Elbar D, et al., J Food Sci Nutr 2024, 10: 191
DOI: 10.24966/FSN-1076/100191

HSOA Journal of Food Science and Nutrition

Research Article

Identification of the Fifteen Varieties of Bio-Dates to Optimize their Nutritional Value

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Abstract

Dates are fruits rich in biologically active substances, which give them a great interest in terms of validation. For this resonance, our study focuses on the biometric, physico-chemical, and biochemical characteristics of fifteen varieties of dates within the palms of the Loudaya experimental area of the centre for scientific and technical research on arid regions CRSTRA, Biskra, Algeria.

The Varieties of Dates are: Ghars, Degletnour, Elhora, Houngu-eljamel, Meknetchy, Mechdegla, Elhyloia, Saffray, Tantbouchet, Noyaethaloiteloulche, Haloiteloulache, Arichetti, Tinissine, Hamraya, and Radbatbencharife.

Method: We did all the physico-chemical analyses to identify these dates such as morphological analyses, pH, moisture, ash, reducing sugars, total sugars, total polyphenols and the mineral contents.

The results obtained demonstrate: the existence of morphological differences between the fifteen varieties and in particular the consistency point, the size and weight of the dates, the rate of total sugars and the rate of total polyphenols. The varieties of the dates that agree with all the premium quality criteria are the three varieties Degletnour, Arichtti, Elhora, and they have the best morpho-metric characteristics to give them an aesthetic appearance.

Keywords: Biochemical properties; CRSTRA; Dates; Morph metric characteristics

Introduction

The agriculture of date oasis (Phoenix dactylifera L.) is estimated according to the most strategic achievements in arid and semi-arid zones. It plays an important role in the economic and social life of the populations of these regions [1,2]. According to the genetic heritage of the date palm is exceptional, in Algeria alone, more than 940 varieties have been inventoried, this is a testament to the immense selection work done by the phoeniciculturists over the centuries to maintain such a high number of varieties, they have very diverse characteristics, both in their degree of resistance to climatic hazards, diseases and insects, as well as in the shape, color, flavor and texture of their fruits [3]. Experts believe that this genetic diversity constitutes a natural bulwark against the degradation factors of the oasian ecosystem.

Dates are considered nutritious and energetic foods (1180kJ per 100g) because they are rich in sugars providing a rapid energy intake, minerals, vitamins, polyphenols, and flavonoids [4-6]. Dates are known to be good for the heart, and their soluble fibers help fight constipation, the antioxidant properties of dates vary with the amount of phenolic compounds, vitamins C and E, carotenoids and flavonoids [7-9]. Different varieties of dates do not hold similar organoleptic, nutritional, technological and advertise characteristics. These date properties can be estimated according to the study of their morphological, physico-chemical, biochemical and sensory criteria. The study of the characteristics of dates admits not only their exploitation, but also to provide information for their use inside particular in biotechnological procedures.

The objective of this work is to evaluate the morpho-metric and biochemical characteristics of date varieties within the palmaris of the Loudaya experimental area of the CRSTRA research centre. What could build the criteria of characterization and identification of each variety of dates which are ghars, degletnour, elhora, houngu-eljamel, meknetchy, mechdegla, elhyloia, saffray, tantbouchet, noyathaloit loulche, haloiteloulache, arichetti, tinissine, el hamraya, and radbatbencharife) according to the morpho-metric plan as well as on the biochemical plan.

Materials and Methods

Vegetal Material

The study was carried out on fifteen varieties of dates produce at full maturity in palmer in the Loudaya experimental area of our CRSTRA research centre.

The Dates are: Ghars, Degletnour, Elhora, Houngu-eljamel, Meknetchy, Mechdegla, Elhyloia, Saffray, Tantbouchet, Noyathaloiteloulleche, Haloiteloulache, Arichetti, Tinissine, El hamraya, et Radbatbencharife.

At our agro-food laboratory, after the dates have been received. All the physico-chemical analyses were done to identify these dates such as morphological analyses, pH, moisture, ash, sugar level, total sugars, total polyphenols and mineral content.

