

## Nutritional assessment of different date fruits (*Phoenix dactylifera L.*) varieties cultivated in Hail province, Saudi Arabia

Ahmed Ali Alghamdi<sup>1</sup>, Amir Mahgoub Awadelkarem<sup>2</sup>, A.B.M. Sharif Hossain<sup>1</sup>, Nasir A Ibrahim<sup>1,3</sup>, Mohammad Fawzi<sup>1</sup> and Syed Amir Ashraf<sup>2\*</sup>

<sup>1</sup>Department of Biology, Faculty of Science, University of Hail, P.O.Box 659, Hail 81421, Saudi Arabia

<sup>2</sup>Department of Clinical Nutrition, College of Applied Medical Sciences, University of Hail, Hail, Saudi Arabia

<sup>3</sup>Department of Biochemistry and Physiology, Faculty of Veterinary Medicine, University of Albutana, Sudan

### ABSTRACT

Date fruits are an imperative crop, especially cultivated in the hot-arid regions of the world having extraordinary nutritional and therapeutic value. In this study, we performed nutritional profiling and mineral analysis of different varieties of date fruits cultivated in north-western region of Saudi Arabia. Among the sample tested, we found that moisture contents was highest in Helwah Hail ( $23.83 \pm 0.49\%$ ) and Berhi ( $23.20 \pm 0.10\%$ ). Moreover, ash and protein content was found to be more in Ajwah ( $2.50 \pm 0.53\%$ ) and Hamra ( $4.34 \pm 0.06\%$ ) respectively. Similarly, total fibre percentage of the tested sample varied from  $4.35 \pm 0.05\%$  to  $5.13 \pm 0.12\%$  and monosaccharaides was found highest in Helwah Hail and Deglet Shewaish. However, mineral analysis showed that Ajwah date fruits, Asilah, Nabtat Saif and Barni had high amount of calcium, magnesium, sodium and potassium respectively. The present finding helps in understanding the nutritional status and significance of different date varieties cultivated in north-western region of Saudi Arabia (Hail Region). However, lesser known varieties can be improved through better horticulture practices as a valuable product. Further, this study reveals that, the consumption of these date fruits would have several nutritional health effects.

**KEY WORDS:** NUTRIENT ANALYSIS, PROXIMATE ANALYSIS, DATE FRUITS, HAIL PROVINCE, MINERALS

**Article Information:**\*Corresponding Author: s.amir@uoh.edu.sa

Received 27/03/2018 Accepted after revision 19/06/2018

Published: 30th June 2018 Pp- 263-269

This is an open access article under Creative Commons License,

Published by Society for Science & Nature, Bhopal India.

Available at: <https://bbrc.in/>

Article DOI: <http://dx.doi.org/10.21786/bbrc/11.2/11>

## INTRODUCTION

The date palm (*Phoenix dactylifera* L., family Arecaceae) is one of the oldest fruit trees on the earth and is closely associated with the life of the human beings in the Middle East countries including the Kingdom of Saudi Arabia (Al-Abdoulhadi *et al.*, 2011). Saudi Arabia is considered as the mother country of date palm trees and is second largest producer of date fruits in the world, with more than 300 types of dates, each with its own taste and texture, but only around 50–60 cultivars are used commercially. In 2013, date production in Saudi Arabia reached 1,065, 032 tons, from 3.7 million trees (Assirey 2015; Allbed *et al.*, 2017). However, few studies have also showed that the Kingdom occupies the first rank in the world in terms of average per capita consumption of dates per year, which reached 34.8 kg/year in 2003 (Al Shreed *et al.*, 2012). Date fruits have great importance in human nutrition owing to their rich content of essential nutrients which include carbohydrates sugar ranging from 65% to 80% on dry weight basis mostly of inverted form (glucose and fructose). Fresh varieties have a higher content of inverted sugars, the semi dried varieties contain equal amount of inverted sugars and sucrose, while dried varieties contain higher sucrose, (Aldjain *et al.*, 2011; Hamad *et al.*, 2015).

