



Chemical composition and effective compounds of dates and their use in a snack to give energy to athletes

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Background: Dates are recognized as a rich source of nutrients, so they are considered a complementary food element positioning them as functional food for athletes. Energy balls are nutritious snack foods that people, individuals and athletes enjoy. They are a source of natural sugars, fibers and proteins that are nutritionally balanced. Food supplements consist of protein, fats, vitamins, minerals and carbohydrates.

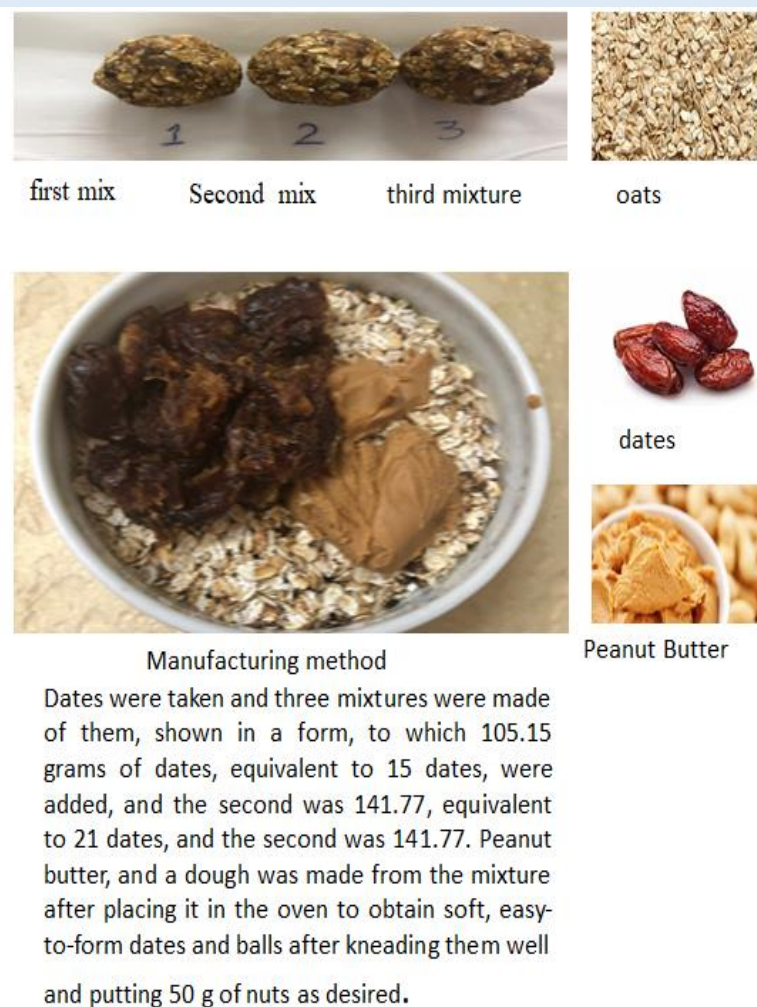
Objective: enrichment some food products, especially energy-rich balls for athletes that made from dates as a main component for it.

Materials and Methods: Date fruits from five cultivars (Dekel Nour, Barhi, zahdi, khlas, sukari) were collected from the orchards of Baghdad Governorate. The fruits were cleaned and dried in an oven at a temperature of 45 ° C until dry, then the fruits were ground by means of a grinder. The ground forms were kept in sealed glass containers at a laboratory temperature of 20-25 °C until use.

Results: Variability in contents was observed across the different cultivars, with the highest percentage of total sugars, amounting to 86.70%, being recorded in Barhi dates. Conversely, the lowest sugar percentage was found in date meat, measuring at 69.20%. The fruits recorded the highest moisture percentage with a value of 30.01%. The mineral composition showed that P was the predominant mineral, followed in descending order by Mg, Ca, and proteins. The protein content ranged from 2.14 to 3.20%, while crude fat ranged from (0.15 - 0.44) %. Moisture content in date varieties with early ripening time was between low and high values of 10% to 30%. The comprehensive nutritional profile encompassed minerals and numerous vitamins, most notably B vitamins. Carbohydrates constitute 70% of the date's composition, including fructose and glucose. Additionally, dates are rich in calcium, magnesium, selenium, copper, phosphorous, potassium, zinc, sulfur, cobalt, fluorine, and

manganese. Lately, interest in dates has increased because of their health importance, catalyzing the development of food products.

