wjpmr, 2022,8(7), 60-66

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

ESTIMATION OF CHEMICAL COMPOSITION AND MINERAL ELEMENTS IN VARIOUS TYPES OF LIBYAN DATES

Ismail A. Ajaj[1], Aziza Abdaljalil Mohamed[2], Manal F. AbuNwara[1], Rafall Mohamed Atya[3] and Wafa Khalleefah Amhimmid[4]*

[1]Chemistry Department, Alasmarya University, Zliten, Libya.
[2]Chemistry Department, Sebha University, Sebha, Libya.
[3]Chemistry Department, Misurata University, Misurata, Libya.
[4]Chemistry Department, Azzaytuna University, Tarhuna, Libya.

***Corresponding Author: Wafa Khalleefah Amhimmid**

Chemistry Department, Azzaytuna University, Tarhuna, Libya.

Article Received on 15/05/2022 **Article Revised on 05/06/2022** **Article Accepted on 26/06/2022**

ABSTRACT

The concentration of some mineral elements in various Libyan dates (Ami, Tabuni, Bakrari, Amftiti, and Al-Fazani) was estimated to be higher than the limits of the Libyan standards, which specified that the moisture content should not exceed 26%, with the exception of the Bakrari dates, which were within the Libyan standards of (3690-4212 ppm), followed by magnesium at concentrations ranging from (690- 870 ppm), calcium ranging from (207- 688 ppm), sodium at (68-112 ppm), iron at (24.9- 37.9 ppm), and copper and chromium with concentrations ranging from (3.93–5 ppm) and (0.31-0.51 ppm) respectively. As for lead, its concentration in the studied samples was less than the device's detection limits.

KEYWORDS: Palm tree, Dates, Chemical Composition, Mineral Elements.

INTRODUCTION

The palm tree is considered a perennial tree, and there are many varieties around the world, up to nearly 2000 varieties[1], with Libya alone having 392 varieties. Libya's production of dates is estimated to be around 153 million tons, the southern regions are considered to be the most productive areas for dates, particularly dry varieties.[2]

Dates are excellent sources of key nutrients such as sugars, organic acids, fats, proteins, dietary fiber, vitamins, etc.[3] Dates also contain significant amounts of minerals such as calcium, potassium, iron, magnesium, copper, phosphorus, zinc, selenium, fluorine, sulfur, cobalt, manganese, and boron.[4] It is regarded as the phosphorus-richest fruit.[5] The proportion of mineral elements in the weight of dry palm dates is about 2 to 3%.[6] 100g of dates, or approximately 7 dates, were found to contain enough magnesium, manganese, copper, and sulfur for the human body's daily needs, as well as a quarter of its calcium, potassium, and half of its iron needs, as well as a high concentration of phenols and antioxidants that protect against cancer.[7]

Researchers intensively study the chemical composition of dates where (Al-Hooti et al. 1992) studied the content of mineral elements in dates during their development stages and found that the content of potassium, magnesium, calcium, phosphorus, zinc, and sodium continues to decline during their growth stages until it reaches its lowest level in the date phase.[8]

A study conducted on five varieties of dates in Misrata, Libya, also showed that the concentration of lead in one of the dates samples was 0.18 ppm, which is considered higher than the limit allowed according to the world food standards, which is 0.1 ppm, and Libyan standard specifications, Parchment 594 for 2009, on the maximum lead limits in food and drinking water.[9] The aim of this study is to estimate the concentration of some mineral elements and to know the extent to which the mineral content varies in some local date varieties in order to compare them and to determine the best types of these varieties to study, as well as to determine the humidity to see the extent to which the date types under study are tolerant of conservation and storage.

EXPERIMENTAL

Collection of Samples

Five types of date samples were collected from a local market in Zliten, Libya. These samples are locally produced in Zliten; namely: Ami, Tabuni, Bakrari, Amftiti, and Al-Fazani. Mature and high-quality dates were selected and cleaned from dust and suspended impurities and kept refrigerated until use.