The nutritional value of dates is due to their high sugar content as well as other important micro and macro nutrients such as potassium (2.5 times more than bananas), calcium, magnesium and iron. Other important components are proteins, fat, vitamins, dietary fiber, fatty acids, polyphenols, antioxidant and amino acids, (Chandrasekaran *et al.*, 2013). In addition, date fruit has been recommended in folk remedies for the treatment of various diseases like diabetes, obesity, cancer and heart diseases. Recently, it has been found that date fruit might be of benefit in glycemic and lipid control of diabetic patients and have also been identified as having antioxidant and anti-mutagenic properties due to their high levels of poly-phenolic compounds and vitamins (Vayalil, 2012; Parvin *et al.*, 2015; Khalid *et al.*, 2016). In appreciation of its fruits, the date tree is referred to as the sacred tree, the tree of life, and the bread of the desert (Ghnimi *et al.*, 2017).

With the increase in obesity and overweight among Saudi nationals, especially young males and females due to the life style and food habits, healthier balanced food may be one of the solutions to this problem (Al-Hazzaa *et al.*, 2012). Date fruits are a perfect food that can provide the necessary minerals. Moreover dates can be given to children instead of chocolates that contain various fats and additives that may subject them to health problems. Dates have longer shelf life and can be stored safely even at the high temperature of the Arabian Pen-

insula. Dates don't require cooking or processing. All of these advantages make dates one of the best food stuff to be consumed (Taha *et al.*, 2015). Considering the nutritional facts and importance of date fruits studying their nutritional quality is increasingly being recognized as a worthy and important task. Our objective was to evaluate the nutritional status and mineral composition of various varieties of Dates fruit cultivated in Hail Province, Kingdom of Saudi Arabia.

## MATERIAL AND METHODS

**Sample collection and preparation:** Thirty two varieties (Nabtat Saif, Khlas, Hamra, Ajwah, Shaishi, Barni, Sabbakah, Seghae, Roshodyyah, Nabtat Ali, Umm-Hamam, Meskany, Rezazy, Asailah, Gasbah, Shaqraa, Meneifi, Sultanah, Wannanah, Umm Kebar, Dhahesyyah, Helwah, Helwah Hail, Helwah Baqqa, Shebeby, Umm-Khashab, Fankha, Berhi, Maktoomy, Sukkari, Deglet Shewaish and Majhoolah) of date palm fruits were collected from local markets and date fruits farms of Hail Province, Kingdom of Saudi Arabia. Subsequently, samples were washed with distilled water and the seeds were removed. Later on, samples were grinded into uniform mixture and stored in air tight containers until further analysis.

**Determination of moisture and ash content:** Two grams sample were placed into the petri-dish and dried in an oven at 105°C for three hours. The dried sample was cooled in a desiccator for 30 min and weighed to a constant weight. The percentage loss in weight was expressed as percentage moisture content on dry weight basis. However, determination of ash contents were performed in triplicates and percentage residual weight was expressed as ash content (Bashir *et al.*, 2015).

**Determination of total protein and fat percentage:** 2g samples taken into thimble and placed into Soxhlet apparatus for the determination of fat content using petroleum ether (60 to 80°C) for 5 hours. Moreover, determination of total proteins was performed by using Kjeldahl method (AOAC, 2006).

**Determination of total fiber:** From the pounded sample, 2.00 g were used in triplicates for estimating the crude fibre by acid and alkaline digestion methods using 20% H<sub>2</sub>SO<sub>4</sub> and 20% NaOH solutions (AOAC, 2006).

**Carbohydrate determination:** Carbohydrate content was calculated using the following formula: Available carbohydrate (%) = 100 – [protein (%) + Moisture (%) + Ash (%) + Fibre (%) + Crude Fat (%)](Bashir *et al.*, 2015).

**Determination of mineral contents:** One gram of dried sample and 50 ml of 20% Nitric acid (HNO<sub>3</sub>) were added to Erlenmeyer flask. The mixture was heated to 70–85 °C

for 48 h. During heating period the volume of the flask was maintained at the same level by intermittently adding 20% nitric acid. After the completion of digestion the content of Erlenmeyer flask was filtered using Nalgene filter (Thermo scientific) unit. The filtrate was collected in 100 ml volumetric flask and allowed to cool. After cooling the volume was made up to 100 ml using deionized water (Milli Q) and analyzed with ICP-MS. For the sample preparation all the glassware was washed with deionized water and rinsed three times with 20% nitric acid (Ahmad et al., 2017).