Methods

Morphological Characterization of Dates

Morphological characteristics were measured on 5 randomly selected fruits from each variety to determine the following characteristics [10].

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Citation: Elbar D, Rekis A, Romanie M, Aksa A, Benaoune S, et al. (2024) Identification of the Fifteen Varieties of Bio-Dates to Optimize their Nutritional Value. J Food Sci Nutr 10: 191.

Received: June 12, 2024; **Accepted:** July 04, 2024; **Published:** July 12, 2024

- Color is visually estimated;
- The dimensions of the date fruit (length and width) are measured in millimeters (mm) using a caliper.
- The weight of the whole date, pulp, and core was measured using an analytical balance brand-name (OHAUS) precision (0.001).

Biochemical Characteristics of Dates

pH Determination

The pH is determined by using a pH meter. A glass electrode, the potential of which depends on the H_3O^+ concentration of the solution, is immersed in the solution. Once the pH meter is calibrated, the pH value [11], is taken. The result represents the average of five replicates.

Determination of Moisture Content

The water content of dates is determined by drying a test sample of a product in a 105°C oven until a constant weight is obtained [12]. The water content of a product can provide information on the potential degree of proliferation of micro-organisms.

The water content shall be expressed as follows: H % = (M_1-M_2)*100/P

H%: Humidity, M_1: capsule mass with fresh material before steaming

M_2: mass of the assembly after drying, P: mass of the test portion.

Determination of Ash Content

The total ashes allow judging the mineral richness and the mineral composition of the product. The ash is determined by incineration of the product in electric muffle oven at 550°C for 3 hours until a white or grey color appears [12]. MO % = (M_1-M_2)*100/P

MO %: organic matter, M_1: capsule mass + test portion.

M_2: capsule mass + ash, P: test sample mass.

The ash content (Cd) is calculated as follows: Cd = 100 - MO%.

Determination of Total Sugars Content

Total sugars were determined using the Dubois et al. method [12]. This method makes it possible to determine the dose using phenol and concentrated sulphuric acid. In the presence of these two reagents, the sugars give a cream yellow color, the intensity of which is proportional to the concentration of the total sugars. The optical density is determined at 490nm.

ST = [(X.V.D)/P]*100

ST: Total sugars (%); D: Dilution factor; V: volume of test solution (ml);

X: Amount of sugars calculated from the calibration curve (mg/ml);

P: weight of test sample (mg).

The Consistency of Dates

Is determined according to the "**r**" quality or hardness index as the ratio of sugar content to the water content of dates [10].

r = sugar content / water content

The calculation of this index makes it possible to estimate the degree of stability of the fruit and leads to the following classification: - Soft dates: r < 2 - Dates half - soft: 2 < r < 3.5 - Dry dates: r > 3.5 For r = 2 the stability of the fruit is optimal and its suitability for preservation is very appreciable.

Determination of Reducing Sugars

This method is based on the reduction of Fehling liquor by the reducing sugars contained in the sample [12]. The following formula was used to express the results:

R = (5*N/N')*F

R: the quantity of reducing sugars in g/litres; N: the number of ml of 5% glucose solution used; N': the number of ml of filtrate used for the discoloration of Fehling liquor; F: the dilution factor.

Determination of total polyphenols

The determination of total polyphenols is carried out using the spectrophotometry method, they resolute according to the Folin-Ciocalteu procedure. The total phenolic content was determined by means of a calibration curve prepared with gallic acid and expressed as µg of gallic acid equivalent (GAE) per g of sample [13,14].

Minerals Determination

Mineral contents, magnesium (Mg), calcium (Ca), iron (Fe) and zinc (Zn) were determined according to the method of AOAC [15], using Atomic Absorption Spectrophotometer, Perkinelmer 2380. The flame photometer was applied for potassium (K), Phosphorus (P) and sodium (Na) determination according to the method described by Pearson (1976).