Estimate the percentage of moisture in dates

Estimation of the moisture in dates

The moisture content was estimated as stated in (AOAC 1990),[10] in which 30g of each "deseeded" sample under study was weighed in a dry crucible, then placed in a drying oven at (115°C) until the weight stabilized, then placed in a dryer for 15 minutes to cool, then weighed and calculated humidity after the stability of weight.

$$Humidity\ \% = \frac{\text{sample Initial weight} - \text{dry sample weight}}{\text{sample inatial weight}}\ x\ 100 \quad \text{Eq (1)}$$

Estimation of the seed-to-date ratio

The weight of a random sample of 10 fruits was assigned to the ratio of the seeds to the fruit of dates, by and then separated the seeds from the dates, according to the weight of the seeds of the same samples, the process applies to the five types of dates, to determine the ratio of the seeds to the fruit of dates.

$$yeild\ \% = \frac{\text{mass of 10 date seeds}}{\text{mass of 10 dates}}\ x\ 100 \quad Eq\ (2)$$

Estimation of organic and inorganic matter

The organic and inorganic matter were estimated according to (Gayba, 2015) method,[11] which involved weighing 15g of each sample in a ceramic crucible and heating it in oven at 550°C. The ceramic crucible is then placed in a dryer (Desiccator) for half an hour before being weighed, this weight represents the total weight of the crucible in addition to the ash of the sample (inorganic or mineral material), from which the weight of the organic material is derived.

$$Inorganic\ Matter\ \% = \frac{\text{inorganic matter weight}}{\text{date weight}}\ x\ 100 \quad Eq\ (3)$$

$$Organic\ Matter\ \% = \frac{\text{date weight} - inorganic\ matter\ weight}{\text{date weight}}\ x\ 100 \quad Eq\ (4)$$

Estimation of protein

The protein was estimated using Kjeldahl method, by weighing 2g from each sample under study, then adding 10 ml of sulphuric acid (5M) and 1g of mixture (Copper sulfate and sodium sulfate), then heating at (120 ºC) in the hood until the fumes stopped mounting, then adding 15 ml of sodium hydroxide solution (40%), after the distillation process is complete, two drops of red methyl were added , and it was calibrated with hydrochloric acid 1M. the protein was calculated by multiplying nitrogen content by 6.25, where nitrogen accounts for about 16% of protein weight.

Estimate the fat ratio

To estimate the fat using the method of (Abdullah et al, 2002)[12], 5g of each sample under study were weighed, extracted by petroleum ether in a Soxhlet device for 24 hr. heated until the solvent evaporation was complete, placed in a dryer for 20 minutes, weighed, and the fat ratio was calculated.

$$Fat\ \% = \frac{\text{fat weight}}{\text{sample weight}}\ x\ 100 \quad Eq\ (5)$$

Where the weight of fat = the weight of the flask with the ether extract of fat - the weight of the flask empty.

Estimation of Fibers

The fibers in dates were estimated using the method described in (AOAC 1990), in which 3g of each sample under study was weighed in 250 ml beaker, 200 ml of sodium hydroxide (0.3 N) was added, heated to boiling, then left at room temperature for 30 minutes, filtered, and washed with 200 ml of sulphuric acid (2M), then heated for 45 minutes, filtered, and washed with sodium hydroxide solution (0.3 N), followed by hot water, then with ethanol. The residue was dried, weighed, then transferred to a dry crucible and placed in the burning oven at 500oC for two hours. The crucible was then placed in a dryer to cool and weigh, and the fiber ratio was calculated.

$$Fiber\ \% = \frac{\text{fiber weight}}{\text{sample weight}}\ x\ 100 \quad Eq\ (6)$$

Estimation of Total Sugars

Total sugars in date samples was calculated according to (Chema et al, 2010)[1] as follows:

Total sugars = 100 - (total percentage of protein, fat, fiber and ash) Eq (7)

Estimation of Reducing Sugar

By using (Abdullah et al., 2002) method[12], in which 5g of each sample was weighed in 100 ml flask completed with distilled water, then placed in a water bath for 30 minutes, filtered, and transferred to another 250 ml flask, and completed with distilled water. 50 ml of the prepared solution was transferred to 100 ml flask and complete with distilled water, the burette then filled with the diluted solution, 15 ml of the solution was transferred to a conical flask, and 12.5 ml of Fehling A solution and 12.5 ml of Fehling B solution were added, turning the solution to blue, then the flask was heated on the flame until the color turned " red", two drops of blue methyl were added, and recorded the reading, The percentage of reducing sugars was calculated.