**Statistical analysis:** All the experiments were carried out in triplicates. The data were analyzed statistically

with SPSS-17 statistical software (SPSS Inc., Chicago, IL, USA). Mean was statistically compared by Duncan's multiple range test at  $P < 0.05\%$  level.

## RESULTS AND DISCUSSION

Date fruits have huge scope and potential for use as food or as healthy food products because of an important source of nutrition as well as economic significance. Proximate analysis of date fruits are considered important in grading, preservation, storage and processing of dates. The average proximate composition and mineral analysis of date fruits are presented in Tables 1, 2 & 3.

Sample Name	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Total Fibre (%)
Nabtat Saif	18.03g ± 0.25	1.95 abcdef ± 0.19	0.43 abcd ± 0.025	2.70 def ± 0.10	4.52 bc ± 0.08
Khlas	18.73 gh ± 0.21	1.31 ab ± 0.09	0.45 abcdef ± 0.050	2.90 ghi ± 0.10	4.40 ab ± 0.10
Hamra	10.36 a ± 0.33	1.84 abcdef ± 0.55	0.55 ghij ± 0.500	4.34 q ± 0.06	4.35 a ± 0.05
Ajwah	14.56 d ± 0.59	2.50 ef ± 0.53	0.42 abc ± 0.015	3.15 kl ± 0.05	4.62 cd ± 0.08
Shaishi	15.97 ef ± 0.45	1.76 abcdef ± 0.05	0.52 efghij ± 0.085	3.29 lm ± 0.01	4.66 cde ± 0.04
Barni	11.23 ab ± 0.21	2.27 cdef ± 0.72	0.49bcdefghi ± 0.030	2.95 hij ± 0.05	4.39 ab ± 0.01
Sabbakah	14.87 de ± 0.35	2.51 f ± 0.34	0.42 abcd ± 0.040	3.25 klm ± 0.05	4.65 cde ± 0.05
Seghae	12.43 c ± 0.11	2.14 bcdef ± 0.51	0.50 cdefghij ± 0.020	2.64 cde ± 0.06	4.87 fghij ± 0.03
Roshodyyah	18.70 gh ± 0.30	2.15 bcdef ± 0.47	0.46 abcdef ± 0.060	2.29 a ± 0.04	4.95 hijk ± 0.05
Nabtat Ali	15.63 def ± 0.15	2.04 abcdef ± 0.46	0.48bcdefgh ± 0.020	2.60 cd ± 0.10	4.85 fghi ± 0.05
Umm-Hamam	18.50 gh ± 0.10	1.24 a ± 0.15	0.39 a ± 0.135	2.50 bc ± 0.10	4.95 hijk ± 0.05
Meskany	19.50 hi ± 0.40	1.54 abcd ± 0.41	0.58 j ± 0.080	3.39 mn ± 0.01	4.80 efgh ± 0.20
Rezazy	11.97 bc ± 0.86	2.47 ef ± 0.57	0.49 bcdefghi ± 0.010	2.88 fgh ± 0.01	4.88 ghij ± 0.02
Asailah	16.20 f ± 0.61	1.67 abcde ± 0.15	0.45 abcdef ± 0.050	2.34 ab ± 0.05	4.95 hijk ± 0.05
Gasbah	22.06 lmn ± 0.05	1.54 abcd ± 0.30	0.43 abcde ± 0.030	2.72 defg ± 0.11	4.69 cdef ± 0.21
Shaqraa	22.13 lmn ± 0.49	1.68 abcdef ± 0.27	0.47 abcdefg ± 0.030	2.75 defg ± 0.05	4.86 fghi ± 0.04
Meneifi	22.57 mn ± 0.21	1.48 abcd ± 0.57	0.49 bcdefghi ± 0.035	3.75 p ± 0.05	4.85 fghi ± 0.05
Sultanah	21.53 klm ± 0.95	1.43 abc ± 0.06	0.50 cdefghij ± 0.060	3.08 ijk ± 0.07	4.90 ghij ± 0.10
Wannanah	20.47 ijk ± 1.13	1.40 ab ± 0.10	0.47 abcdefg ± 0.030	3.53 no ± 0.12	4.90 ghij ± 0.10
Umm Kebar	22.83 no ± 1.98	1.56 abcd ± 0.37	0.41 ab ± 0.020	3.68 op ± 0.17	4.90 ghij ± 0.20
Dhahesyyah	18.89 gh ± 0.11	1.67 abcde ± 0.46	0.46 abcdef ± 0.010	3.58 op ± 0.18	4.80 efgh ± 0.00
Helwah	18.57 gh ± 0.32	2.31 def ± 0.40	0.49 bcdefghi ± 0.010	3.30 lm ± 0.10	4.72 defg ± 0.08
Helwah Hail	23.83 o ± 0.49	1.87 abcdef ± 0.65	0.56 hij ± 0.060	2.95 hij ± 0.05	4.80 efgh ± 0.20
Helwah Baqqa	21.07 jkl ± 1.53	1.69 abcdef ± 0.35	0.51 defghij ± 0.015	2.80 efgh ± 0.20	4.85 fghi ± 0.05
Shebeby	19.47 hi ± 0.15	1.59 abcd ± 0.42	0.46 abcdef ± 0.015	3.20 kl ± 0.20	5.13 k ± 0.12
Umm-Khashab	21.53 klm ± 0.31	1.80 abcdef ± 0.26	0.57 ij ± 0.050	2.70 def ± 0.10	4.78 defgh ± 0.07
Fankha	18.10 g ± 0.71	1.83 abcdef ± 0.48	0.52 fghij ± 0.000	2.70 def ± 0.10	5.00 ijk ± 0.10
Berhi	23.20 no ± 0.10	1.50 abcd ± 0.00	0.45 abcdef ± 0.010	2.96 hij ± 0.06	4.93 hij ± 0.07
Maktoomy	15.17 def ± 0.55	1.59 abcd ± 0.17	0.39 a ± 0.010	3.15 kl ± 0.15	5.03 jik ± 0.02
Sukkari	20.13 ij ± 1.70	1.85 abcdef ± 0.83	0.42 abcd ± 0.010	2.75 defg ± 0.15	4.95 hijk ± 0.10
Deglet Shewaish	14.40 d ± 0.10	1.55 abcd ± 0.13	0.49 bcdefghi ± 0.010	2.65 cde ± 0.05	5.05 ik ± 0.05
Majhoolah	15.03 def ± 0.40	1.58 abcd ± 0.58	0.46 abcdef ± 0.006	3.10 jk ± 0.10	4.95 hijk ± 0.05