Keywords: Dates, active substances, chemical compounds, functional foods, oat, nuts,



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INTRODUCTION

Dates stand as one of the natural sources of sugars, including sucrose, fructose and glucose. Each 100 g of fresh dates contains about 157 calories, while dry dates contain 300 calories of energy per 100 g [1]. In addition to sugars, dates contain nutritional components, including proteins, raw fiber and antioxidants. Consequently, many products are made from dates due to their many health benefits [2]. Dates are considered an energy booster because they contain high-quality carbohydrates. They are a source of protein and a booster for the immune

system because they work to increase the beneficial organisms in the digestive system [3]. Dates contain 50-80% moisture. The basic sugars found in dates are glucose and fructose, which constitute two-thirds of the dates in addition to fiber and vitamins [4]. Dates play a high-value nutritional role in meeting human nutritional needs [5]. Date flesh contains about 0.2-0.5% oil and fatty acids including unsaturated fatty acids such as oleic, linoleic, linoleic and palmitoleic. The nuclei predominantly contain oleic acid ranging between 41.1 - 58.8%. Dates contain protein ranging from 23 types of different amino acids. The vitamin

spectrum includes C, B, A and niacin, among others, further underscoring their nutritional richness [6]. Carbohydrates are the main energy source in dates, in addition to glucose and fructose, they contain polysaccharides such as cellulose and starch [7]. The percentage of sugars in dry dates is estimated at about 50% [8], and this ratio is important from an economic point of view, given that the amount of sugars in dry dates is about 50%. Sucrose surpasses reducing sugars in this context [1,9]. Protein content in dates ranges from 1% to 7%, encompassing amino acids likes: lysine, histidine, arginine, aspartic acid, glutamic acid, threonine, histidine, arginine, serine, proline, glycine, alanine, cysteine, valine, methionine, isoleucine, phenylalanine [10]. The highest amino acids in dates are glutamic and aspartic acid, characterized by molecular weight ranging from 12000-72000 daltons. Date meat bears approximately 0.2-0.5% oil and fatty acids, predominantly unsaturated ones like oleic, linoleic, linoleic and palmitoleic, which are unsaturated fatty acids. Dates contain dietary fiber with a ratio of 6.26-8.44 g/100 gm, including pectin, hemicellulose and cellulose, of which 84-94% are insoluble fibers [11]. Dates contain vitamins and minerals ranging between 0.1-0.16 mg / 100 g [13] . Notably, the prescence of elements such asand K and Na are useful for people suffering from high blood pressure, and boron is useful for treating brain cancer. Historically, dates were used in the treatment of rheumatism [5.] The inclusion of elements such as fluorine are important for preventing tooth decay, selenium is important for preventing cancer and strengthening the immune system, with concentrations ranging from 1.48-2.96 µ/g. Dates are considered antioxidants because of their content of carotenoids and flavonoids [14]. The aim of the study to produce a food product of high nutritional value, low in calories and beneficial to the body.

MATERIALS AND METHODS

Collection and Preparation of Plant Samples: Date fruits of five cultivars (Dekel Nour, Barhi, zahdi ,khlal , sukari) were collected from the orchards of Baghdad Governorate. The fruits were cleaned and dried in an oven at a temperature of 45 ° C until dryness, then the fruits were ground by means of a grinder. The ground forms were kept in sealed glass containers at laboratory temperature of 20-25 ° C until use.

Moisture Content Determination: Twenty grams of the fresh plant material was weighed in a glass dish and dried at 45° C until completely dry. Following the drying process, the sample was then weighed after placement in a Discater containing CaCl₂. The percentage of moisture was then estimated according to the method outlined in [15].

Ash Percentage Estimation: To estimate the ash percentage, a mass of 2 grams of dry samples was employed. The samples were incinerated in an electric Muffle Furnace of Carbolitic type, operating at a temperature of 550°C for a duration of 6 hours. The ash

$$\% \text{ of Ash} = \frac{\text{Weight of Ash after burning}}{\text{Sample weight}} * 100$$

Chemical detection of some active substances in the parts of the date fruits: Approved methods were used to detect the most important active substances in the dry powder samples.