Estimation of non-reducing sugars

Non-reducing sugars theoretically calculated the result as following:

Non-reducing sugars = total sugars - reduced sugars Eq (8)

Estimation of some mineral element concentrations

The concentration of some minerals in the studied dates was estimated in ppm units according to the method (Gyaba, 2015) with some modifications, where sodium, potassium, calcium, and magnesium were estimated in each extract using a flame photometer, while heavy metals chrome, iron, copper and lead were estimated by flame atomic absorption spectrometry.

RESULTS AND DISCUSSION

Through the results of the chemical analyses obtained in this study for five varieties of local dates (Ami, Tabuni,

Bakrari, Amftiti, and Al-Fazani) where the percentage of seeds, humidity, and nutritional content were estimated and discussed as follows:

Humidity in date samples

Table 1: Humidity in date samples.

Date Type	Amftiti	Bakrari	Tabuni	Ami	Al-Fazani
Dry Wight	18.06	23.04	20.37	16.48	19.65
Humidity%	39.8	23.2	32.1	45.06	34.5

According to the results shown in table (1) and figure (1), the humidity of the dates samples, with the exception of Bakrari, was higher than the Libyan standard specifications, which stated that the humidity should not exceed 26%.

These findings were similar to (Abdessalem et al., 2008) study[13], which found humidity ranging from14 ~ 47%, and differed from (Rania., 2014) study[14], which found humidity ranging 8.78 to 10.68%, which is low compared to the current study results.

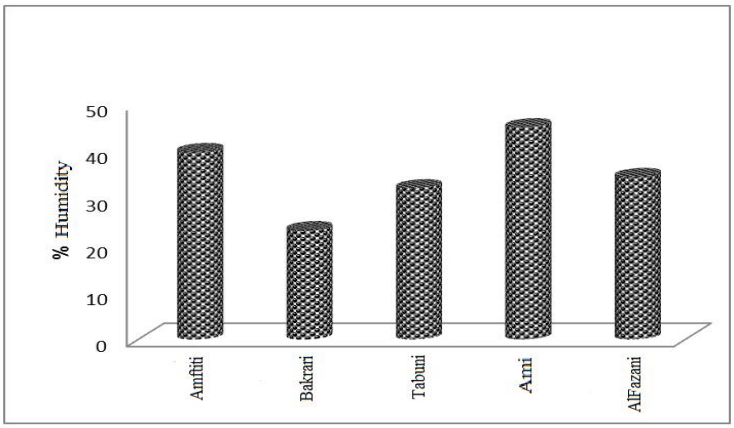

Figure 1: Percentage of moisture in date samples.

Seed-to-date ratio

The ratio of seeds to dates in the five varieties is similar, as shown in table (2) and figure (2), with the exception of the Ami, which has the highest percentage of 15.32% These findings are similar to those of (Ezri., 2013)[15], who discovered that the seed – to- date ratio ranged from 11,431% to 21.02%.

We conclude from previous results that the ratio of seed to dates in the Amftiti type is only 10.051%, indicating that the amount of dates meat is greater compared to other varieties studied, i.e. the Amftiti type has the greatest economic benefit in terms of quantity, whereas the Ami type has the weakest and lowest percentage of date meat because the ratio of seed to dates is greater than 15%.

Table 2: The ratio of seed to dates.