Means bearing different superscript letters are significantly different at  $p < 0.05$ .

Table 2. Carbohydrate and monosaccharide sugar analysis of date fruits

Sample Name	Monosaccharide (%)	Carbohydrate (%)
Nabtat Saif	36.13 ef ± 0.66	72.23 i ± 0.35
Khlas	42.25 h ± 0.77	72.05 hi ± 0.05
Hamra	45.28 ij ± 0.82	78.69 m ± 0.34
Ajwah	45.29 ij ± 0.82	74.23 j ± 0.65
Shaishi	36.17 ef ± 0.66	73.83 j ± 0.37
Barni	36.13 ef ± 0.66	77.37 l ± 1.07
Sabbakah	48.39 k ± 0.88	74.23 j ± 0.09
Seghae	43.92 i ± 0.80	77.39 l ± 0.39
Roshodyyah	37.53 f ± 0.68	71.71 ghi ± 0.26
Nabtat Ali	43.92 i ± 0.80	74.12 j ± 0.42
Umm-Hamam	37.53 f ± 0.69	72.36 i ± 0.01
Meskany	37.53 f ± 0.69	70.12 ef ± 0.31
Rezazy	40.51 g ± 0.73	77.56 l ± 0.86
Asailah	43.92 i ± 0.80	74.11 j ± 0.51
Gasbah	39.97 g ± 0.73	68.24 cd ± 0.17
Shaqraa	34.89 de ± 0.63	68.07 bcd ± 0.61
Meneifi	56.68 n ± 1.03	66.94 ab ± .010
Sultanah	46.18 j ± 0.83	68.58 d ± 1.06
Wannanah	50.77 l ± 0.92	69.10 de ± 0.90
Umm Kebar	50.77 l ± 0.92	67.12 abc ± 2.25
Dhaesyayah	39.44 g ± 0.71	70.88 fgh ± 0.28
Helwah	27.36 a ± 0.49	70.54 fg ± 0.52
Helwah Hail	56.62 n ± 1.02	66.39 a ± 0.01
Helwah Baqqa	40.51 g ± 0.73	68.75 d ± 1.66
Shebeby	53.62 m ± 0.97	70.42 f ± 0.11
Umm-Khashab	32.65 c ± 0.59	68.72 d ± 0.41
Fankha	36.13 ef ± 0.66	72.19 i ± 0.11
Berhi	48.39 k ± 0.88	66.92 ab ± 0.06
Maktoomy	34.38 d ± 0.62	74.59 jk ± 0.51
Sukkari	43.92 i ± 0.81	69.94 ef ± 0.71
Deglet Shewaish	56.67 n ± 1.03	75.76 k ± 0.04
Majhoolah	30.66 b ± 0.56	75.09 jk ± 0.25