Results and Discussion

Morphological Characterization of Dates

Date Varieties	Colore	Weight Date P.D (g)	Weight Pulped P.P (g)	Weight Core P.N (g)	Report P.P/P.D (%)	Report P.N/P.D (%)	Group
ARichetti	golden brown	14.05±0.03	12.89±0.01	1.56±0.02	91.75	11.10	A
Degletnour	golden brown	14.69±0.05	13.8±0.015	0.9±0.08	93.94	6.13	A
Elhora	brown	14.38±0.20	13.34±0.11	1.04±0.05	92.77	10	A
Mechedgla	Yellow Brown	5.68±0.015	4.74±0.017	1.21±0.11	83.45	21.33	B
Elhamraya	red brown	5.77±0.01	4.76±0.12	1.26±0.22	82.45	21.83	B
Saffray	Golden	7.22±0.048	6.15±0.301	1.07±0.22	85.18	14.82	B
Tantboucht	black brown	9.87±0.083	8.63±0.114	1.77±0.108	87.44	17.93	B
Noyetha yatelolech	Dark brown	10.24±0.03	9.13±0.014	1.32±0.11	89.16	12.82	B
Haloyate loulech	light brown	7.338±0.048	6.548±0.208	1.186±0.22	89.23	16.22	B
Radbet bencharif	Dark brown	6.31±0.117	5.435±0.301	1.144±0.01	86.12	18.13	B
Ghars	Dark brown	3.58±0.081	2.68±0.118	0.89±0.11	75	25	C
Tinicine	black brown	4.64±0.02	3.52±0.135	1.031±0.102	75.94	22.25	C

Hong-jamel	Amber Brown	4.09±0.108	3.04±0.20	0.96±0.01	74.33	23.47	C
Mekn-etchy	Yellow orange	5.57±0.031	4.31±0.107	0.86±0.15	77.38	15.44	C
Elhylioa	brown Red	5.17±0.015	4.18±0.115	1.14±0.22	80.85	22.05	C

Table 1: Color and Weight of Dates Varieties.

Date Colors

The color of the dates is a fundamental parameter for the marketing of the dates, where the greater part of the consumers preferred the color (golden or honey aspect), on the other hand there are dates have a color revealing to the black take a good taste [16].

From the table 1, the color of the dates studied is not homogeneous; nevertheless the brown color predominates, spreading between yellow, yellow orange, brown, brown black and black, with the exception of the tantbouchet, tinicine, and hamraya varieties which represents a black brown and red brown color due to the presence of polyphenols in significant quantities in advanced maturation stages. Indeed, the study by Acuorène et al., shows that out of 54 Algerian varieties, 50% are in brown color followed by 31% yellow and 16% black, against 3% red [17]. It is concluded that color is an essential criterion of approximation the dates whose choice differs from one country to another, where in Saudi Arabia and Arab Emirates the dates of yellow color on 70% of marketing [18], against in Qatar, Bahrain, Kuwait and Oman the red dates represent a 64% marketing value [19].

Weight of Dates and their Constituents

The weight of the dates is a quality decisive factor that makes the difference between the different varieties. Table 1 shows the weight of the dates studied and their components (pulp and kernel) as well as the Pulp/Date and Kernel/Date ratios.

The variety with the highest weight is the variety degletnour (14.69g), with a pulp weight of 13.8g and kernel weight of 0.9g, the varieties ghars, tinicine, hongjamel, mecknetchy, and elhylioa have the lowest weight of 3.58 g, 4.64g, 4.09g, 5.57g and 5.17g respectively, with a ratio (pulp/ date) of 75%, 75.94%, 74.33%, 77.38%, and 80.85% in that order. We also note that the varieties (arichtti, degletnour, and elhora) have a vital ratio (pulp/ date) of 91.75%, 93.94%, and 92.77% respectively, because the weight of the pulp almost all the weight of dates, while the varieties mechdegla, hamraya, tantbouchte, sfaray, noyethaloiteloulache, haloiteloulache, and radbetbencharife comprise a ratio (pulp/ date) of 83% to 89%.

