



ESTIMATION OF IRON, POTASSIUM AND LEAD IN DATE FRUIT

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Abstract

Date palm (*Phoenix dactylifera*) fruit are an major nutritional source in Iraq and many other countries. Essential nutrients, including sugars, proteins, fibers, trace elements, etc. can all be found in date fruit. Three types of date (burhi, tabrizi and zahdi) were collected from different sites in Baghdad from July to October 2017 in order to analyze the elemental contents present, to be able to obtain a picture of the impact dates has on human health and to be able to compare the nutritional value among different types of date. The selected types were washed then digested, the concentration of iron, potassium and lead were analyzed using atomic absorption spectroscopy and flame photometry.

Keywords: *Phoenix dactylifera*, Atomic absorption, spectrometry (AAS), Flame photometry

Introduction

Date palm tree (*Phoenix dactylifera* L.) known as Nakl in Arabic is one of the most important food sources in middle-east and northern African regions (Zohary *et al.*, 2000) It belongs to the Palmae (Arecaceae) family (Barreveld WH 2015), The name pheonix is greek in origin meaning purple or red while *dactylifera* means “finger-bearing” which is thought to be inspired by the fruit clusters produced by the plant. *Dactylifera* is a combination of the Greek word *dactylus*, which means “finger,” and the Latin word *ferous*, that mean “bearing” (Ashraf *et al.*, 2011).

Dates grow in dry, hot areas and can generally withstand difficult environmental conditions. One old saying describes the date palm as growing with “its feet in the water and its head in the fire.” These conditions are usually found in middle-eastern countries. (Zaid, 2002).

Many research studies have shown that date fruit have many preventative and therapeutic effects as well as major nutritional importance. these studies have describe that date fruit possess an antioxidant activity (Vayalil, 2002), This activity of *P. dactylifera* may be due to their total phenolic content, flavonoids, vitamins C, A and E and β -carotene and GSH (Borochoy-Neori *et al.*, 2015), anticancer (Eid N *et al.*, 2014) due to its polyphenolic and β -glucan contents (Ishurd *et al.*, 2005). Date fruit also exhibit hepato-protective (Al-Qarawi A *et al.*, 2004), nephro-protective (Saafi-Ben SEB *et al.*, 2012), gastrointestinal- protective (Al-Qarawi AA 2005), antimicrobial (Shraideh ZA *et al.*, 1998; Sallal *et al.*, 1989) and anti-hyperlipidimic (Abuelgassim AO 2010) activity.

Date fruits are also rich in macro-elements e.g. Calcium, phosphorus, sodium and potassium as well as micro elements e.g iron, copper, cobalt, potassium, magnesium, iodine, zinc, manganese, molybdenum, fluoride, chromium, selenium and sulfur. (Eruvbetine, 2003) while others such as lead and cadmium are considered trace elements.

This study will focus on three elements Iron [Fe], potassium [K] and Lead [Pb], determining their concentration then comparing the results to the daily nutritional requirements for those selected elements thus providing us with a glimpse of the nutritional benefits of date palm fruit.

Iron is a biologically essential element for every living organism (Lieu PT *et al.*, 2001), it plays a major role in the formation of oxygen-transporting protein, particularly hemoglobin and myoglobin, and in many iron-containing

enzymes that play a role in the oxidation-reduction processes throughout the body. (Hurrell, 1997; Gupta, 2014).

Potassium is an essential element. It is the most widely found cation in intracellular fluid, where it plays a key role in maintaining cell function, particularly in excitable cells such as muscles and nerves. It is essential for cardiac-functions as well skeletal and smooth muscle contraction (Weaver and Tietz, 1987).

Lead is considered a dangerous pollutants whose levels should be monitored in all the consumed products, high lead concentration are considered toxic and can lead to major health problems (Jarup, 2003, Kennish, 1992).

Materials and Methods

Equipment

- 1- SHIMADZU double beam UV-visible spectrophotometer model (UV-1650PC) 160 digital equipped with a computer via SHIMADZU UV probe data system program (version1.10) and using 1cm quartz-cells.
- 2- GENWAY PEP7 flame photometer with butane as fuel and air as an oxidant.

Chemicals and reagents

- 1- Deionized distal water DDW
- 2- Concentrated nitric acid
- 3- Perchloric acid
- 4- Hydrogen peroxide

1- Sample collection

Date palm fruits were collected at tamar stage (dry ripe dates) for three different types (tabrizi, burhi, and zahdi) from different sites of Baghdad from July to October 2017.

2- Sample preparation

The samples were first weighed, 5g of date at tamar stage were washed with three times with DDW and the residues were collected from which one gram was placed in a beaker and 10 ml solution that contains one part perchloric acid and two parts nitric acid was added.

The resulting samples were then put at approximately 90c for 40-50 minutes after the temperature was increased to

150c at which the samples began to boil and continued to do so for 2-3 hrs. At this point the sample was a clear solution.