**Moisture and ash contents:** Our results showed that, the moisture content in all the evaluated sample varies from (10.36<sup>a</sup> ± 0.33 - 23.20<sup>no</sup> ± 0.10). Hamra date varieties had lowest moisture percentage among the selected varieties. Which indicates that, hamra date have low water content and could be good for long term storage compared to other cultivars. The low moisture content would not be more inclined to decay, since nourishments with high dampness substance are more inclined to perishability. It might be profitable in perspective of the specimen timeframe of realistic usability (Shaba *et al.*, 2015). However, Berhi had highest moisture content among the

evaluated varieties. Similarly, previous studies have been reported moisture content 10%- 25%. This indicates that, our results were in accordance with the previous studies (Rehman *et al.*, 2012; Al-Harrassi *et al.*, 2014). The ash content of the selected varieties was found to be in the range of 1.31% ± 0.09 - 2.50% ± 0.53. Ghnimi S *et al.*, 2017 reported ash content of date fruits in the range of 1.4 % - 2.3%. However, earlier studies reported ash content of various date fruits varieties ranging from 0.9 % - 2.0 % (Al-Harrasi *et al.*, 2014). This results was in agreement with our obtained quantification.

**Total protein and fat content:** Total protein content was determined and it was found that, among the tested sample Hamra date had highest amount of protein 4.34% ± 0.06. However, Roshodyyah had lowest amount of protein 2.29%<sup>a</sup> ± 0.04. Statistically it was found that, all the samples were significantly different at  $p < 0.05$ . High content of protein in hamra varieties suggest that, it could be of good potential for nutritional benefits. Moreover, earlier studies reported average protein content of fresh and dried dates is 1.50 - 2.14%, respectively (Kazi *et al.*, 2015). On the other hand our result showed that, tested samples had results ranging from 2.29-4.34. Our results were in accordance with previous studies (Al-Harrasi *et al.*, 2014). Fat content was found to be significantly different at  $p < 0.05$ . The fat content in several date fruits varieties ranged from 0.3% -0.6%. Similarly, previous studies reported percentage of fat in accordance with our results (Assirey 2015; Khalid *et al.*, 2016).

**Total fibre content:** Table 1 showed that, the percentage of total fibre was adequate and ranged from 4.39% - 5.13 %. Total fibre content for all the varieties of date fruits found to be significantly different at  $p < 0.05$ . However, Shebeby variety had significantly higher ( $p < 0.05$ ) than the other varieties. Moreover, Barni was significantly lower ( $p < 0.05$ ) than the rest of the selected varieties. Al-Harrasi 2014 reported average total fibre content in date fruits was 2.5%, this was lower than our reported values. This could be due to environmental as well as duration of fruits collection. On the other hand, few studies suggested that, the total average fiber could be from 5%- 8% (Nasir *et al.*, 2015).

**Total carbohydrate content and monosaccharide content:** Our result showed that, all the samples were significantly different at  $p < 0.05$  as presented in table 2. Moreover, highest carbohydrate contents were found in Hamra dates and were significantly higher ( $p < 0.05$ ) than the other varieties. In addition to that, Helwah dates had low amount of carbohydrates than rest of the varieties. On the other hand monosaccharide sugar was found to be highest in Helwah Hail followed by Deglet

