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Classification of some date cultivars

Algerian soft consistency according to their glycemic index

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Abstract :

Dates are the fruits of the date palm (*Phoenix dactylifera* L.), they are highly appreciated by the Saharan population. They are classified as carbohydrate foods. These tend to raise blood sugar levels. The objective of this study is to classify the dates of six soft cultivars (Ghars, Itima, Bentqbala, Aliwrached, Mizit and Tinissine) the most answered in the South-East region of Algeria according to their Glycemic Index (GI) and to check their glycemic power in order to establish a good management of the consumption of these fruits. especially for diabetics and the obese. Initially a qualitative and quantitative characterization of carbohydrates realized for the cultivars studied, followed by dietary characterization (GI determination). The thin layer chromatography (TLC) shows the presence of reducing sugars in all investigated cultivars. Biochemical analysis recorded levels of total sugars varied between 65.84% ± 0.61 and 89.89% ± 0.05, reducing sugars contents fluctuate between 58.38% ± 0.03 and 75.28% ± 0.05%, that of sucrose is between 5.71% ± 0.1 and 17.66% ± 0.03. The pectins oscillate between 1.88% ± 0.21 to 4.43% ± 0.6. The GI values obtained seem low, they are equal: 31.01, 35.99, 36.50, 42.42, 49.00 and 51.80 respectively for Itima, AliWrached, Tinissine, BentQbala, Ghars and Mizit. Low GI foods do not cause a significant increase in postprandial blood sugar. We can classify the dates of six cultivars studied among low GI foods because (< 55). This allows us to develop adequate food management strategy for diabetics and the obese.

Key words: Soft dates, glycemic index, classification, diabetics, Ouargla, Algeria.

1. Introduction

Oasis agriculture which is practiced intensively in a desert environment or strongly marked by aridity, is based on the cultivation of the date palm (*Phoenix dactylifera* L.) (Chniti, 2015). Dates from the date palm play an important role in the economic and social life of the Saharan populations (Taouda et al., 2014). These fruits are very appreciated by the Saharan population. They constitute a very important energy source by their richness in carbohydrates, fibers… etc. It is known that the consumption of carbohydrate foods causes different elevations in blood sugar for an equivalent carbohydrate intake. Indeed, the speed of digestion of carbohydrates in a food depends on its complexity, in particular its fiber, fat and protein content. In addition, technological and culinary treatments and the inherent characteristics of the raw material are all factors that can influence this speed. The glycemic index and glycemic load are two tools which allow a qualitative and quantitative estimation of the carbohydrates ingested and inform us about their glycemic effect (Jenkins et al., 1987 and David, 2011). The food behavior of the Saharan populations is based on the consumption of dates most often accompanied by goat milk. The native consumer suggests that this fruit would be non-hyperglycemic for certain cultivars, in this case "Addela" (MImouni and Siboukeur, 2014). Since dates contain substances other than glucose (whose GI is by convention equal to 100), namely fructose and fibers whose respective GIs are equal to 20 and 0 (David, 2011). In this context, we are proposing to classify six cultivars (Ghars, Itima, Aliwrached, Bentqbala, Tinissine and Mizit) of soft dates from South-East Algeria that are the most widespread in the Ouargla region according to their glycmic index and to verify thus their glycemic power.

2. Material and Methods

2.1. Material

The material used in this study is based on plant material (date cultivars). The choice of cultivars Ghars, Itima, Ali w Rached, BentQbala, Tinissine and Mizit is justified by their relative abundance in the region of South-East Algeria (Ouargla), their membership in the class of soft cultivars and their appreciation, consumption and marketing by the people of the south. Two (2) kg of the same date cultivar are harvested at the stage of complete maturation (Tmar) in November 2018 and stored at 4 ° C (Fig. 1). In general, these cultivars can be eaten unaltered or intended for technological transformation into multiple products. 50%

glucose (50 g of glucose in 100 ml) is used as a reference food, this solution was provided to us by the laboratory of the Mohamed Boudiaf Hospital. Seven healthy volunteers (non-diabetic), their fasting blood sugar varies between 0.87 and 1.10 g / and post-prandial varies between 1.17 and 1.32 g / l are selected for the classification of soft dates. These volunteers were subjected to various tests before their selection (weight, age,height,etc.)(Table1)

