

Determination of Sugars and Mineral Salts in Fresh Figs of Iraqi Cultivars

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Abstract

The sugars in the Iraqi fresh fig fruit (Al-Wazeri, Kadota, White Adriatic, and Black Diala Variety) were examined; which are the major nutrient components in fig (*Ficus Carica* L., Moraceae).

Glucose and fructose contents were assessed in different Iraqi fresh fig cultivars using paper chromatographic analysis and then determined by spectrophotometric method. The values of glucose and fructose range from 9.41 – 20.27 and 6.25–12.53 g/100 g of fresh matter, respectively. While the values of sucrose and galactose range from 1.15– 2.30 and 1.12– 2.01 g/100 g of fresh matter, respectively. All cultivars were rich in mineral elements, especially in Ca, K and P. Which were being determined by atomic absorption spectrophotometer methods. Their values were: 572, 222.25 and 152.875 mg/100 g, respectively. While the other elements Fe, Cu, Zn, Mg and Na were having very low values.

Key words: mineral elements, sugars, fig fruit, atomic absorption spectrometer.

Introduction:

Fig (*Ficus Carica*) belongs to the family Moraceae is one of the oldest cultivated fruits. It has a symbiotic relationship with insects for fruit setting^[1]. Fig is considered as one of the oldest fruit trees in the mediterranean zone^[2]. Fig are a good source of carbohydrates, including fiber, fructose and glucose are the major sugars in figs^[3-5]. Of all common fresh fruits, figs have the most mineral content^[6-7]. The important mineral elements are K, Ca, Mg, P, Na and Zn^[8-9]. Those nutrients compositions are very important for the assessment of the commercial quality of fresh and dried figs^[5]. A comparison of the mineral elements contents of figs with that of other fruits indicates that figs have calcium contents higher than apples, dates, grapes, strawberries fruits, and contain more potassium than apples and dates fruits^[7]. Another study have also analyzed the contents of fresh figs in Turkey varieties to determinate mineral salts^[10].

Another study has also analyzed the sugars and amino acids in dried Iraqi figs by paper chromatographic analysis^[11]. The aim of the present study is to analyses the sugars and mineral elements of fresh figs of four types in Iraq.

Experimental and procedure

Collection of fig fruit:

Four types available of fresh fig samples were collected of 8 different areas in Kurdistan-Iraq. The four types are (Al-Wazeri, Kadota, White Adriatic, and Black Diala). In the fig ripening season (Summer 2008), 30 figs were gathered early in the morning from each tree were taken randomly, samples were placed in polyethylene bags and frozen at -20°C until analyzed.

Apparatus and Reagents

Atomic Absorption Spectroscopic standard solutions for Zn, Ca, Cu, Fe, Mg, P, K and Na were purchased from Fisher Scientific Company, USA. The stock solutions for each element were prepared by dissolved 1.0 g of the metal in 50 ml of hydrochloric acid and 2 ml of nitric acid, and then diluted to 1 liter in a volumetric flask with deionized water. Working standard solutions were prepared by diluting the stock solution. Hydrochloric acid, ethanol, n-butanol, benzene, pyridine, aniline oxalate, phenol and sulfuric acid were all of analar quality (BDH, England).

Extraction of Mineral Elements using Atomic Absorption Spectrophotometer

Mineral elements were extracted and analyzed by Atomic Absorption Spectrophotometer according to the methods described^[10-14]. 30 g of fresh fig fruits were weighed and dried at 105°C for 24 h, before placing the dry matter in a porcelain cup and charring it in a muffle oven at 550°C for 4 h. After cooling, 5 ml hydrochloric acid solution at 20% (v/v) was added. Then it was boiled and the content was filtered into a 100 ml flask with ionized water.

Calibration Curve

The Atomic Absorption Spectrometer (AAS), (Perkin Elmer model AA200) was used in this study. The range of linearity of the concentration vs. absorbance curve is of great importance in determining the elemental concentration of the samples. Standard aqueous solutions of different elements obtained from Fisher Scientific Company, USA were used to calibrate the AAS machine. The calibration curves were drawn for Zn, Ca, P, K, Cu, Fe, Mg and Na using linear regression analysis of the concentrations of the standard solutions versus absorbance values. The calibration graphs obtained for Fe, Cu, Mg and Zn are shown in Figures 1 and 2. Similar graphs were also drawn for Ca, P, K and Na with R² equal to 0.967, 0.993, 0.972 and 0.985, respectively.