Table 3. Mineral analysis of date fruits

Sample	Calcium (%)	Magnesium (%)	Sodium (%)	Potassium (%)
Nabtat Saif	0.0122i ± 0.00021	0.0051e ± 0.00012	0.0538 s ± 0.00100	0.72 n ± 0.013
Khlas	0.0102g ± 0.00021	0.0061f ± 0.00012	0.0355 m ± 0.00062	0.43 d ± 0.008
Hamra	0.0091 f ± 0.00015	0.0122 k± 0.00021	0.0517 r ± 0.00095	0.76 o ± 0.014
Ajwah	0.0182n ± 0.00032	0.0040 d ± 0.00006	0.0203 f ± 0.00038	0.53 g ± 0.009
Shaishi	0.0162m ± 0.00032	0.0020 b ± 0.00006	0.0172 d ± 0.00032	0.56 ij ± 0.010
Barni	0.0132j ± 0.00026	0.0030 c ± 0.00006	0.0385 o ± 0.00068	0.96 u ± 0.017
Sabbakah	0.0152l ± 0.00026	0.0030 c ± 0.00006	0.0172 d ± 0.00032	0.78 p ± 0.014
Seghae	0.0142k ± 0.00026	0.0061 f ± 0.00012	0.0182 e ± 0.00032	0.78 p ± 0.014
Roshodyyah	0.0122i ± 0.00021	0.0040 d ± 0.00006	0.0223 h ± 0.00042	0.53 gh ± 0.009
Nabtat Ali	0.0112 h± 0.00021	0.0071 g ± 0.00010	0.0436 u ± 0.00079	0.81q ± 0.014
Umm-Hamam	0.0091f ± 0.00015	0.0051 e ± 0.00012	0.0203 f ± 0.00038	0.40 c ± 0.007
Meskany	0.0091 f ± 0.00015	0.0020 b ± 0.00006	0.0213 g ± 0.00036	0.47 e ± 0.008
Rezazy	0.0142 k ± 0.00026	0.0020 b ± 0.00006	0.0406 p ± 0.00074	0.67 m ± 0.012
Asailah	0.0091f ± 0.00015	0.0152 l ± 0.00026	0.0294 k ± 0.00053	0.46 e ± 0.008
Gasbah	0.0061c ± 0.00012	0.0020 b ± 0.00006	0.0122 b ± 0.00021	0.19 a ± 0.003
Shaqraa	0.0071d ± 0.00010	0.0051 e ± 0.00012	0.0152 c ± 0.00026	0.55 i ± 0.010
Meneifi	0.0102g ± 0.00021	0.0030 c ± 0.00006	0.0152 c ± 0.00026	0.58 j ± 0.010
Sultanah	0.0081e ± 0.00015	0.0102 i ± 0.00021	0.0172 d ± 0.00032	0.52 g ± 0.009
Wannanah	0.0040b ± 0.00006	0.0061f ± 0.00012	0.0213 g ± 0.00036	0.48 e ± 0.009
Umm Kebar	0.0071d ± 0.00010	0.0061 f ± 0.00012	0.0203 f ± 0.00038	0.49 f ± 0.009
Dhaesyayah	0.0112h ± 0.00021	0.0010 a ± 0.00000	0.0385 o ± 0.00068	0.60 k ± 0.010
Helwah	0.0102g ± 0.00021	0.0030 c ± 0.00006	0.0284 j ± 0.00053	0.52 g ± 0.009
Helwah Hail	0.0152l ± 0.00026	0.0020 b ± 0.00006	0.0406 p ± 0.00074	0.70 n ± 0.013
Helwah Baqqa	0.0102g ± 0.00021	0.0020 b ± 0.00006	0.0254 i ± 0.00047	0.53 gh ± 0.009
Shebeby	0.0081e ± 0.00015	0.0071g ± 0.00010	0.0182 e ± 0.00032	0.55 hi ± 0.009
Umm-Khashab	0.0102g ± 0.00021	0.0102i ± 0.00021	0.0426 q ± 0.00079	0.41 c ± 0.007
Fankha	0.0030 a ± 0.00006	0.0081 h ± 0.00015	0.0294 k ± 0.00053	0.63 l ± 0.011
Berhi	0.0071d ± 0.00010	0.0122 k ± 0.00021	0.0375 n ± 0.00068	0.64 l ± 0.011
Maktoomy	0.0122 I ± 0.00021	0.0030 c ± 0.00006	0.0324 l ± 0.00059	0.53 g ± 0.009
Sukkari	0.0081e ± 0.00015	0.0081 h ± 0.00015	0.0294 k ± 0.00053	0.25 b ± 0.004
Deglet Shewaish	0.0091f ± 0.00015	0.0071 g ± 0.00010	0.0294 k ± 0.00053	0.47 e ± 0.008
Majhoolah	0.0102 g± 0.00021	0.0051e ± 0.00012	0.0112 a ± 0.00021	0.55 i ± 0.010

