phoenix dactylifera* L. صنفي الحلاوي والبرحي في مرحلة التمر. صممت التجربة وفق التصميم العشوائي الكامل CRD أظهرت النتائج تبايناً معنوياً في طول وقطر الثمرة وطول وقطر البذرة والأوزان الرطبة والجافة للثمار ووزن اللحم والبذور. ظهرت فروق ذات دلالة إحصائية بين بذور الصنفين في بعض التركيبات الكيميائية الحيوية مثل الرطوبة والبروتين والدهون، فقد سجل صنف الحلاوي أعلى قيمة في محتوى اللبيدات ، بينما كان البرحي أعلى معنويًا في محتوى البذور من الرطوبة والبروتين

الكلمات المفتاحية: البرحي، البروتين، بذور، دهون، وزن رطب