The results of the variance analysis of the date weight parameter show a significant difference between the dates studied. Table 1 shows that the tantbouchte, sfaray, noyet haloiteloulache, haloiteloulache, and radbetbencharife varieties constitute a homogeneous group (B) with a higher weight in comparison with group (C) which includes the varieties: mecknetchy, elhyloia, hongejamel, ghars, and tinicine. The varieties degletnour, arichtti and elhora show a very important weight equal or greater than 14g, which allows it en route for group independently to the other varieties of dates studied group (A).

Date Length and Width Characterizations

Table 2 shows the length and width of fifteen varieties studied, single-factor variance analysis (ANOVA1) of the (length and width) parameters show a significant difference at a 5% probability threshold between the dates varieties studied. The size of the different date varieties varies between 48 and 24 mm of average length and with 15 to 24mm of average width. It is noted that the variety Arichetti exhibits the largest size with a Length of 48.54 mm and a width of 22.50mm, followed by the varieties Alhora and degletnour which has a Length of 47.79mm, 46 mm and 19.9mm, 22mm width respectively. The variety with the smallest size is the hamraya variety with 13.54mm in length and 10.05mm in width. In conjunction with other studies, we note that the morphometric characteristics of dates differ from one variety to another and from one region to another. This morphological diversification could be due to date cultivars, but also to ecological factors and growing conditions [20].

Date Varieties	Length Date (mm)	Width Date (mm)	Length Core (mm)	Width Core (mm)
Ghars	34.55±0.1	16.7±0.14	21.82±0.1	7.83±0.4
Degletnour	46.02±0.2	22.5±0.08	26.55±0.3	7.82±0.1
Elhora	47.79±0.1	19.9±0.03	24±0.6	8.23±0.9
Hongjamel	29.23±0.1	16.7±0.05	19.35±0.1	8.81±0.2
Mechedgla	25.85±0.2	15.2±0.01	20.33±0.8	10±0.1
Meknetchy	30.64±0.1	17.5±0.2	21.05±0.1	8.14±0.8
Saffraye	33.26±0.1	19.8±0.1	22.18±0.5	8.3±0.05
Elhylioa	34.11±0.3	15.3±0.31	20.06±0.1	11±0.03
Tantboucht	24.24±0.1	23.5±0.15	18.32±0.7	10.03±0.05
Noyet ha lyatelolech	40.41±0.1	25.05±0.1	25.02±0.04	9.05±0.14
Haloyate loulech	38.23±0.3	23.11±0.31	23.11±0.14	8.65±0.11
Radbet ben-charif	37.81±0.1	23.5±0.1	22.05±0.03	9.58±0.04
ARichetti	48.54±0.1	22.5±0.03	25.05±0.1	5.35±0.12
Tinicine	14.24±0.1	10.5±0.03	10.05±0.2	3.05±0.13
Elhamraya	13.54±0.2	10.05±0.1	10.84±0.2	3.21±0.04
F Value	95.301	15.369	23.301	3.369
Probabilité (4%)	$1.6935*10^{-19}$	$4.6391*10^{-3}$	$2.33635*10^{-10}$	$0.6391*10^{-4}$
F Critique	2.156978	2.136598	1.333378	0.33398

Table 2: The length and width of dates and their cores.

Physico-Chemical and Biochemical Results of the Dates Studied

Table 3 summarizes the physico-chemical properties found in the fifteen varieties dates of Loudaya experimental area of our CRSTRA research centre.

Water Content of the Dates Studied (Humidity)

The water content is an essential quantity for the determination and careful guidance of harvesting and conservation operations. Dates with humidity between 10% and 24% have a good character [21]. In our study, the fifteen varieties of dates have varying water contents between 14% and 33% therefore have good quality. It is