Alkaloid Detection: The method mentioned in [17] was followed. By boiling 10g of the plant part in 50 ml of distilled water acidified with drops of HCl, at a concentration of 4%, the solution was cooled and filtered. The detection process was carried out using the following reagents: Dragendorff reagent for the detection of alkaloids orange precipitate (+), Wachner

reagent for the detection of alkaloids brown precipitate (+), Mayer reagent for the detection of quaternary alkaloids white precipitate (+) and Marcus reagent for the detection of solatin yellow-orange precipitate (+).

Detection of Saponins: The two methods adopted by [15] were employed. The first method involved vigorously shaking the aqueous extract and noting the appearance of abundant foam that persists for a long time, indicating a positive result.– This result was confirmed by the use of filtration under pressure for aqueous extracts. The second method: adding (5.0 ml) of mercuric chloride to 5.1 ml of the aqueous extract. A positive detection was confirmed by the appearance of a white precipitate.

Detection of astringents: Tannin detection, an assessment of astringent properties, was executed following the prescribed procedure in [18]. . Five grams of the plant material were subjected to boiling in the presence of 50 ml of distilled water. The resulting solution was filtered and left to cool. The filtrate was divided into two parts, to the first segment, a 1% concentration of lead acetate was added, and the appearance of a gelatinous precipitate signified a positive detection. The second segment was subjected to the addition of a 1% concentration of ferric acid, the development of a bluish-green color indicated a positive outcome, confirming the presence of holding materials (Tannins).

Detection of polysaccharides: Glycosidedetection, followed the approved method documented in [19]. Equal parts of aqueous extracts from plant parts were mixed with Benedict's reagent. Benedicts test shows a red precipitate indicating the presence of sugars in the aqueous extracts. For confirmatory purposes, the reaction with Fehling's reagent was employed. An equal amount of the aqueous extract was reacted

with Fehling's reagent in a boiling water bath for 10 minutes. The formation of a red precipitate substantiated the positive detection of sugars.

Detection of resins: The approved method in [15] was used in the detection of resins as follows: 10 mL of ethyl alcohol CH₃CH₂OH at a concentration of 95% were added to 1 g dry weight of the plant part and left to boil in a water bath for two minutes. The solution was filtered, and 20 mL of acidified distilled water was added to the filtrate with drops of HCl at a concentration of 4% showing turbidity in the solution.

Detection of Glycosides: Five ml of Fehling's reagent was taken and mixed with 5 ml of aqueous extract of the sample powder and left in a boiling bath at 100° C for 10 minutes. The presence of glycosides was inferred from the formation of a red precipitate. 1 ml of the aqueous extract was added to 5 ml of Benedict's reagent, and thus the presence of glycosides was indicated by the appearance of the red precipitate [15].

Detection of Flavonoids: Flavonoids were detected according to the method presented in [20], which included the preparation of two solutions: - The first consists of dissolving 10 g of the extract for each of the samples in 5 ml of 95% ethyl alcohol, then filtered. The second solution was prepared by adding 50% ethyl alcohol to a 50% potassium hydroxide solution. The two solutions were mixed with each other in equal quantities, and through the appearance of the yellow color, the presence of flavones was indicated.

Microbial Analysis; Assessment of Microorganisms: Samples of dates weighing 10 g were sterilized in sterile bags, then 90 ml of sterile physiological saline was added. The samples were left to homogenize for 10 minutes and (0.1 ml) was taken directly or as a 10-

fold dilution in physiological saline. Bacterial and fungal colonies were counted and expressed as colony forming units (cfu. g-1). Total viability was determined using a Count Agar dish incubated at 37°C for 48 hours. Mannitol salt agar medium was used to count staphylococci at 30°C for 48 hours. Bacillus cereus was counted using an agar plate after heating the samples at 70-80°C for 10 minutes. The plates were incubated at 30 °C for 48 hours. Potato dextrose agar medium was used to count the yeast and molds. The plates were incubated at 30 °C for 7 days. Desoxycholate Lactose Agar medium was used to enumerate coliform microorganisms [21].

Manufacturing Method: The method used by [22] was modified and adapted for this study. Dates were

taken and three mixtures were made from them, shown in Figure (1). In the first mixture 105.15 gm of dates were added, which is equivalent to 15 dates. The second mixture integrates 141.77 grams, which is equivalent to 21 dates. Lastly, the third mixture integrates 180.20 grams, equivalent to 27 dates. These mixtures were blended with 135 gm of oats and 50 gm of peanut butter, and a dough of the mixture was made after placing it in the oven to get the dates soft and pliable.