Date Type	Total Wt. (g)	Seed Wt. (g)	Seed %
Amftiti,	164.053	16.49	10.051
Bakrari	98.059	12.023	12.26
Tabuni	125.428	14.398	11.479
Ami	105.953	12.023	15.32
Al-Fazani	119.775	15.48	12.924

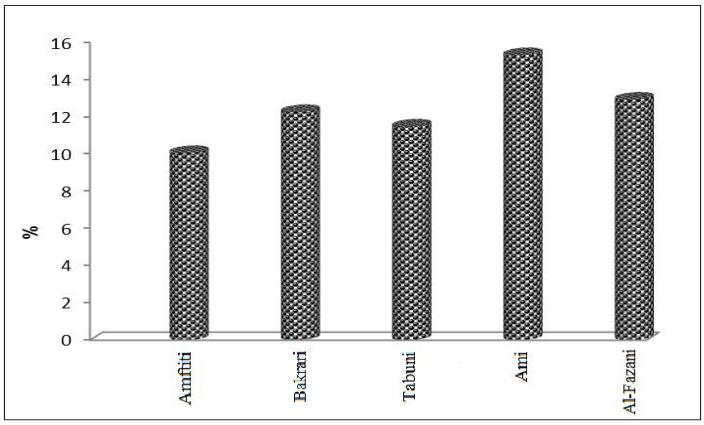

Figure (2): the ratio of seed to dates.

Estimate the amount of organic and inorganic matter

According to the results shown in table (3) and figure (3) that the proportion of organic matter is much higher than that of inorganic (minerals), and varies from type to type, with Ami having the highest at 91.733%, and Bakrari having the lowest at 88.066%. On the other hand, small percentages of inorganic matter were found, ranging from 8.26% to 11.93.

These findings are consistent with (Gyaba, 2015), which found that the proportion of inorganic matters ranges from 1.888% to 15,106%, and the current study's findings differed from (chema et al., 2010), which found that the proportion of inorganic matter ranges from 1.73% to 2.59%, and this difference can be explained by the variation in the proportion of minerals in the soil from one region to another.

Table 3: Percentage of organic matter and inorganic material samples of dates studied.

Date Type	Organic Matter (g)	Inorganic Matter (g)	Organic Matter %	Inorganic Matter %
Amftiti,	13.327	1.673	88.846	11.153
Bakrari	13.21	1.79	88.066	11.93
Tabuni	13.44	1.56	89.60	10.40
Ami	13.76	1.24	91.733	8.26
Al-Fazani	13.54	1.673	90.266	9.73

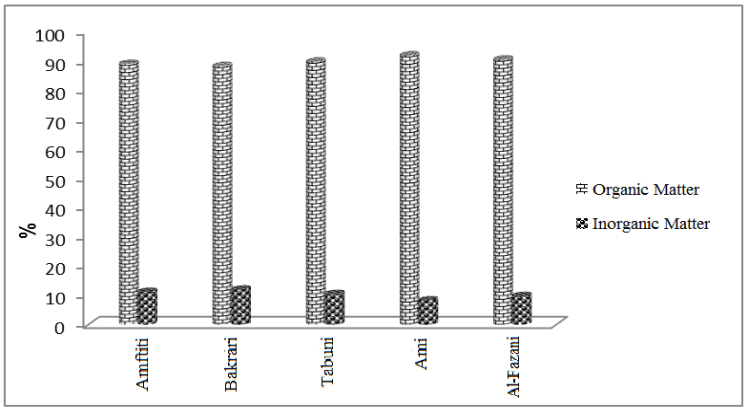

Figure 3: Percentage of organic and inorganic matter in dates samples studied.

Percentage of protein, fat, sugars and fiber in studied date samples

According to the results shown in table 4, sugars are the highest percentage of the main nutrients found in dates, while fiber and protein were low and somewhat close, and fat was the lowest.

Table 4: Percentage of protein, fat, fiber and sugars in the types of fruit studied:

Date Type	Protein %	Fats %	Fibers %	Total Sugar %	Reduced Sugar%	Non-Reduced Sugar%
Amftiti,	0.90	0.68	2.67	84.597	50.2	34.397
Bakrari	1.41	0.21	1.33	85.12	61.219	23.9
Tabuni	2.33	0.20	1.66	85.41	57.045	28.365
Ami	2.19	0.32	2.0	87.23	62.75	24.48
Al-Fazani	1.26	0.72	2.0	86.29	43.27	43.02