Identification and Determination of Sugars using Paper Chromatography

Sugars were extracted with 80 % ethanol solution and after concentration; portions were fractionated by descending chromatography on Whitman No. 1 filter paper using, n-butanol: benzene: pyridine: water (5: 1: 3 :3) v/v as solvent for 18 h. After the development of the solution chromatoplates, the spots or the zones are located by spraying with aniline oxalate then heated the plates at 100°C for 5-10 minutes^[15]. The sugars were determined by method as described by Dubois et al^[16].

Results and Discussion

The mean values of mineral elements content in fresh fig fruit were showed in Table 1 for a four variety of Iraqi fig. A high variability within cultivars for all analyzed parameters and significant difference was observed. It showed that potassium has higher value 572 mg/100 g then calcium and phosphor values were 222.25 and 152.875 mg/100 g of dry matter, respectively (Table 1). While the other elements founded in a trace values. The contents of mineral elements mg/100 g of dry matter of the present study were compared with those in USA, Iran and Turkey^[15] which was shown in Table 2. We

observed that the mean value of potassium was 572 mg/100 g are lower than those in USA, Iran and Turkey. While the mean values of phosphor was 152.875 mg/100 g (Table 2) was similar to those in Iran 157 mg/100 g but higher than the value of USA and Turkey. The mean value of calcium is equal to 222.25 mg/100 g (Table 2) which was higher than that in USA and Turkey, but lower than those in Iran. The study showed that the other elements Fe, Cu, Zn, Mg and Na were in a good agreement with those studied in USA, Iran and Turkey (Table 2). These differences may be due to various factors, i.e., different origin of figs cultivars, plants nutrients, differences in ripening, etc.

Mean values of sugars are reported in Table 3. A high variability within cultivars for all analyzed parameters and significant difference was observed. The explanation of the differences in the values of sugars in the present study with the other study, it may be due to the kinds of the cultivars and the stage of maturity.

The values obtained for glucose ranged from 9.41 – 20.27 g/100 g fresh matter (Table 3). These results were higher than those obtained by Fateh et al [3]. and those obtained by Turkish investigators (Melgareio et al.) [4]. The values obtained for fructose was lower than glucose

(Table 3) which ranged from 6.25–12.53 g/100 g of fresh matter. These results were higher than those obtained by Melgareio et al [4].

The values obtained for sucrose and galactose range from 1.15– 2.30 and 1.12– 2.01 g/100 g of fresh matter, respectively. These values obtained were lower than those obtained by Sayed and Abdulanour [11] for a dried Iraqi fig, these differences may be due to using a dried Iraqi fig, while in present study we used fresh matter. While the other differences could be attributed to the methods used for determination, to the varieties differences and the stage of maturity.

Conclusion

In general, all the studied cultivars were rich in those nutrients elements.

In present study, the varieties of Iraqi fresh fig cultivars were being rich in sugars and also in minerals.

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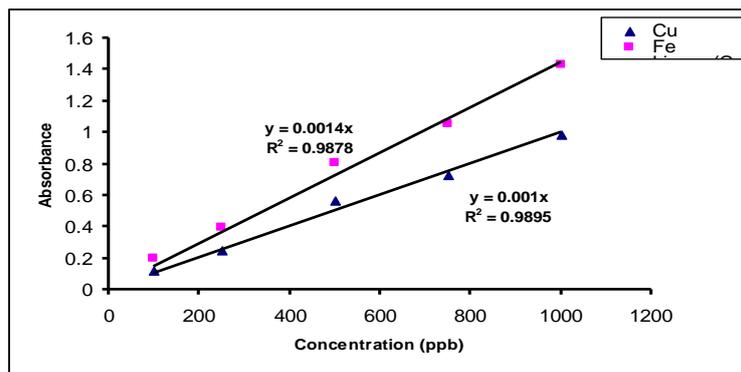


Figure (1): Concentration versus Absorbance calibration curves for Fe and Cu.

