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Valorization of Algerian Semi-Soft Date and Traditional Preparation of Date Syrup: Physicochemical and Biochemical Properties

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***Abstract*— In Algeria, the production of dates occupies a large part of Saharan agricultural production. The wilaya of Bechar is one of the most productive regions for dates, where more than half of their production is considered as a second quality dates which are sold by barter or used as animal feed. Families in these regions use this type of date to prepare by-products, namely; date syrup locally called "*Robb*". The preparation of this type of product is limited and confined to the individual scale. The aim of this study is to highlight the physicochemical and the biochemical quality of this home-prepared artisanal product by comparing it to two others marketed in the wilaya of Bechar and of El-Bayadh (Algeria).**

The physicochemical and the biochemical results of the three analyzed samples showed an acidic pH value ranged from 4,26 to 4,7, a degree of acidity ranging from 8,2 to 12%, a soluble solids content of 64 to 75%, a total sugars and reducing sugar content of 51 to 63,6 and 40 to 52% respectively. While the water content is relatively high ranging from 28 to 37%, and a significant potassium ions content compared to sodium ions varies from 195 to 555 and from 5,8 to 137mg/L respectively. These characteristics are not only considered as a high added value to the product which enhances the value of the second-quality low marketing dates but also contributes to increasing their shelf life, constituting an economic priority for the oasis' inhabitants of the Southern Algeria region.

***Keywords*—*Hmira* dates variety; date syrup (*Robb*); Physicochemical and biochemical properties; Valorization; Bechar; El-Bayadh (Algeria).**

I. INTRODUCTION

God Almighty says in Quran 16:67 [1] *after In the Name of God, the Most Gracious, the Most Merciful :* ***'..., and from the fruits of palm trees and grapevines you derive intoxicants as well as wholesome provision. Surely in this is a sign for those who understand'****. Great truth of God*. With more than 18 million date palms, 940 cultivars identified and a production of more than 7 million quintals per year, Algeria is one of the largest countries with a strong phoenicultural potential [2,3]. The importance of date fruit comes not only from its nutritional quality which is a main component of the diet of several countries in view of the richness of dates in sugar and mineral salts, but also comes from the contribution of the date sector in the national economy [3,4,5].

There are different types of dates: wet, semi-wet and dry dates, and for each variety there is a particular method of use [6]. However, thousands of tons of dates are not subject to real industrial outlets for their recovery [7,8,9,10], and common dates such as *Degla Beida* and *Mech-Degla* are of an economic importance [11], while other cultivars produce dates with a low market value constitute a marketing problem to be resolved, and in general are very poorly exploited, except some varieties, pushing farmers to a selective orientation, otherwise to an industrial valorization [12].

In fact, in the field of the dates' technology, and its valuation, the used systems have remained archaic [13]. For this reason, many traditional techniques are involved in the common dates transformation into several date derivatives, namely: honey, vinegar, jam, date syrup also called (*Robb*), date sugar, date flour [12,14]. "*Robb*" or date syrup: molasses or date jam are characterized not only by their interesting nutritional and organoleptic quality, but also by their therapeutic virtues [12,15].

This traditional knowledge is experiencing a clear decline which threatens to disappear, and actions to promote it are still insufficient [16], and in this context, this study aims to establish the traditional knowledge by elucidating the physicochemical and the biochemical properties characterizing date syrup (*Robb*).

II. MATERIAL AND METHODS

A. Sampling

There is no date sampling method, however the most widely used method is that cited by Girard [17] which recommends the choice of homogeneous palms for each cultivar [18]. Below the *Hmira* date variety as well as the date palm '*Phoenix dactylifera* L'. (Figure 1).

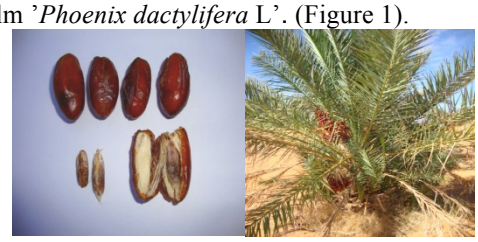

Fig. 1 *Hmira* date variety [12].