Date Varieties	Water Content (%)	Total Ash (%)	pH	Reducing Sugars (% MF)	Total Sugars (% MF)	Quality Index r	Polyphenol (EAG mg/100g MF)
ARichetti	23.44±0.81	2.62±0.38	5.97±0.05	31.36±0.07	71.06±0.03	3.03	119±0.12
Degletnour	28.19±2.43	1.65±0.06	5.75±0.11	39.28±0.32	73.64±0.07	2.61	200±0.13
Elhora	26.69±0.77	1.89±0.38	5.89±0.18	30.6±0.05	70.22±0.08	2.63	103±0.07
Houngeljamel	17.73±0.22	2.05±0.16	6.5±0.14	28.07±0.79	44.75±0.05	2.53	90.13±0.11
Meknetchy	15.32±1.75	2.06±0.41	6.45±0.09	24.59±0.98	59.77±0.025	3.90	61.51±0.01
Saffraye	33.7±0.38	1.72±0.38	6.89±0.24	40.46±0.5	45.77±0.025	1.36	75±0.03
Tantbouchtte	28.79±2.05	2.09±0.23	6.62±0.09	44.14±0.45	52.31±0.02	1.82	89.3±0.07
Mechdegla	16.93±2.05	2.11±0.23	5.79±0.31	25.00±0.98	64.77±0.025	3.82	65±0.07
Elhyloia	30.52±0.38	2.62±0.38	5.78±0.38	28.46±0.5	45.77±0.025	1.50	81.3±0.09
Noyet halyatelolech	14.13±0.18	2.64±0.03	6.45±0.09	28.70±0.98	49.87±0.05	3.53	79.3±0.05
Haloyate loulech	15.52±0.03	2.52±0.15	6.35±0.14	35.09±0.98	59.17±0.06	3.81	68.4±0.36
Radbet bencharif	30.02±0.01	1.66±0.08	5.70±0.01	43.09±0.98	58.97±0.19	1.96	60.6±0.25
Gharss	30.22±0.43	2.28±0.59	5.77±0.51	44.68±0.62	59.97±0.03	1.98	63.5±0.05
Tinicine	19.95±0.03	2.62±0.38	6.77±0.51	28.69±0.09	49.97±0.03	2.50	92±0.28
hamraya	21.32±0.13	2.62±0.38	5.67±0.51	31.09±0.08	60.97±0.03	2.85	110±0.61
LSD at 0.05	65.6	10.226	230.226	100.6	130.6		90.6
Probabilité (4%)	1.99583 *10-19	2.6852 *10-2	3.6852 *10-20	2.118 *10-19	3.9658 *10-18		1.669358 *10-17
F Critique	3.000119	3.000119	2.149823	2.880119	3.000119		2.13669

Table 3: The physico-chemical properties found in the date varieties studied.

noted that the water content of the elhyloua, radbetbencharif, sfaray, and ghars varieties exceeds 30%, making them susceptible to microbial alterations, unlike other varieties. High water levels make the soft varieties susceptible to microbial colonization, including fungal flora [22]. The study carried out by kenfhar [23], showed that the varieties of dates deglet nour, gharss and mechdeglat of the region Feliache Biskra reach a water content of 22.6%, 25.4% and 13.7% respectively, slightly different with our dates (deglet nour, gharss and mechdeglat) of Loudaya where reach a water content of 28.2%, 30.22% and 15.93% respectively. Subsequently, the difference in climatic conditions has an effect on changes in the weight, dimensions and moisture content of dates [24,25].

Ash Content of the Dates Studied

The ash rate represents the total amount of mineral salts in the sample. They are expressed as a percentage of dry matter. The rate of ash of the fifteen varieties diverge between 1.65% and 2.60%.The highest ash rate is attributed to the variety noyethaoyetteloulеche 2.64%±0.03. While the variety degletnour is characterized by the lowest ash rate 1.65%±0.06. These results are similar to those in the literature because Gourchala reported an ash rate of 2.42%, 2%, 1.64% respectively for El H'mira, Ghars and Deglat-Nour [26]. Many authors, including, agree that the date contains 2% ash [20,27-29].

pH

The pH is the indivisible of the parameters determining the ability to preserve food.