From figure 4, the protein ratio in dates samples varies, with Al Tabouni having the highest at 2.33%, Ami having 2.19%, Al-Fazani having 1.26%, and the lowest Amftiti at 0.90%. This is consistent with the findings of (chema et al., 2010), where the ratios were between (0.46 and 2.85%). Also consistent with (Abdel Moneim, 2012)[16], where protein ratio ranged from (1.86 to 3.723%), while (Aribi,2018) found in his study on the dom palm dates in Iraq that the protein ratio (6.135%).[17]

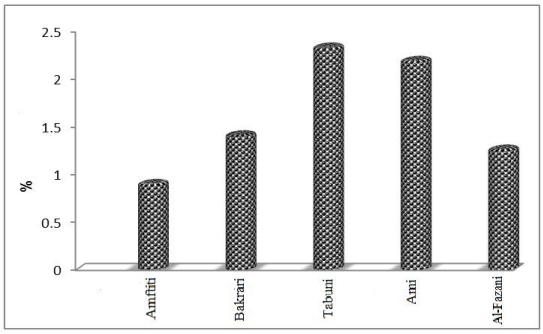

Figure 4: Percentage of protein in date samples.

From the figure (5), the percentage of fats in date samples varies, with the highest being 0.72% in Al-Fazani dates, and the lowest being 0.20% in Tabuni dates, as shown in table (4).

These ratios are consistent with the findings of (Eman. A, 2015)[18], where the fat ratio ranged from 0.12 to 0.72%. It is similar to the findings of the (Abdel Moneim., 2012) study, where the fat content ranged from 0.32 to 0.33%.

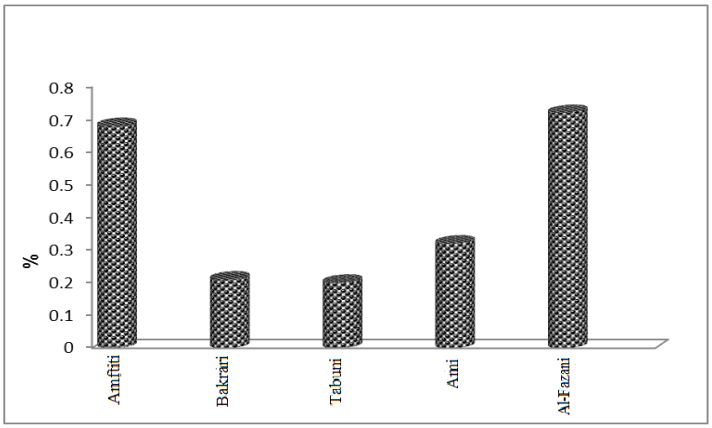

Figure 5: Percentage of fat in date samples.

Table 4 showed that the percentage of fiber in dates ranged from 1.33% to 2.67%, the highest in Amftiti and the lowest was in the Bakrari type. as shown in figure 6. Comparing these results with the results of the(Ahmad et al., 2014)[19] conducted on 22 types of dates in Oman, which found that the fiber ratio ranged from 1.0 to 2.5%, the results were significantly similar.

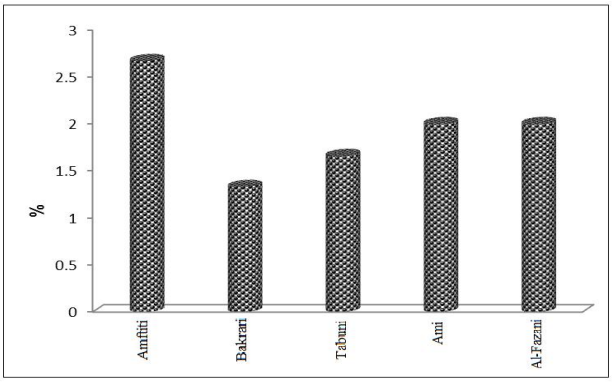

Figure 6 shows the percentage of fibers in the date samples.