Once the mixture attains a suitable consistency, it is kneaded well and subsequently formed into balls. Additionally, 50 grams of nuts are optionally added to the mixture, according to preference.



Figure 1. shows the steps for manufacturing date balls with oats

RESULTS AND DISCUSSION

The varieties were characterized by high sugar, low percentage of ash, fat and protein, as outlined in Table (1). The chemical composition of dates aligns with previous findings reported by other researchers for various taxa [23]. The protein content ranged from 2.14 to 3.20%. Crude fat ranged from 50.1 to 0.44%, which is similar to that reported by [24] for dates grown in the United Arab Emirates; But it is low compared to some Iranian varieties (0.4 to 0.9% fat) [25]. Fleshy, that is mainly concentrated in the skin

(2.5 to 7.5%) has a physiological importance in protecting the fruit contributing to the nutritional value of dates [26]. Moisture content in date cultivars with early ripening time was between low and high and ranged from (10-30%) as indicated by their short shelf life. There are no significant differences in sugar contents between the varieties, and the highest percentage was 86.70% in

Barhi dates. While the lowest sugar percentage found in date flesh was sugary (69.20%). The fruits recorded the highest percentage of moisture with a

value of 30.01%. The mineral composition showed that P was the predominant mineral, followed in descending order by Mg and Ca. These results are in close agreement with the results [23] of Dekel Nour date palm from Tunisia. The variation in composition

of dates may have several causes, chiefly stemming from differences in varieties. It is possible that local production conditions and climatic conditions at the time of harvest likely affect the final composition of the chemical composition of dates.

Table 1. Proximate composition of date

Date Variety	Sodium	Phosphorous	Magnesium	Potassium	Calcium	Fiber	Ash	Fats	Moisture	Protein	Sucrose	Glucose	Fructose	Total Sugars
Dekel Nour	2.0	50.3	5.88	774.71	26.1	3.01	1.88	0.44	13.6	2.64	25.0	19.9	19.5	85.22
Barhi	26.0	.0183	7.55	855.14	12.0	2.25	1.44	0.15	30.01	2.5	5.0	35.7	40.5	86.7
Zahdi	5.04	14.02	58.0	887.0	207.0	1.85	1.6	0.35	16.2	2.0	9.6	37.3	34.0	77.2
Khlas	5.2	60.12	12.2	575.0	60.96	2.8	1.8	0.25	10.98	2.14	5.9	34.4	33.5	70.9
Sukari	11.12	77.1	9.1	396.0	65.41	3.77	1.9	0.26	10.12	3.20	55.04	8.0	6.2	69.2

Table (2) summarizes the results of the chemical detection of the active substances of the parts (fruits) of dates that were detected (alkaloids, saponins, tannins, saccharides and resins. The results showed that the saccharides glycosides, alkaloids, saponins and flavonoids, were positive for all varieties of date., Additionally, the results indicated the presence of

Resins and tannins in Dikl Nour, Zuhdi and Sukari cultivars in higher proportions than in Barhi and Khalas. Most of the alkaloids and saponins vary in amounts in different parts of the fruits during the ripening stage, as indicated by [27-31] . The presence of foam upon the introduction of water is indicative of these substances.

Table 2. Chemical detection of the active compounds in dates

Dates varieties	Flavonoids	Glycosides	Tannins	Alkaloids	Soaps	Resins	Carbohydrate
Dekel Nour	+	+	+	+	+	+	+
Barhi	+	-	-	+	+	-	+
Zahdi	+	+	+	+	+	+	+
Khlas	+	-	-	+	+	-	+
Sukari	+	+	+	+	+	+	+

It is clear from Table No. (3) and Figure No. (2) that there was no presence of bacteria in all date samples, while there was presence of fungi in all

samples except for the Dekel Nour and Al Zahdi sample. The washing and dusting processes to which dates are exposed during the date storage process are

sufficient to reduce the number of bacteria, yeasts and molds. These results agree with what was obtained [30-38] while *Aspergillus* is present in fresh samples. The appearance of fungi in these samples may be attributed to the possibility of contamination of the product during packaging or from the used containers, especially since dates are packed in plastic containers. Yeasts, along with molds, are among the

most important groups of microorganisms responsible for spoiling dates and are responsible for the formation of undesirable flavors in different storage conditions. They are responsible for converting sugar into alcohol and carbon dioxide through fermentation processes with gradual changes in flavor by types of yeasts with Resistance to high concentrations of sugar in the range found in dates.