It is one of the main obstacles that the microbial flora must overcome to ensure its proliferation [30-32]. Thus a pH of about 3 to 6 is very favorable to the development of yeasts and moulds, which cause alterations that mainly affect the organoleptic quality [33]. Since pH is a factor that determines the quality of dates. Indeed in exploit the good quality date generally has a pH of about 6 and a meager quality date have pH less than 5 [34]. When the pH decreases, the taste of the dates becomes acidic, significantly reducing the quality of the date [35]. Based on the pH results in Table 3, the pH of the varieties studied varies between 5.67 and 6.89. Saffraye has the highest pH value 6.89±0.51. While the variety hamraya characterized by the lowest pH 5.67 ±0.51, and the pH of deglettenour 5.75±0.51 in agreement with Bessas A, et al., it is noted that the variety Deglet-Nour from Algeria has a pH 5.7±0.51 [32].

The Content of Reducing Sugars

Sugars come in two forms: sucrose and reducing sugars. Reducing sugars main are fructose and glucose but dates contain other sugars such as Arabinose, Galactose and others. During the maturation of dates, sucrose is converted into reducing sugars by inverts and the amount of sucrose decreases as it matures [36]. This reversal continues even during the storage of dates. The different values of reducing sugars expressed as a percentage of the dry matter are shown in table 3, the highest level of reducing sugars is given by the varieties gharss, saffray, radbetbencharif and tantbouchte, with value varied between 40% and 45%, the varieties degletnour, arichti, elhora, halyateloulache and hamraya are characters by the middle content of reducing sugars varied between 30% and 40%. Whereas hongeljamel, mechdegla, tinicine, noyethaletlouleche, elheloya, and mechdegla are characterized by the lowest content of reducing sugars ranging from 29% to 25%. However, the content of reducing sugars in Algerian varieties; Deglet Nour (semi-soft), Degla-Beida (dry) and Ghars (soft) fluctuates between 13 and 70% [37]. In addition, Sawaya et al., who have worked on Saudi varieties report date-reducing sugars levels at the tmar stage ranging from 37.6 - 58%. Dry date varieties contain high levels of sucrose [38], on the other hand, soft varieties are very rich in reducing sugars, and semi-soft varieties contain as much sucrose as reducing sugars [39].

Total Sugar Content

Sugars are the most important components in dates, and they are a responsible for the sweetness of the food [40]. Total sugars expressed in relation to dry matter, according to Table 3 the results show a significant difference between the studied varieties of dates (p 0.05) where the highest total sugar content is attributed to degletnour, elhora, and arichti with a higher value of 70%. The varieties date include the total sugar various between (55% to 65%) are mecknethchy, mechedegla, halyote loulache, radbet bencharif, gharss, et hamraya, and the varieties hongeljamel, saffray, tantbouchte, elhyloia, noyethaloteloulech and tinicine have total sugars values varying from 45% to 55%. These results appear to be consistent with those of the literature as Gourchala found the total sugar content of 65.52 %, 58.39 %, 73.45 % for elh'mira, ghars and deglat-nour varieties respectively [26] and Taouda found total sugars levels of 58.73% for degla-beida and deglat-nour [22]. Where Acourene S. and Tama M. estimate the total sugar values of ghars 87.42%, tantbouchte 73.8%, mechdegla 75.1%, and elhora 82.46% [37]. This variation in total sugar concentrations can be attributed to differences between cultivars, maturation stage, and nature of sugar, storage and geographic dispersion (climate and soil type) [24,25]. A number of authors confirm the presence of sucrose, glucose and fructose but at different proportions according to the varieties [29]. Several studies on Saudi, Emirian and Omanian dates have shown that varieties containing only glucose and fructose have low total sugar levels [39-41].

The results reported by different authors depend in part on the method used. Nevertheless, everyone agrees that the total sugar content of dates is in the range of 50% to 60%. From the composition and nature of sugars also varies, depending on the consistency of the date.