Shewaish dates 56.67% and 56.62%, respectively. High amount of monosaccharide sugar could be due to freshness of the sample. However, Majhoolah had 30.66% monosaccharide sugar, this was significantly lower ( $p < 0.05$ ) than the other varieties. Similarly, it was observed that, earlier reports suggested total carbohydrate content as well as monosaccharide sugar ranged from 50–70%, this was in accordance with our results (Al-Harrasi et al., 2014; Assirey, 2015; Khalid et al., 2016).

**Mineral Analysis:** Results of mineral analysis (calcium, magnesium, sodium and potassium) showed that, all the date varieties are rich source of minerals. Moreover, our result showed that, all the date varieties were signifi-

cantly different at  $p < 0.05$  as presented in table 3. In addition to that, we found that, calcium was highest in Ajwa dates, when compared with other selected varieties. However, Fankha dates had lowest calcium concentration 0.0030%. In case of magnesium, Asailah was found to have 0.0152% followed by lowest concentration of magnesium in Shaishi and some of the varieties of dates. Sodium was quantified highest in Nabtat Saif 0.0538% followed by 0.0122% in Gasbah dates. In addition to that, potassium was found to be highest in Barni dates 0.96%. Similarly, all the quantified minerals reported were in accordance with earlier studies (Nasir et al., 2015; Parvin et al., 2015; Shaba et al., 2015).

## CONCLUSION

Dates fruits are an extremely famous and oldest food known to human beings and it has been proven to contain high levels of carbohydrate, proteins, vitamins, crude fibers and essential minerals. Therefore, dates not only delicious with sweet taste and a fleshy mouth feel but also considered as an almost ideal food that provides a wide range of essential nutrients with many potential health benefits. Our study revealed baseline information on different date varieties grown in Hail region of Saudi Arabia. The results showed that, ash and protein content was highest in Ajwah ( $2.50 \pm 0.53$ ) and Hamra ( $4.34 \pm 0.06$ ) dates, respectively. Similarly, monosaccharides sugar content was found highest in Helwah Hail and Deglet Shewaish. Mineral analysis showed that Ajwah date fruits, Asilah, Nabtat Saif and Barni had high amount of calcium, magnesium, sodium and potassium respectively. However, lesser known varieties grown in this region can be improved through better horticulture practices as a valuable product and results obtained from the investigation in this study may help in expanding the utilization of these date palm varieties for commercial gain.

## ACKNOWLEDGEMENTS

This work was supported by Sheikh Ali Al-Jumaiah Chair for Sustainable Development in Agricultural Communities, University of Hail, Saudi Arabia.

## CONFLICT OF INTEREST

The authors do not have any conflict of interest.