Through the results of table 4 and figure (7), there are similar values for total sugar ratio with a difference in the proportions of reduced and non-reduced sugars, where the total sugar ratio ranges from 84.597% to 87.23%. The highest percentage of total sugars was in Ami dates, and the lowest was in the Amftiti. This is consistent with each of the studies conducted by (Chema et al. 2010), where the percentage of total sugars ranged from 77.31% to 88.02%, and (Gasim., 1994), where the total sugar content ranged from 75.2% to 84.2%.[20]

Reduced sugars range from 43.27% to 62.75%, with the highest percentage of sugars reduced in Ami dates and the lowest in Al-Fazani dates for reduced sugars, while non-reduced sugars range from 23.9% (in Bakrari) to 43.02% (in Al-Fazani) as shown in the figure (7). These results are close to those obtained by (Abdessalem et al. 2008), where the proportion of reduced sugars ranged from 26% to 51%, while (Eman.A 2015) study showed that the proportion of reduced sugars ranged from 68.2% to 78.3%, which is higher than the results obtained in the current study.

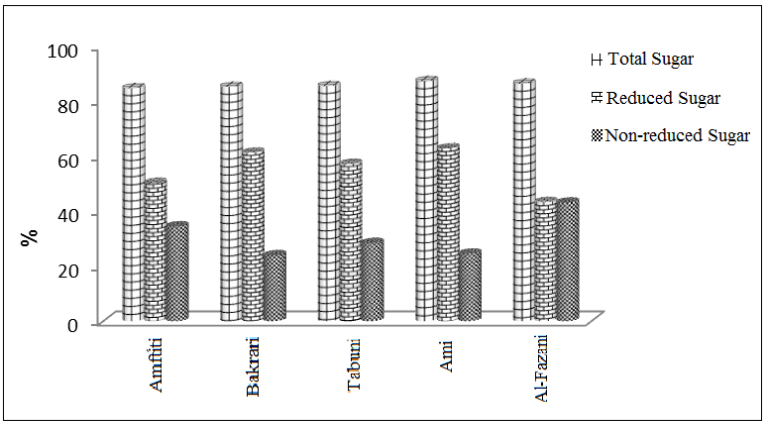

Figure 7: Percentage of total sugars and reduced and Non- reduced sugars in date samples.

Concentration of some elements in studied date samples

Table 5: Concentration of some elements in date samples studied in standard deviation units.

Date Type	K	Na	Ca	Mg	Cr	Fe	Cu	Pb
Amftiti,	4186±50	73.67±0.33	264±7	870±4	0.51±0.005	27.7±1	3.93±0.13	*
Bakrari	3850±35	100±0.36	311±2	690±3	0.31±0.002	28±0.5	5±0.39	*
Tabuni	3802±90	68.33±0.33	688±4	765±7	0.45±0.05	37.7±0.1	4.9±0.36	*
Ami	3601±70	112±0.56	538±2	738±5	0.50±0.01	28.1±2	4.11±0.33	*
Al-Fazani	4212±70	78±0.77	207±3	86.29	0.43±0.001	24.9±0.5	4.71±0.26	*

(*) Value means less than device detection limits

Through table 5, the most abundant element is potassium ranging from 3690 and 4212 ppm, followed by magnesium at concentration ranging from 690 to 870 ppm, then calcium 207ppm to 688 ppm then sodium ppm68 to ppm 68 112, followed by iron ppm 24.9 to ppm37.9, then copper and chromium with concentrations ranging from (ppm 3.93-5) to (ppm 0.31-0.51) respectively, while for lead, its concentration in the samples studied was below the detection limits of the device.

Comparing the results of this study with a study carried out by (Al-Jarushi., 2021), where the concentration of potassium ranged between 2146.1 and 3393 ppm, sodium at 17 to 69 ppm, calcium between 24 to 64 ppm, and magnesium concentration ranged between 69 and 115.3 ppm, And while the concentrations of potassium, iron, and copper were close to the results of the current study, the concentrations of sodium, calcium, and magnesium were lower, and while the concentration of lead in the samples studied was below detection limits, (Al-Jarushi, 2021), two types of dates contained lead, one with a concentration of 0.1 ppm and the other 0.64 ppm, which is considered to be in excess of the limit allowed according to the world food standards (ppm0.1) and Libyan standard specifications No. 594-2009.[9]