The Consistency of Dates

The quality index r (ratio of total sugars/water content) is used to determine the consistency of the date, and allows the classification of dates into dry, semi-soft and soft dates [11,26]. According to table 3, we have the varieties: safray, tantbouchte, elhyloia, radbetbencharif and ghars have a soft indolence and their **r** inferior of 2, so are soft dates. The varieties of dates: arichti, degletnour, honegljamel, elhora, tinicine and hamraya have a half-dried texture moreover their quality index r varies from 2 to 3. Finally meknetchy, mechdegla, noyethaloteloulech and haloyeteloulech have dry up construction and have index **r** greater than 3.5, which introduced that are dried dates.

Total Polyphenols Content

Polyphenols are suffering from their antioxidant power and biological virtues, so they play an important role in the body according to [42-43]. Polyphenols have anti-inflammatory, antioxidant effects and are involved in the prevention and treatment of diseases related to oxidative stress such as cancer, cataract, atherosclerosis, diabetes, high blood pressure, neurodegenerative diseases, and arthritis.

The determination of total polyphenols gives us an overall estimate of the content in different classes of phenolic compounds contained in the date extract. From table 3, the polyphenols found in the dates studied are between 60 to 200mg EAG/100g MF. These results are higher than those reported by Mansouri et al. [44], on Algerian varieties (Tazizaout, Ougherouss, Akerbouche, Tazerzait, Tafiziouine, Deglet Nour, Tantbouchte) that range from 2 to 8mg EAG/100g MF. And the results that give values of 1.8 and 2.35% (MF) of total poly phenols for the Egyptian varieties Siwi (dry) and Amhat (soft) [45], but they were lower than that given by Besbes and al. which give average levels of 280,6, 431.5 and 681.5mg EAG/100g MS for the Tunisian varieties Kentichi, Allig and Deglet-Nour respectively [46].

However, the results of the determination of phenolic compounds do not indicate the exact values of polyphenols, since despite its high sensitivity, the Folin-Ciocalteu method may present interference problems, the Folin-Ciocalteu reagent can react with amino acids (tyrosine, tryptophan), reducing sugars such as glucose and fructose [47]. The different PPT levels of the date variety are the result of a number of factors, the main ones being: climatic and environmental factors (light, precipitation, topography, season and soil type) [48], genetic heritage: polyphenols are highly variable in concentration from one species to another and from one variety to another and decrease steadily during maturation, as well as during harvesting and storage by different routes of browning, and the extraction method and quantification method [49].

Minerals Content of Date Varieties

Dates contain some minerals: potassium, sodium, magnesium, phosphorus, calcium, iron and zinc. It contributes to the formation of teeth and bones. They play an important role in the formation of red blood cells and are involved in blood clotting. These elements are implicated in muscle shrinkage and proper functioning of renal function; in addition play an essential function in many vital processes such as immune defense, growth and regulating the mood of the human being.

Dates are rich in various mineral elements, some of which are well represented and used to characterize them, while others are only present as traces. From table 4, our analyses indicate the quantities of minerals by (mg/100g dry weight basis), results of the one-way pooled ANOVA showed a significant difference in the concentration means of all minerals ($p \leq 0.001$) for the different date varieties except for zinc ($p=0.05$). The minerals Potassium and phosphorus are high in fruit. For potassium, the value is minimum (426.46mg) for saffray and maximum (691.55mg) for ghars. For sodium, the values are lower, with a maximum (47.47mg) for tantebouchte and a minimum (17.81mg) for hongeljamel. For phosphorus, the value is lowest for noyethaloutelolache (44.15mg) and greatest (85.03mg) for mechdegla. It should be noted that the dates tantbouchte and saffraye whose potassium and phosphorus levels are minimal contain the highest level of sodium. In contrast, hamraya, which has the highest levels of potassium and phosphorus, has the lowest levels of sodium.

For calcium, the maximum level is 74.64mg for mechdegla and the minimum of 52.15mg for tinicine, halouteloulache and noyethaloute loulache cultivars. The variety degletnour have the higher quantity of magnesium with a 79.16mg followed by mechdegla 77.26mg, and the variety noyethalout loulache contain the least amount 46.55mg. For iron, the mechdegla, gharss, tincine and deglatnour varieties will have significant quantities (4.92mg, 4.24mg, 4.19mg, and 4.10mg) respectively. The level of mineral zinc varies between 2.29% and 1.07% for all the varieties studied. These analyses accepted with many of previous literatures which revealed that the date palm contains a suitable concentration of calcium, potassium, phosphorus and magnesium which are very important for human body and metabolic operations in the creature cells [50-52].

