



Research paper

Fruit Characterization of Some Local Dry Date Cultivars in Rubatab Area

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ABSTRACT

The present study aimed to evaluate the physical and chemical properties of three known date cultivars in Abu Hamed Locality, River Nile State, Northern Sudan, namely; Sikkouti, Sunta and Boor. The physical characterization of fruits included whole fruit and pulp mean weight, seed weight, fruit length and width, pulp thickness, fruit volume, colour and shape. The results indicated significant differences, in most characteristics between the three cultivars. Boor recorded the highest fruit weight and fruit length. Sunta and Boor recorded the highest pulp thickness and pulp weights. Concerning fruit width, Sunta showed the highest value, followed by Sikkouti and Boor, respectively. Boor recorded the highest moisture content, while Sikkouti recorded the lowest value. Regarding chemical characteristics, the moisture content values indicated that the three cultivars are dry dates (moisture content below 20%). Sikkouti cultivar recorded the highest mean values of total sugars (71.1%) and non-reducing sugars (32.4%), while Boor and Sunta recorded the highest reducing sugars (42.2%). Sikkouti had the highest fiber and ash content, while, the least values were recorded by Sunta. For minerals content, the analysis indicated the presence of high levels of K (1164-1641mg/100g) in all tested cultivars, beside different rates of Fe, Ca, Zn, Cu and Mn.

Keywords: Date fruits, physical and chemical properties

دراسة خواص ثمار بعض اصناف التمر الجاف في منطقة الرباطاب

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هدفت هذه الدراسة لتحديد خواص ثلاثة اصناف من التمر السوداني المعروفة بمنطقة الرباطاب في محافظة أبو حمد بولاية نهر النيل شمال السودان وهي تحديداً: سكوت، سنطة وبور. شملت الدراسة تقييم الاصناف الثلاثة اعتماداً على الخصائص الفيزيائية والكيميائية. فيما يتعلق بالخصائص الفيزيائية تم قياس متوسط وزن الثمرة، وزن اللب، وزن البذرة و الطول والعرض للثمرة وكذلك تم قياس سمك اللب وحجم الثمرة بالإضافة إلى تقييم اللون والشكل. أظهرت النتائج وجود فروقات معنوية واضحة لمعظم الصفات الفيزيائية بين الاصناف الثلاثة حيث سجل الصنف بور أعلى متوسط لوزن الثمرة وأعلى متوسط للطول، سجل الصنفين سنطة وبور أعلى متوسط لسمك اللب وأعلى متوسط لوزن اللب. بالنسبة لعرض الثمار اظهرت سنطة أعلى قيمة، يليها سكوت ثم بور. بالنسبة للخصائص الكيميائية سجل الصنف بور أعلى نسبة للمحتوى الرطوبي وكان الصنف سكوت الأكثر جفافاً ومن ثم أثبتت التجارب أن الاصناف الثلاثة هي اصناف تمر جاف (نسبة الرطوبة أقل من 20%). سجل الصنف سكوت أعلى متوسط للسكريات الكلية (71.1%) وللسكريات الغير مختزلة (32.4%)، بينما سجل بور أعلى متوسط للسكريات المختزلة (42.2%). فيما يتعلق بالرماد والألياف سجل سكوت أعلى متوسط بينما سجلت سنطة أقل نسبة للألياف. بالنسبة للعناصر المعدنية فقد خلصت النتائج الى وجود مستويات عالية من البوتاسيوم (1641-1164 مج/100جم) في الاصناف الثلاثة، بجانب كميات متفاوتة من الحديد، الكالسيوم، الزنك، النحاس والمنجنيز.

Introduction

Dates are a staple food in many desert areas. Their high energy value and good storability make them an ideal crop in areas where they can be grown (Nixon, 1951; Zaid and de Wet, 2002). The world production of dates mounted to about 7 millions tones/year and the major producers are situated in the Middle East and North Africa (FAO, 2006; Chao and Krueger, 2007).

Dates have high nutritional value with superb energy and possess antioxidant and anti-mutagenic properties. Their energy is in the form of sugars (44-88%). Dates also contain proteins (2.3-5.6%), fibre (6.4-11.5%), fat (0.2-0.5%) and a number of essential minerals and vitamins. They are particularly good source of potassium and have appropriate amounts of iron, magnesium and calcium and vitamin B7 (Al-Shahib and Marshall, 2003; Al-farsi *et al.*, 2005; Mansouri *et al.*, 2005).

Dates can be identified by their characteristic appearance and texture and fall into three types: soft, semi-dry and dry (Al-Shahib and Marshall, 2003). The type of fruit depends on the moisture, glucose, fructose and sucrose content. This classification is based on the texture or consistency of fruit under normal conditions of ripening. The dry date cultivars represent relatively small number of the international cultivars which is more than two thousand. Dry dates were unknown in economic level except in Sudan and Egypt where they are consumed locally. The suitability of date cultivars from the consumer's point of view is usually evaluated according to time of the ripening, yield, storage, quality and consumer preference. However, physical and chemical characteristic of fruits are one of the most important criterion for the evaluation of cultivars and considered more common than the vegetative characters in differentiation between date palm cultivars (Al-Akaidy, 1994).