Date syrup (*Robb*) prepared according to traditional practices under hygienic conditions from *Hmira* dates variety, according to the method described by Benyagoub et al., [18], which is considered as the first sample (S1) (Figure 2), while the other two samples (S2 and S3) were purchased from the local market of the wilaya of El-Bayadh, and of Bechar respectively. The preparation steps of date syrup is shown in Fig.3

Fig. 2 Date syrup (Source: Original, 2019).
(**S1**): Date syrup sample prepared at home according to the traditional method; (**S2**): Date syrup sample marketed in the wilaya of El-Bayadh; (**S3**): Date syrup sample marketed in the wilaya of Bechar.

Fig. 3 Traditional Algerian date syrup recipe of *Hmira* date variety (Source: Original, 2019)

B. Robb's physicochemical and biochemical analyses

The three samples of date syrup were subjected to physicochemical and biochemical analyses according to the standards as follows:

• The pH parameter was measured by a pH meter (Adwa AD1040, Romania) according to standards [19];

• The water content was determined by the thermogravimetric method, where 1g of sample is placed in a porcelain capsule, and then dried in a ventilated oven at atmospheric pressure, at a temperature of 103±2°C [20]. The result was expressed in (%).

• The titratable acidity was determined by titration method of an aqueous date solution with a sodium solution NaOH (N/9) in the presence of phenolphthalein (1%) as an indicator according to standards [21]. The result was expressed in (%).

• The ash content was determined by the calcination method at 550°C for 3 hours in a muffle furnace (Nabertherm, Germany) until whitish ash of constant weight to be obtained [22]. The result was expressed in (%).

• The total soluble solids content (TSS or SS Brix rate) was determined by a refractometer (Convex 8200 Medline Scientific, UK) according to the method described by AFNOR [23]. The result was expressed in (%).

• Electrical conductivity expresses the ability of an aqueous solution to conduct an electric current. It correlates with the content of soluble salts [24] where it was determined by a conductimeter (Hanna, Romania). The result is expressed in µs/cm.

• The sugar content was determined by the method described by Dubois et al., [25] using phenol and concentrated sulfuric acid. In the presence of these reagents, the sugars give a creamy yellow color, the intensity of which is proportional to the concentration of total sugars. The absorbance is determined using a UV-visible spectrophotometer (Analytik Jena AG Spekol 1500, Germany) at the wavelength 490nm [26]. The result was expressed in (%).

• The determination of the sodium and potassium ion content was carried out by atomic flame emission photometry (Jenway PFP7 flame photometer, UK) [27,28]. The result was expressed in mg/L.

• The density of date syrup is determined by pycnometry based on the determination of the mass of the tested material placed in a pycnometer of known volume at 20°C. To calculate the density: the obtained weight is divided by the volume of the tested liquid [29].

The methods should be written clearly in this section along with their references.

C. Statistical analysis of data

The different analyses were carried out in two trials (duplicate) to confirm the obtained results, where the average value was used for each parameter, on which the graphical presentations in the form of a curve were plotted using the Origin Lab software (2018).

III. Results and Discussion

The physicochemical and the biochemical results of the analyzed *Robb* samples are given in Figures 4 to 10.

A. pH and titratable acidity

The pH of the analyzed samples of the date syrup prepared from *Hmira* variety was varied from 4,26 to 4,70. These values corroborate the results of a previous study carried out on the date extract of the *Hmira* variety reported by Benyagoub et al., [18], where the analyzed product was characterized by a pH ranging from 4,1 to 4,2. However, they were closer to that given by Barreveld [30], with values ranging from 4,14 to 4,60 (Figure 4). The variation in pH is due to the composition of the used date, as well as the storage condition and the manufacturing process. The obtained results corroborate those given by Bouzidi and Aribi [31] which was 4,77; and were higher compared to the value obtained by Bendida and Messaoudi [14] which was 4,03. According to Touily and Belloula [32], date syrup, like any sweet solution, is an acidic product. They report a pH value equal to 4,60.

The titratable acidity of the analyzed samples showed an acidity level of 8,20 to 12,06% (Figure 3). These rates are comparable to the acidity rate given by Bouzidi and Aribi [31] which was 12,5%.