Date Type	Potassium mg/100g	Sodium mg/100g	Phosphorus mg/100g	Magnesium mg/100g	Calcium mg/100g	Iron mg/100g	Zinc mg/100g
ARichetti	653.69±2.52	30.91±1.92	83.65±0.07	74.63±0.31	66.00±4.27	4.08±0.23	2.02±0.37
Degletnour	649.67±7.30	29.98±1.45	84.51±1.33	79.16±0.26	70.57±2.43	4.10±0.61	2.14±0.48
Elhora	670.83±3.52	26.17±1.06	76.56±1.49	47.40±0.34	70.55±0.64	3.60±2.65	1.83±0.39
Houngel jamel	545.97±6.20	17.81±3.49	65.41±1.13	56.89±0.67	62.34±1.36	2.25±1.40	1.98±0.42
Meknetchy	552.90±5.27	32.56±1.44	72.36±1.75	67.55±1.06	65.06±0.27	3.31±2.96	1.90±0.30
Saffraye	426.46±4.74	55.04±1.18	51.60±1.66	53.33±1.85	56.45±1.20	1.50±6.08	1.07±0.38
Tantbouchte	566.56±5.63	57.47±1.03	69.27±1.64	62.70±1.38	64.55±1.16	4.17±3.11	1.85±0.45
Mechdegla	681.74±1.44	42.83±1.62	85.03±1.75	77.26±4.26	74.64±1.47	4.92±2.43	2.03±0.41
Elhyloia	656.75±3.80	35.0 ±2.18	72.42±1.47	65.65±2.47	62.2 ±1.89	2.08±2.01	1.15±0.37
Noyetha lyatelolech	606.95±2.11	21.13±2.50	44.15±1.03	46.55±1.09	52.34±1.75	2.71±2.89	1.96±0.34
Haloyate loulech	627.88±1.21	42.44±2.56	41.63±1.29	57.77±0.91	52.48±1.58	2.97±0.43	1.77±0.31
Radbet bencharif	664.43±1.61	20.29±1.08	47.53±0.22	63.54±1.72	58.47±0.79	2.09±2.99	1.73±0.25
gharss	691.55±1.05	33.25 ±2.8	83.12±1.15	58.71±2.31	62.15±1.21	4.24±2.33	2.29±0.32
Tinicine	614.43±1.05	30.14±2.03	80.42±1.05	53.64±1.02	52.15±1.30	4.19±2.33	2.09±0.02
hamraya	654.33±0.35	30.54±0.33	80.02±1.10	60.54±1.32	62.15±1.21	4.12±2.33	2.11±0.12
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0005

Table 3: The physico-chemical properties found in the date varieties studied.

Conclusion

- The study of the biometric, physico-chemical characteristics of some date varieties in the palmerai of the Loudaya experimental area of our CRSTRA research centre shows that we have:
- The existence of morphological differences between the fifteen varieties of dates and in particular the size and weight. The analyses showed significant dissimilarity for all parameters measured in the fifteen varieties studied. In which the total water content and sugar content, allow to know the consistency of each variety of dates, mutually to the reducing sugars that characterize the dates with a half-soft consistency, dark color and soft texture.
- These dates are fruits rich in biologically active substances (phenolic compounds), which gives them great interest in terms of validation.
- The content of minerals; phosphorus, potassium, sodium, calcium, magnesium, iron and zinc in the dates studied varied depending on the variety to another, ripening stage, agronomical practices and environmental conditions.
- These dates are an internal source of natural energy and therefore a functional food or a functional ingredient for food products.
- Finally, a distinctive gathering must be given to these varieties, their intolerance, their popularization and the subsidy to farmers would allow their commercial and technological development at national and international level.

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