## REFERENCES

- AOAC (Association of Official Analytical Chemists) (2006). Official Methods of Analysis, 18th edn. (Gaithersburg, S. edn). AOAC Press, Washington DC., USA.
- Al-Abdoulhadi, I.A., Al-Ali, S., Khurshid K., Al-Shryda F., Al-Jabr A.M., Abdallah A.B. (2011). Assessing fruit characteristics to standardize quality norms in date cultivars of Saudi Arabia. *Indian Journal of Science and Technology*. 4(10):1262-1266.
- Assirey E.A.R. (2015). Nutritional composition of fruit of 10 date palm, (*Phoenix dactylifera* L.) cultivars grown in Saudi Arabia. *Journal of Taibah University for Science* 9:75-79.
- Allbed, A., Kumar, L., and Shabani, F. (2017). Climate change impacts on date palm cultivation in Saudi Arabia. *Journal of Agricultural Science*. 1-16. doi:10.1017/S0021859617000260.
- Al-Shreed, F., Al-Jamal, M., Al-Abbad, A., Al-Elaiw, Z., Abdallah A. B., and Belaifa, H. (2012). A study on the export of Saudi Arabian dates in the global markets. *Journal of Development and Agricultural Economics*. 4(9):268-274.
- Al-Harrasi, A., Rehman, N., Hussain, J., Khan, A. L. Al-Rawahi, A. Gilani, S. A., Ali, L. (2014). Nutritional assessment and antioxidant analysis of 22 date palm (*Phoenix dactylifera*) varieties growing in Sultanate of Oman. *Asian Pacific Journal of Tropical Medicine*. (Suppl 1): S591-S598.
- Aldjain, I.M., Al-Whaibi, M. H., Al-Showiman, S. S. & Siddiqui, M. H. (2011). Determination of heavy metals in the fruit of date palm growing at different locations of Riyadh. *Saudi Journal of Biological Sciences*. 18:175-180. doi:10.1016/j.sjbs.2010.12.001.
- Al-Hazaa, H. M., Abahussain, N. A. Al-Sobayel, H.I., Qahwaji, D. M., and MUSAIGER, A.O. (2012). Life style factors associated with overweight and obesity among Saudi adolescents. *Public Health*. 12: 354.
- Ahamad S. R., Al-Ghadeer, A. R., Ali, R., Qamar, W., Aljarboa, S. (2016). Analysis of inorganic and organic constituents of myrrh resin by GC-MS and ICP-MS: An emphasis on medicinal assets. *Saudi Pharmaceutical Journal*. 25: 788-794.
- Bashir, A., Ashraf, S.A., Khan M. A., and Azad, Z.R.A.A. (2015). Development and compositional analysis of protein enriched soybean-pea-wheat flour blended cookies. *Asian Journal of Clinical Nutrition*. 7: 76-83.
- Chandrasekaran, M., Bahkali, H. A. (2013). Valorization of date palm (*Phoenix dactylifera*) fruit processing by-products and wastes using bioprocess technology – Review. *Saudi Journal of Biological Sciences*. 20:105-120.
- Hamad, I., AbdElgawad, H., Al Jaouni S., Zinta G., Asard, H., Hassan, S., Hegab, M., Hagagy N., and Selim, S. (2015). Metabolic analysis of various date palm fruit (*Phoenix dactylifera* L.) cultivars from Saudi Arabia to assess their nutritional quality. *Molecules*. 20:13620-13641. doi:10.3390/molecules200813620.
- Ghnimi, S., Umer, S., Karim, A., Kamal-Eldin, A. (2017). Date fruit (*Phoenix dactylifera* L.): An underutilized food seeking industrial valorization. *NFS Journal* 6:1-10.
- Khalid, S., Ahmad, A., Masud, T., Asad, M. J., and Sandhu, M. (2016). Nutritional assessment of Ajwa date flesh and pits in comparison to local varieties. *The Journal of Animal & Plant Sciences*. 26(4):1072-1080.
- Nasir, M. U., Hussain, S., Jabbar, S., Rashid, F., Khalid, N., Mehmood, A. (2015). A review on the nutritional content, functional properties and medicinal potential of dates. *Science Letters*. 3(1):17-22.
- Parvin, S., Easmin, D., Sheikh, A., Biswas, M., Jahan, M. G. S., Islam, M. A., Shovon, M.S. (2015). Nutritional analysis of date fruits (*Phoenix dactylifera* L.) in perspective of Bangladesh. *American Journal of Life Sciences*. 3(4): 274-278.
- Rehman Z, Salariya A.M, Zafar, S.I. (2012). Effect of processing on available carbohydrate content and starch digestibility of kidney beans (*Phaseolus vulgaris* L.). *Food Chemistry*. 73:351-355.

Shaba, E. Y., Ndamitso, M. M., Mathew, J. T., Etsunyakpa, M. B., Tsado, A. N., and Muhammad, S. S. (2015). Nutritional and anti-nutritional composition of date palm (*Phoenix dactylifera* L.) fruits sold in major markets of Minna Niger State, Nigeria. *African Journal of pure and applied Chemistry*. 9 (8): 167-174.

Taha, K.K., and Al Ghahtani F.M. (2015). Determination of the elemental contents of date palm (*Phoenix dactylifera* L.) from Kharj Saudi Arabia. *World Scientific News*. 6: 125-135.

Vayalil PK. (2012). Date fruits (*Phoenix dactylifera* Linn.): an emerging medicinal food. *Critical Review of Food Science and Nutrition*. 52: 249-271.