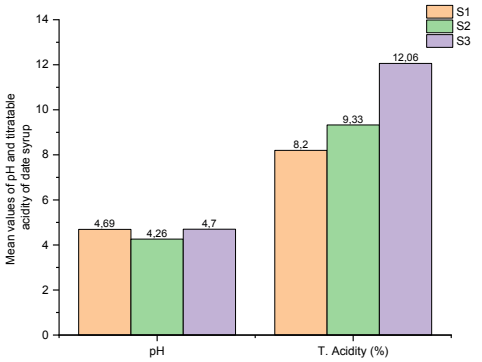

Fig. 4 pH and titratable acidity results of the *Robb* samples.

B. Water and total soluble solids content

The water content of the analyzed samples varied from 28 to 37% (figure 4). These values are higher than those found by Touily and Belloula [32] ranging from 26,33 to 27%, and also higher than that reported by Benyagoub et al., [18] and Rambabu et al., [33] which was 17,75 and ranging from 14,8 to 20,5% respectively, and lower than those given by Bouzidi and Aribi [31]; Alanazi [34] (16%). The water content varies depending on the manufacturing process, the volume of used water, the temperature and the cooking time. All these parameters have an impact on the concentration of date syrup constituents.

The rate of total soluble solids (TSS or SS) of the analyzed samples was varied from 64 to 75% (Figure 5). These values are comparable to those found by [14, 35, 36] who found a value of 70%. A rate of 86,5% was reported by [34, 37], and remain lower than the results reported by Benyagoub et al., [18], where the dry matter content was high up to 82,25%.

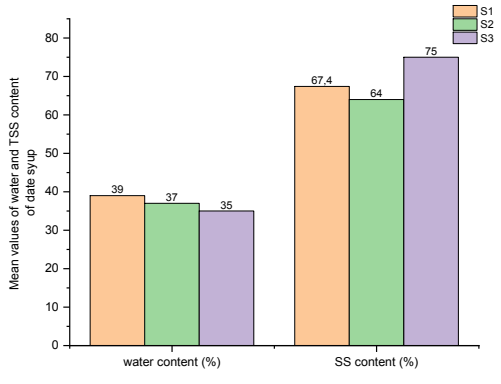

Fig. 5 The water and total soluble solids content of the *Robb* samples.

C. Electrical conductivity and total ash content

The ash content of the analyzed samples varied from 1,16 to 1,82% (Figure 6). These results are comparable to the values given by Bouzidi and Aribi [31] which was 1,8; and by Barreveld [30], Al Eid [37] (1,5%), and that reported by [18, 33] which ranged from 1,62 to 2,12 and 1,37 to 1,97% respectively.

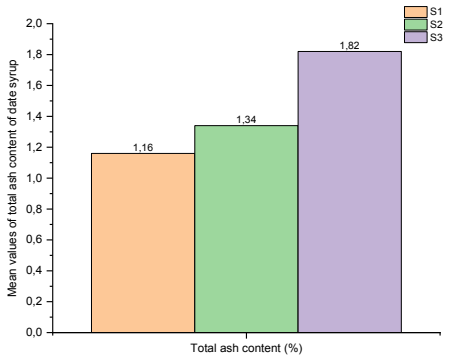

Fig. 6 The total ash content of the *Robb* samples.

The electrical conductivity varies from a sample to another, and ranged from 246 to 1160 µs/cm (Figure 7). This result was lower than that reported by Benyagoub et al., [18] where the obtained electrical conductivity varies from 3380 to 3730µs/cm. This variation is mainly due to the mineral composition of dates as a raw material, and the quality of used water in the preparation of *Robb* product.

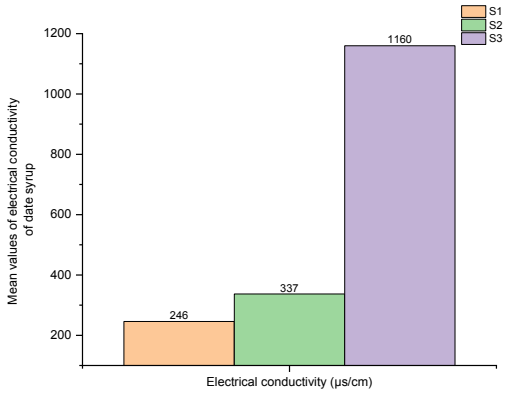

Fig. 7 The electrical conductivity of the *Robb* samples.