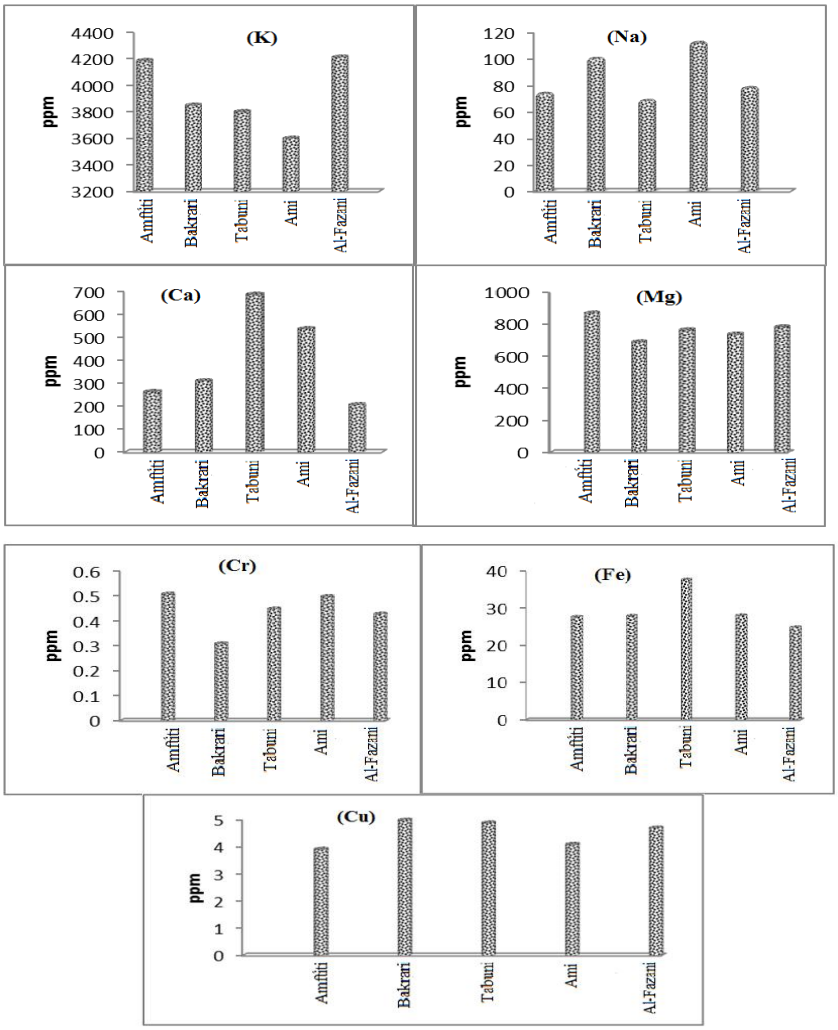

Figure 8: Concentration of metals in date samples.

CONCLUSIONS

Based on the previous findings, the dates studied contained high levels of humidity, as the importance of estimating moisture lies in knowing how to deal with food during conservation and storage, as well as for ash, which is a clear guide to knowledge of the content of food minerals, We conclude that the dates' fruits contain high and close percentages of total sugars, with a difference in the percentage of reduced and Nun-reduced sugars, with the highest percentage of total sugars for the Ami dates being 87.23%, the lowest being Amftiti at 84.597%. As the results showed that the percentage of both proteins and fats was low in all varieties, The study found that the types studied were a good source of mineral elements, with potassium being the dominant ingredient in all varieties, followed by magnesium. Lead was below detection limits in all samples, and the difference in mineral content between these varieties could be due to different agricultural areas.