Table 3. Microbial analysis of different dates samples

Dates varieties	Mold	Yeast	Bacillus	Staphylococcus	E. coli	Coliform	TVC
Dekel Nour	0	0	0	0	0	0	21
Barhi	3	2	0	0	0	0	17
Zahdi	0	0	0	0	0	0	20
Khlas	4	1	0	0	0	0	3
Sukari	2	1	0	0	0	0	4

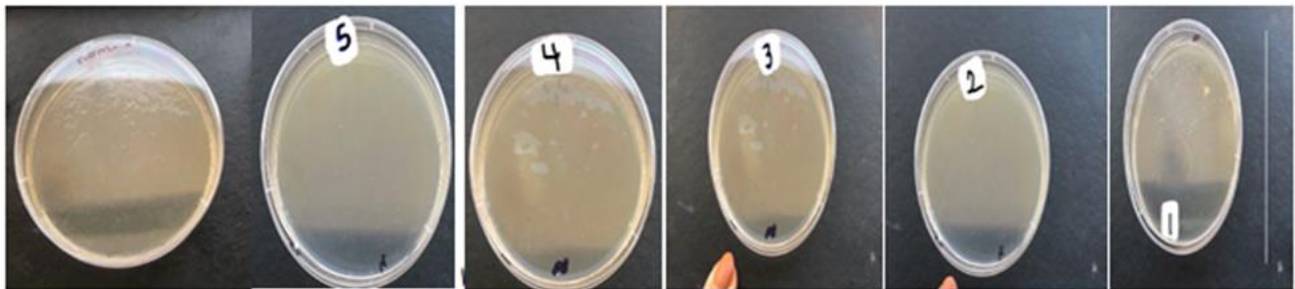


Figure 2. Shows the results of microbial analysis of date samples at 2- 10 dilution

Table (4) shows the results of the analyzes of the evaluators of the date ball models and the extent to which the product was accepted by them. A food product was obtained if the product was accepted by the residents with some notes. If mixture No. 2 was

accepted, the best result was obtained, but the mixture number one was not Coherent. Mixture No. 3 elicited mixed responses, as it was accepted by certain evaluators but not by others, primarily due to an inherent imbalance within the mixture [39-41].

Table 4. Shows the sensory evaluation of the manufactured product

Samples	Taste	Color	Shape	Taste	Flavor	Texture	General Acceptance	Notes
1	7.66	8.33	6.00	8.00	8.33	5.66	43.98	Too many oats and not cohesive
2	7.90	7.33	7.66	9.00	8.00	9.00	48.89	Very good with all the ingredients
3	5.00	6.66	8.00	5.33	6.00	8.33	44.32	Too many dates

CONCLUSION

The addition of dates to the energy nutrition product had a positive effect on consumer acceptance and admiration in addition to the good sensory traits and high nutritional value ratings. The dates in our Energy Nutrition Balls are high in natural sugars, fiber and minerals, with a delicious, sweet taste as well as other nutrients that athletes need. Dates are an essential ingredient in preparing the Energy Nutrition Balls in order to provide the energy needed for physical activity. Our Energy Nutrition Balls can be used as an alternative to the traditional nutrition snacks currently available in the market, our newly developed product can be marketed as a nutritious piece of fruit, ready-to-eat snack, or dessert, It will also help food manufacturers and processors think about nutrition components of different types. Additional work is needed to determine consumer acceptance of the different flavors (eg, water rose, cinnamon, ginger, green tea, mint, black seed, sweetcorn, cardamom, mastic, male frankincense) in order to provide consumers with a wide range of products. It is also important that additional work is done on stabilizing

the shelf life of this new product to ensure safety and of the highest quality.

Abbreviations: Ca: Calcium, Mg: magnesium, P: phosphorous, HCl: hydrochloric acid, CH₃CH₂OH: ethyl alcohol .

Authors Contribution: Sara Thamer Hadi: Formal analysis; Methodology; Project administration; Funding acquisition; Validation; Writing-original draft. Doaa Muthanna Shaban and Mohammed Abd Hemed Morgab,: Data curation; Formal analysis; Methodology; Project administration; Supervision; Resources; Validation; Safa Mohammed Jasim Writing-review and editing.

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