A solution consisting of a combination of nitric acid, perchloric acid and hydrogen peroxide was prepared and added to the sample a couple of times until the volume of the sample was reduced to about 1ml, after cooling the sample 5 ml of 1% HNO₃ was added and the resulting solution was filtered then the volume was completed with deionized distal water using a 25 ml volumetric flask (Saudi Journal of Biological Sciences 2011).

3- Sample analysis

A series of dilution solutions was prepared and analysis of potassium was done using the flame photometer, while iron and lead were analyzed using UV-spectrophotometer. A calibration curve was drawn using the data obtained, this plot was used to measure the concentration of the elements.

Results and Discussion

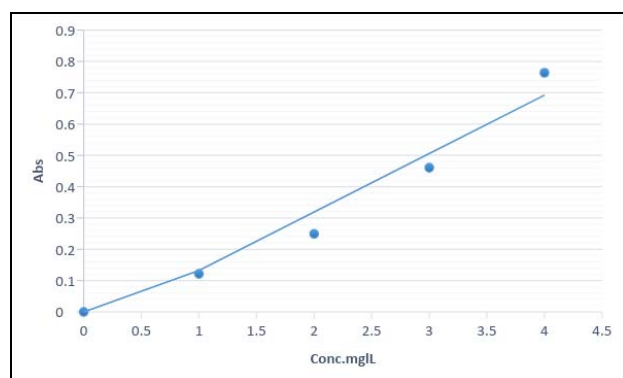


Fig.1 : Calibration curve of Iron by Atomic Absorption spectrometry.

Table 1 : The Concentration data for Iron determination by UV-visible spectrophotometer

No ₀	Mean Unit	Conc.mg/L	Abs
No ₁	Zahdi	0.0697	0.00338
No ₂	Tabrizi	0.1522	0.01516
No ₃	Burhi	0.1248	0.01126

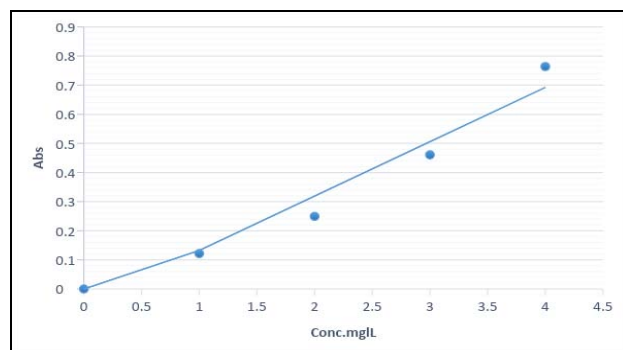


Fig. 2 : Calibration curve of Lead by Atomic Absorption spectrometry.

Table 2 : The Analytical data for Lead Determination by UV-visible spectrophotometer

No ₀	Mean Unit	Conc.mg/L	Abs
No ₁	Zahdi	0.0646	0.00248
No ₂	Tabrizi	0.1157	0.00686
No ₃	Burhi	0.0795	0.00376

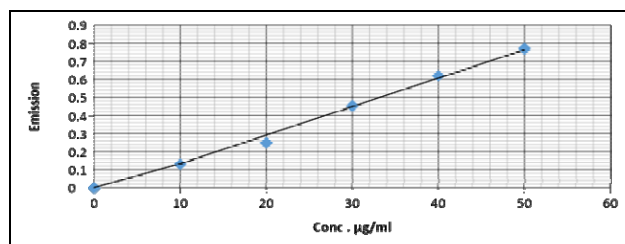


Fig. 3 : Calibration curve of potassium by Flame Atomic photometer.

Table 3 : The Analytical data for potassium Determination by Flame photometer

Concentration of K. [µg/ml]		Recovery %	SD	R.S.D Error %	
Taken	Found			%	%
20	19.8	99	0.0025	1.01	1
30	30.13	100.4	0.0015	0.33	-0.4
40	41.05	102.6	0.001	0.16	-2.6

Table 4 : Amount of potassium found in 500mg of each type of date fruit.

Type	Amount
Zahdi	59
Burhi	65.5
Tabrizi	56.5

By analyzing the data provided in this table it becomes clear that burhi date fruit contains the highest concentration of potassium so it can be used as a nutritional supplement

The suggested method described offers rapidly and efficient preparation of sample for direct determination of Fe and K

Conclusion

Using the data obtained for each of type of date fruit we were able to calculate the amount of K, Fe, and Pb in one date fruit of each of the three date types under study. It was found that one zahdi date fruit provides 2.5% of the daily nutritional potassium requirement and 0.7% of the iron daily requirement while one piece of burhi fruit provides 1.2% and 2.7% of the daily nutritional requirement of iron and potassium respectively, one piece of tabrizi fruit provides 2.4% and 1.5% of the daily requirement for potassium and iron respectively.

Washing the fruit plays a major role in eliminating extra lead which is found mostly on the surface so it is advised that the fruit is washed prior to consumption, in the washed residues it was found that lead concentrations to be within the safe limits.

Lastly, due to high nutritional value, it is concluded that date fruit provides a very good source of nutrients and minerals and regular consumption is very beneficial to human health and maintaining healthy minerals levels in the body, so the study recommends making date fruit part of our daily diet.

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