



RESEARCH ARTICLE

Physicochemical properties and radioactivity assessment of Iraqi dates

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Radioactivity assessment for five types of Iraqi dates (Zahdi, Barhi, Khistawi, Maktoum and khdrawi) were studied, by using NaI gamma ray spectrometer. The samples were collected from the local market in Baghdad. The obtained results show that the levels of radioactive materials in the studied samples are below the detection levels (BDL).

As well as some chemical and physical properties of dates were studied by measuring gravimetric, moisture, ash, total sugars, proteins and lipids. The obtained results show high contents of total sugar but low content of proteins, lipids and ash as compared with other types of fruits.

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Introduction

Date palm *Phoenix dactylifera* is the main fruit crop in arid and semi-arid regions, particularly in the western Asia and North Africa. The palm tree is well adapted to desert environments that are characterized by extreme temperature and water scarcity. Dates considered in many developing and sub developing country the main food and traditional crop because they are produced in great quantities, where each palm tree produce up to 500 kg. Dates consumption is very high in rutab stage because of nutritional value. Date palm tree have great religious significance in all three major religions of the world. The Mediterranean basin is original habitat of date palm tree that grow in large numbers and varieties, there are more than 600 different types of these fruits (1, 2).

Radiation is a natural part of the environment in which we live. All people receive exposure from naturally occurring radioactivity in soil, water, air and food. The largest fraction of the natural radiation exposure we receive comes from a radioactive radon gas. Radon (^{222}Rn) is emitted from uranium, a naturally occurring mineral in rocks and soil; thus, radon is present virtually everywhere in the air over the earth (3, 4). Additionally, weapons used in gulf war 1 and 2 caused radio contamination of Iraqi soil in many regions which cause reduction and declination in many crops and date palm is one of them (5, 6, and 7). Al- Saadi et al., 2013 found that radon and uranium concentrations in two types of Iraqi dates and their seeds, using solid state nuclear track detector, were below the permissible limit given by International Commission of Radiation Protection agency (ICRP).

The aim of the present study is to investigate the chemical and physical properties for five main types of dates in Iraq. In addition, radioactive isotopes were analyzed for the five samples using NaI(Tl) gamma spectrometer.

Materials and methods:

Fifteen samples of dates belong to five varieties (Zahdi, Barhi, Khistawi, Maktoum and Khdrawi) were provided from the general company of dates marketing (Baghdad- Al-Shalchia), from five different Iraqi governorates

(Baghdad, Diala, Anbar, Salah-alidin and Basrah) respectively in rutab stage. Each sample divided into two parts one used for radioactive assessment and the second used for physicochemical properties determination.

1. Physical and chemical properties assessment:

- **Moisture determination**
Moisture was determined according to (8) by measuring the difference between wet and dried fruits weight.
- **Protein determination assay**
The protein was measured by Biuret method according to (9).
- **Total sugars assay**
Total sugar of five dates varieties were measured according to (10).
- **Ash determination**
Ash was measured by following method cited in (11).
- **Lipid determination assay**
Lipids were evaluated according to (12).
- **Gravimetric measurements of fruits**
To calculate the weight of fruits and cores we followed method of Dowson, 1962.

2. Radioactive elements assessment

The collected samples were dried at 100 °C for 48 hours, then powdered and homogenized, dry-weighted, sieved through a fine mesh (<2mm) then they were put in 1 kg standard Marinelli beakers. Gamma spectrometry was used to assess gamma ray emitting radionuclides in the prepared samples. Gamma spectrometer from ORTEC was used which is equipped with NaI(Tl) scintillation detector (3×3) inch crystal with relative efficiency 2.00% at 0.5 MeV and 1.30% at 2.0 MeV. The detector was housed in a thick lead shield in order to reduce the ambient background. The detector is connected 14-Pin PMT Base. The detector was energy calibrated using a gamma standard source. The background spectrum was measured under the same conditions as the samples measurements and was subtracted from the calculated sample activities. The measured spectra were analyzed using gamma Vision software from ORTEC.

Results and discussions:

Table 1 shows the physical properties (fruit length, diameter, total weight, core weight and fleshy weight) of the five types of the studied dates. The variations in the physical properties are due to genetic variety of each type. The longest and the heaviest among all other types of dates is Maktoum with 3.71±1.35 cm and 10.92±0.76 gm respectively, while Barhi is the shortest fruit with 2.62±0.28cm and Khistawi is the lightest fruit with 6.21±0.11 gm. The chemical properties (moisture, ash, sugar, protein and lipids) of the five varieties are also given in Table 1. Zahdi has the highest proportion of total sugar and protein contents among the other varieties with values of 82.14% and 2.16 mg/ml, respectively with significant differences of ($p \leq 0.05$). The highest proportion of lipid is found in Maktoum of 1.73mg/ml. The obtained data indicate that dates have low contents of lipids but this is not a signal of low nutritional value, because dates have high contents of minerals, sugars and vitamins.

In the case of radioactivity measurements, the obtained results show that the levels of radioactive materials in the studied samples are below the detection levels (BDL).

Table 1: Physicochemical properties of date palm

Varieties	Physical properties					Chemical properties				
	Length (cm)	Diameter (cm)	fruit weight (gm)	Core weight (gm)	Weight of fleshy part	Moisture %	Ash %	Sugar %	Protein mg/ml	Lipids mg/ml
Zahdi	3.47±1.02	1.63±0.52	7.27±0.74	0.85±0.02	6.42±0.42	8.26±0.77	1.86±0.12	82.14±0.69	2.16±0.78	0.43±0.06
Barhi	2.62±0.28	2.07±0.33	6.79±0.61	1.67±0.13	5.08±0.77	20.90±0.93	1.30±0.15	74.90±1.56	1.01±0.07	0.10±0.02
Khistawi	3.52±0.30	1.80±0.18	6.21±0.11	1.20±0.18	5.01±0.16	11.10±0.93	1.63±0.04	76.10±0.96	2.20±0.35	0.16±0.05
Maktoum	3.71±1.35	2.91±0.68	10.92±0.76	1.61±0.57	9.31±0.57	12.10±1.35	1.73±0.19	75.10±1.54	1.80±0.14	1.73±0.24
khdrawi	3.26±0.60	1.40±0.28	6.93±0.61	0.97±0.11	5.96±1.24	12.60±0.57	1.40±0.03	74.20±1.43	1.70±0.13	0.20±0.07

Conclusions:

The obtained results showed that:

1. According to physical properties, Maktoum has the longest (3.71 ± 1.35) cm and the heaviest (10.92 ± 0.76) gm among all other types of studied dates.
2. According to chemical properties, Zahdi has the highest values of ash and sugar while Barhi, Khistawi and Maktoum have the highest values of moisture, protein and lipids, respectively.
3. Finally, according to radioactive measurements the levels of radioactive isotopes are below the detection limit of the detection system.

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