Sudan is ranked number 8 in the list of top date producing countries of the world with annual production of 330,000 tons (FAO, 2006). Sudan has its own endogenous date cultivars and consumption per capita is considered high. Date production in Sudan is dominated by Barakawi variety followed distantly by Gondaila, Pittamuda, Mishrigi and Sikkouti. However, Sudan is very capable of producing larger quantities of these industrial grade dates.

The long, hot dry summers with low relative humidity make Northern State and northern part of the River Nile State in Sudan ideal locations for date palm culture (Idris *et al.*, 2012; Baballa *et al.*, 2016).

A number of Sudanese date cultivars were studied by different researchers; Gondaila and Pittamuda by Khattab *et al.* (1982); Boor, Sunta, Sikkouti, Humboga, Gwad, Mesaiheen and Kirkrimma by Abdallah (2002) and Barakawi and Gondaila by Shattir *et al.* (2002).

The main objective of this study was to determine the fruit quality of the three local date cultivars namely; Sunta, Boor and Sikkouti, grown at Abu Hammed Locality, River Nile State.

Materials and Methods

Plant material

Date samples from the three cultivars (Sunta, Boor and Sikkouti) were collected in the fully dry ripe stage from Abu Hammed Locality area in the River Nile State, season 2006. Five date palm trees of the same age were randomly selected from each farm. Fruits were collected randomly from different bunches of the same tree. Fruits collected from each cultivar were then grouped together and considered as a working sample. Results were analyzed using complete block using computer program.

Physical characteristics

Fruit color was determined visually. Fruits shape was determined according to the International Atlas for date palm cultivars (Ebraheem, 2005). Fruit, flesh and seed weights were obtained using a digital balance (0.00gm). Fruit dimensions (length and width) for the individual fruits were measured by a vernier caliper (cm). Fruit thickness was measured by a micrometer caliper (mm). Whole fruit and seed volumes were determined by water displacement from known quantity of water in a measuring cylinder.

Chemical constituents of the fruit

Moisture, ash, crude fiber content of each fruit sample was determined according to the standard Official Methods of Analysis (AOAC, 2000). The reducing sugars content was determined according to the modified method of Lane and Eynon as described by AOAC (2000). Tannins were assessed using modified vanillin-HCl method as described by Price *et al.* (1978). Minerals (potassium, calcium, manganese, zinc, copper and iron) in date fruit flesh were determined using atomic absorption method (AOAC, 2000).

Statistical analysis

Analysis of variance was used to test the significance of treatment effects. Least Significant Difference Test was used to compare treatment means using the computer program MSTAT-C (MSTAT-C, 1991).

Results and Discussion

Physical properties of date fruits

The physical properties of the three date fruit cultivars were depicted in Table (1). The fruit skin color of Sunta and Sikkouti tended to be yellow to brown, while Boor fruits were black. The fruits shape was assessed according to the International Atlas for Date Palm Cultivars as described by Ebraheem (2005). The fruit shape of Sunta, Boor and Sikkouti cultivars were ovate, cylindrical and ovoid-elongated, respectively.

The fruit weight of the three cultivars was significantly different (0.05%). Higher fruit weights were obtained by Boor (9.2g) and Sunta (8.3g). However, close results were obtained by Abdallah (2002). Boor and Sunta cultivars recorded significantly heavier flesh weight; which averaged 8.1 and 7.5 gm, respectively, while Sikkouti showed the lowest value of 5.61gm. These values are in agreement with those obtained by Abdallah (2002). Results also showed a significant difference in fruit pulp%. Sunta obtained the highest pulp ratio (89.8%), followed by Boor (88.3%) and Sikkouti (82.9%), respectively. These results are in line with that of Abdallah (2002). Among the three cultivars, Boor has the longest fruit (4.50 cm), followed by Sikkouti (3.81cm) and Sunta (3.79 cm), respectively. Both Sikkouti and Sunta were significantly shorter than Boor. Average values of the fruit width were found as 2.08, 1.81 and 1.68 cm for Sunta, Sikkouti and Boor, respectively. However, following Ibraheem and Kaleif (1998) size classification, the three investigated date cultivars could be classified as medium size (3-5cm). Boor and Sunta cultivars recorded significantly greater flesh thickness (5.69 and 5.50 mm, respectively), while Sikkouti recorded the least value (4.68 mm). In terms of fruit volume, Sunta and Boor cultivars recorded significantly larger values (8.45 and 8.13 cm³, respectively), than Sikkouti (6.38 cm³). These results are in accordance with the findings of Abdallah (2002). No varietal significant difference was obtained for seed weight. Values of seed weight were found as 1.08, 1.03 and 1.04 for Sikkouti, Sunta and Boor, respectively. Similar results were reported by Abdallah (2002).