REFERENCES

1. Chema, B., Souhail, B., Christophe, B., Manel, M., Rochdi, B. and Hamadi, A Chemical properties of 11 date cultivars and their corresponding fiber extracts. African Journal of Biotechnology, 2010; 9(26): 4096-4105.
2. Saidi, Abu Qasim Amer, Abdul Rahim, Abu Azum Al-Lafi Agricultural Policies and their impact on the development of date productivity in southern Libya from, 2017; 2012 to 2016.
3. Ghulam Sarwar Markhand, Adel A. Abul-Soad, Ameer Ahmed Mirbahar and Nisar Ahmed Kanhar Fruit characterization of Pakistani dates, 2010; 42(6): 3715-3722.
4. Reem A. Al-Alawi, Jawhara H. Al-Mashiqri, Jawaher S. M. Al-Nadabi, Badria I. Al-Shihi and Younis Baqi Date Palm Tree (Phoenix dactylifera L.): Natural Products and Therapeutic Options, 2017.
5. Ahmed, Arwa Abdul Rahman miracle dates in healing and preventing harmful microbes and nurses. 10th World Conference on Scientific Miracles in the Qur'an and Sunnah, 2018; 160-186.
6. Frankel, E. N. Lipid Oxidation. Pray. Lipid Res., 1980; 19: 1-22. Pergamon Press Ltd Printed in Great Britain.
7. Hassan, Basma Kazaz The economic importance of the date industry and the possibilities of developing its exports in Basra province, 2016.
8. Al-Hooti, S., Sidhu, J. S., & Qabazard, H. Physicochemical characteristics of five date fruit cultivars grown in the United Arab Emirates. *Plant Foods for Human Nutrition*, 1997; *50*(2): 101-113.
9. Al-Jarushi, Amal Mohammed compared the physical, chemical and nutritional content characteristics of some local dates. Master's degree at the Graduate Academy of Misrata University, 2021.
10. Association of Official Analytical Chemists Official methods of analysis of AOAC international. 15th ed. Washington D.C.: Association of Official Analytical Chemists, 1990.
11. Ghiaba, Zainab Haram Mwali analytical study of pesticides, phnolats and other ingredients for some local date palm varieties. A doctoral thesis at The University of Qasdi Marbah warjla, 2015.
12. Abdullah, Mohammed Amin, Al-Qalyubi, Mamdouh Helmi, Khalaf, Mohammed Magdi Mustafa Chemistry of Food Analysis scientific foundations and their applications, Dar Al Shorouk magazine first edition, 2002.
13. Abdessalem Mrabet, Ali Ferchichi, Nizar Chaira, Ben Salah Mohamed Physico-Chemical characteristics and total quality of Date Palm varities grown in Southern of Tunisia.Pakistan Journal of biological Science, 2008; 11(7): 1003-1008.
14. Rania, M. A., Aisha, S. M., Mohamed, M. El. And Isam, A. M. Chemical composition, antioxidant capacity, and mineral extractability of Sudanese date palm (Phoenix dactylifera L.) fruits. Food Science & Nutrition, 2014; 2(5): 478–489.
15. Ezri, Khadra Study of libedat and phenols in some types of local dates. Master's degree at The University of Wargla, Faculty of Science, Technology and Subject Sciences in Algeria, 2013.
16. Abdel Moneim, E. S., Itimad, A. A., and Awad, M. A. Comparative Study on Five Sudanese Date (Phoenix dactylifera L.) Fruit Cultivars. Food and Nutrition Sciences, 2012; 3: 1245-1251.
17. Aribi, Maryam Abdel Bari Study of the chemical properties of the fruit of palm dom and extract pectin and study its physical and chemical properties, 2018; 17: 1-2.
18. Eman, A. A. Nutritional composition of fruit of 10 date palm (Phoenix dactylifera L.) cultivars grown in Saudi Arabia. Journal of Taibah University for Science, 2015; 9: 75–79.
19. Ahmad, A., Najeeb, U. R., Javid, H., Abdul Latif, K., Ahmed, A., Syed, A.G., Mohammed, A .and Liaqat, A. Nutritional assessment and antioxidant analysis of 22 date palm (Phoenix dactylifera) varieties growing in Sultanate of Oman. Asian Pacific Journal of Tropical Medicine, 2014; 7(1): 591-598.
20. Gasim, A. A. Changes in Sugar Quality and Mineral Elements During Fruit Development in Five Date Palm Cultivars in AI-Madinah AIMunawwarah. Journal of King Abdulaziz University-Science, 1994; 6: 29-36.