D. Sodium and potassium ions content

According to the obtained results, the *Robb* samples were rich in potassium ions compared to sodium ions where the obtained values varied from 195 to 555 and from 5,8 to 137mg/L respectively (Figure 8). This corroborates the result reported by Khalil et al., [38] where the sodium content ranged from 69,97 to 86,97mg K^+/100g of dry matter. Potassium was further identified as the major microelement in all date varieties analyzed by Rambabu et al., [33].

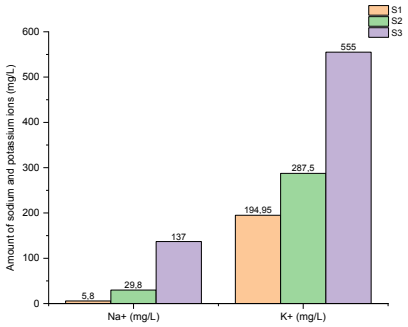

Fig. 8 Sodium and potassium ions content of the *Robb* samples.

E. The density

Based on the obtained results, the density of the *Robb* samples ranged from 1,30 and 1,37 g/ml (Figure 9). These results corroborate the result reported by Boulal et al., [10], where the density value was 1,375 g/ml.

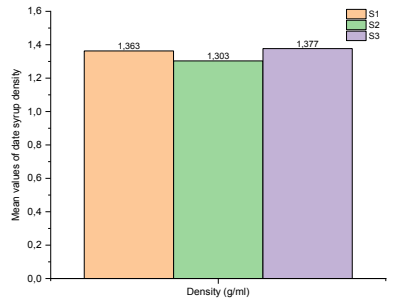

Fig. 9 The density of the *Robb* samples.

F. Total sugars and reducing sugars content

The total sugar content of the *Robb* samples ranged from 51 to 63,6%, and from 39,73 to 52,46 for the reducing sugars (Figure 10). These values were lower than the results reported by [31, 32, 37, 14, 39, 40, 18] where the obtained total sugar content was 68,12; 79,45; 81; 70; 79,45 and ranging from 34 to 40% respectively.

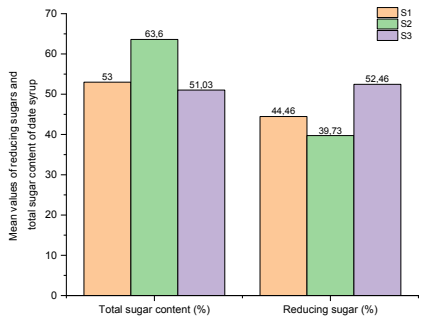

Fig. 10 Total sugars and reducing sugars content of the *Robb* samples.

According to the study results carried out by [18, 15], the date extract of the *Hmira* variety was poor in proteins and lipids, and has levels that do not exceed 1,5 and 0,4% respectively, argued by the study conducted by Rambabu et al., [33] where the protein and the lipid content of the analyzed dates ranged from 2,19 to 3,12% and from 0,25% to 0,51% respectively. For that, the production of date syrup as a by-product can be an optimal method for increasing the added value of the low-quality dates, which is not limited by '*Hmira'* dates variety but also suitable for different dates' varieties [41, 42].

The composition of *Robb* samples can be affected by various factors such as variety, growing conditions, date fruit ripeness, and storage conditions [18]. The physicochemical and the biochemical results of the analyzed date syrups were found to be comparable with the results reported in several studies held in Algeria or other countries, namely Libya and Iraq.

IV. Conclusion

The determination of the dates' composition as raw material, as well as their by-products, is necessary in order to consider a better valuation, hence the importance of the analyzed physicochemical and biochemical parameters. The obtained results confirm the richness of the analyzed product in sugars and reducing sugars of up to 63%, which gives it a high energy power. This product has a high water content of up to 37% which depends on the manufacturing process, a parameter that not only determines the macro and the microelements' concentration but also, the shelf life of the *Robb* product.

In general, and in the light of the obtained results, it can be concluded that date syrup has a good dietary quality as a valued by-product with a high added value, where the scaling up of this traditional preparation and in addition to other date derivatives, undoubtedly constitute an economical priority to promote the standard of living of the oasis inhabitants of southern Algerian regions, with a vision in the future to expand the production and promote by-products, especially those made from dates of low commercial quality that are produced in huge quantities.

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