Chemical analysis of date fruits

The chemical composition of the three date cultivars is illustrated in Table (2). The moisture content in fruit was significantly different for the three cultivars, the highest value was obtained by Boor (6.75 %), and the least value was obtained by Sikkouti cultivar (5.46%). According to Hussein *et al.* (1976), these cultivars could be classified as dry dates (of moisture less than 20%). However, these results are lower than those recorded for dry dates of Barakawi, Gondaila and Pittamuda (9-13%) by Nour and El-Mogboul (1985).

In terms of sugars; Sikkouti have the highest average value of total sugars (71.06%) which was comparable to Gondaila cultivar (72.6%) as reported by Khatab *et al.* (1982). Lower values were attained by Boor and Sunta cultivars (59.56 and 59.18%, respectively). Boor variety recorded the highest average value of reducing sugars (42.2%) while Sunta and Sikkouti recorded lower values (35.9 and 37.0%, respectively). Further, Sikkouti variety showed the highest average value of non-reducing sugars (32.4%) followed by Sunta (22.1%), while Boor attained the lowest value (16.5%). The relationship between the sucrose and moisture content is inversely correlated; it was found that when moisture was high, the sucrose was low.

Crude fiber content was found as 2.9, 2.1 and 1.3 % in Sikkouti, Boor and Sunta cultivars, respectively. Selim *et al.* (1968) classified 15 date cultivars grown in Egypt into three groups according to their crude fibers content. The first group had the cultivars of more than 2% fiber. The second group included cultivars with fiber content which ranged from 1.0 to 2.0% and the third group included cultivars of less than 1.0% fiber content. The cultivars investigated in the present study varied between the first and the second group.

The total ash content of Sikkouti variety was the highest (2.7%), followed by Sunta (2.5%) and Boor (2.5%), respectively. These values were close to the findings of Khatab *et al.* (1982) for other date cultivars.

Minerals composition of the three date varieties is illustrated in Table (3). Sikkouti showed the highest value for potassium and iron (1641 and 35.55mg/100 gm, respectively). Sunta variety gave the highest calcium level (242mg/100g), while Boor gave the lowest calcium (38.7 mg/100g). However Sunta showed the highest values for manganese and zinc (1.717, 2.7124mg/100g, respectively). Potassium values obtained in the present investigation was found higher than the values

reported by Shattir *et al.* (2002) in Gondaila and Barakawi and Sawaya *et al.* (1982) in Saudi dates (Salg, Sifri and Kudare). Iron values recorded the same values of other Sudanese cultivars as obtained by Khatab *et al.* (1982). Generally, the date fruits under this study were rich in potassium, iron and calcium (except Boor variety which was poor in calcium) and contained low values of zinc, copper and manganese.

Tannins values for date fruits were 0.185, 0.142 and 0.122% in Sikkouti, Sunta and Boor, respectively. However, these results are lower than those recorded by Nail (1994) in Siwy date fruit cultivar.

Table (1): Fruit physical characteristics of three date cultivars

Cultivar	Fruit weight (gm)	Flesh weight (gm)	Seed weight (gm)	Fruit width (cm)	Fruit length (cm)	Flesh thickness (mm)	Fruit volume (cm ³)	Flesh %
Sikkouti	6.6 c	5.5 b	1.08a	1.81 ab	3.81 b	4.68 b	6.38 b	82.9 b
Sunta	8.3 b	7.5 a	1.03a	2.08 a	3.79 b	5.50 a	8.45 a	89.8 a
Boor	9.2 a	8.1 a	1.04a	1.68 b	4.50 a	5.69 a	8.13 a	88.3 a
LSD	0.77	0.6	0.6	0.3	0.028	0.6	1.34	4.7
CV.	2.3	0.02	3.9	3.8	2.4	2.74	8.13	8.83

Means followed by the same letters in the same column are not significantly different

Table (2): Chemical composition (%) of three date fruit cultivars

Cultivar	Moisture	Sucrose	Reducing sugars	Total sugars	Fiber	Ash	Tannins
Sikkouti	5.46 c	32.35 a	37.01 b	71.06a	2.89 a	2.7 a	0.185 a
Sunta	6.39 b	22.14 b	35.88 b	59.18 b	1.28 c	2.5 c	0.142 b
Boor	6.75 a	16.47 c	42.22 a	59.56 b	2.13 b	2.48 b	0.122 b
LSD	0.34	2.27	2.63	0.91	0.45	0.084	0.028
CV.	1.13	1.97	1.41	0.3	4.43	0.68	3.9

Means followed by the same letters in the same column are not significantly different

Table (3): Minerals content of three date fruit cultivars

Minerals (mg/100g)	Variety		
	Sikkouti	Sunta	Boor
K	1641	1345	1164
Ca	169.5	242	38.7
Mn	0.8804	1.1772	0.808
Zn	1.717	2.7124	1.9376
Fe	35.55	20.78	22.03
Cu	3	1.02	2.54

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