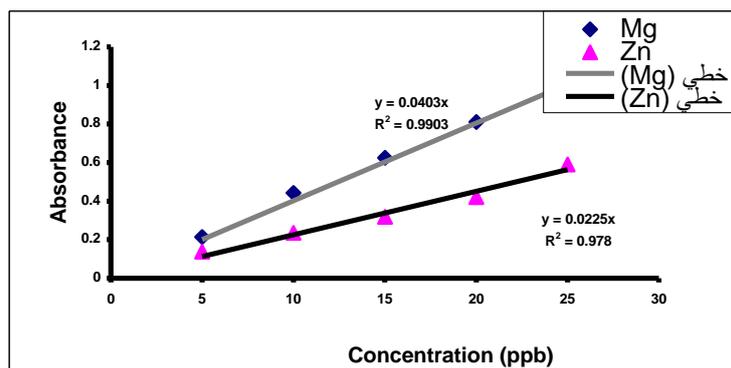


Figure (2): Concentration versus Absorbance calibration curves for Mg and Zn.

Table (1): Means of mineral elements contents (mg/100 g dry matter) of Iraqi fresh fig cultivars.

Cultivars name	Ca	K	P	Fe	Cu	Zn	Mg	Na
Al-Wazeri	145	232	155	12.95	0.387	22.622	17	8.32
Kadota	345	894	145	2.71	0.342	0.47	23.08	9.03
White Adriatic	225	482	233	3.46	0.271	2.08	78.72	10
Black Diala	174	680	78.5	2.05	0.511	9.15	60	2.54
mean	222.25	572	152.875	5.2925	0.37775	8.5805	44.7	7.4725

Table (2): Comparison the means of mineral elements contents (mg/100 g dry matter) of Iraqi fresh fig cultivars (Present study) with those in (USA, Iran, Turkey) ^[17].

Country	Ca	K	P	Fe	Cu	Zn	Mg	Na
USA	133	609	70	3.07	0.31	0.48	62	12.26
Iran	363	1060	157	1.89	0.34	5.21	51.4	5.2
Turkey	138	800	94.07	4.2	0.47	12.72	24.71	14
Iraq (Present study)	222.25	572	152.875	5.2925	0.37775	8.5805	44.7	7.4725

Table (3): Means sugars (g/100 g fresh matter) of Iraqi fresh fig cultivars.

Cultivars name	Fructose	Glucose	Sucrose	Galactose
Al-Wazeri	6.25	9.41	2.3	2.01
Kadota	10.08	12.18	2.11	1.44
White Adriatic	8.31	20.27	1.15	1.32
Black DIALA	12.53	10.09	2.02	1.12
mean	9.293	12.988	1.895	1.473

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تقدير السكريات واملاح المعادن في ثمرة التين الطازج العراقي

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المخلص

تم في هذا البحث دراسة السكريات في الثمرة الطازجة للتين العراقي بأنواعه الاربعة (الوزيري، كادوتا، الابيض الادرياتيكي والاسود ديالي). حيث تم تقدير محتوى الكلوكوز، الفركتوز، السكروز والكلكتوز في مختلف انواع التين الطازج العراقي باستخدام التحليل الكروماتوغرافي الورقي ثم تقديره طيفيا باستخدام المطياف الضوئي، فكانت قيم كل من الكلوكوز والفركتوز تتراوح بين ٩،٤١-٢٠،٢٧ و ٦،٢٥ - ١٢،٥٣ غم/١٠٠ غم بالحالة الطازجة و على التوالي. بينما كانت قيم كل من السكروز والكلكتوز تتراوح بين ١،١٥ - ٢،٣٠ و ١،١٢-٢،٠١ غم/١٠٠ غم بالحالة الطازجة و على التوالي. كل انواع الثمرات كانت غنية بالعناصر المعدنية وخاصة الكالسيوم، البوتاسيوم والفسفور. وكانت معدل قيمهم ٥٧٢، ٢٢٢،٢٥ ، ١٥٢،٨٧٥ ملغم/١٠٠ غم، على التوالي. بينما بقية العناصر كالحديد، النحاس، الزنك، المغنيسيوم والصوديوم كانت محتوهم قليلة القيمة.