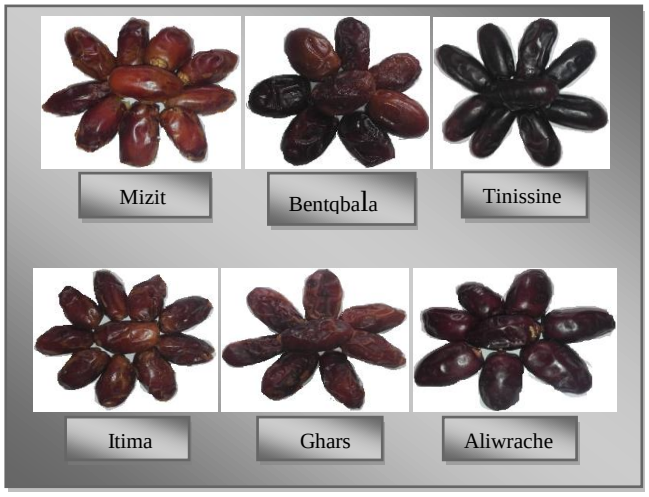


Fig. 1: Date cultivars studied

Volunteer	Age (years)	Weight (Kg)	Height (m)	BMI (Kg /m^2)	Blood sugar (g /l)
1	26	59.5	1.60	23	0.88
2	26	65	1,75	21	0.97
3	24	56	1, 62	23,5	1.04
4	24	59	1,69	21	0.81
5	29	75.5	1 ,75	24	0.94
6	26	77	1,74	25	0.80
7	30	63	1,73	21	1.01
Mean ± Standard Deviation	26 ±2.71	65.68 ±7.87	1.70 ± 0.06	22.5 ±1.51	0.94±0.09

BMI : Body Mass Index

2.2. Biochemical characterization

Chromatographic analysis (TLC) is performed by thin layer chromatography of silica gel for date extracts, it concerns the identification of major sugars in dates, such as sucrose, glucose and fructose (Randerath, 1971). The solvent system used acetic acid / water / chloroform (ml)

56/2 / 44. The major sugars in dates are glucose, fructose, and sucrose. In the present study we quantitatively assayed these compounds of high energy value by the method described by AOAC, (2005). The pectins are determined in the form of calcium pectate, after extraction with hot water, then saponification with NaOH and precipitation with CaCl2 in acetic medium (AOAC, 2005).

2.3.Determination of the glycemic index

The determination of the glycemic index in accordance with the method recommended by the FAO / WHO (1998), the measurement method must be carried out in the presence of at least 6 subjects healthy, the result corresponding to the mean of the values obtained in the different subjects. For the present study, we opted for a human cohort of 7 volunteers (sex feminine).

2.4. Food preparation (test and reference)

Date cultivars contain varying amounts of sugar. By estimating this total sugar content, we determined the adequate quantity of dates that contains 50 g of carbohydrate. (Table 2). The reference food (glucose) is a solution prepared with 50 g of anhydrous glucose in 100 ml of distilled water.

Table 2: Quantity and number of dates consumed by each visit and for each volunteer.

Cultivars	Quantity equivalent to 50g of carbohydrates	Number of dates consumed by voluntary
Ghars	55.66g	6
Mizit	67.71g	12
BentQbala	55.56g	7
Ali w Rached	63.45g	9
Itima	48.97g	5
Tinissine	48.02g	7

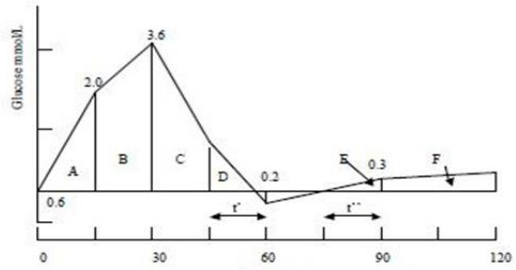
2.5. Blood sugar measurement

The blood sugar level is determined by a blood glucose meter. The latter works with test strips allowing the quantitative measurement of blood glucose from fresh capillary blood. Recommendations are made to volunteers: They should take a light dinner the day before, consisting of low GI foods, at a time that ensures that

they will have fasted for 10 hours before the first tests. The test begins at 8 am, with a capillary blood test using a lancing device (fasting blood sugar). During the first visit, 50 g of glucose are served and consumed by each volunteer. During the second visit, a quantity of dates capable of providing around 50g of carbohydrates is served and consumed under the same conditions. During the 2 hours, the blood sugar of these volunteers is measured every 15 min during the 1st hour and then every 30 min (David, 2011).

2.6. Calculation of the glycemic index

The glycemic index is a method of ranking foods according to their response glycemic compared to a reference food. It's a way to classify food on a scale according to their ability to increase blood sugar after ingestion of a food (Nantel, 2003). The glycemic index is calculated by measuring the area under the blood sugar curve (determining the overall rise and fall in blood sugar levels over time), following the ingestion of approximately 50 g of carbohydrate from the food to be tested, divided by the area under the blood glucose curve induced by 50 g of carbohydrate from the reference food (glucose) (Fig. 2A; B). We calculated the GIs using a computer tool called "IG DATTES".



A

$$GI = \frac{\text{Area under glucose curve}}{\text{Area under glucose curve}} \times 100$$

B

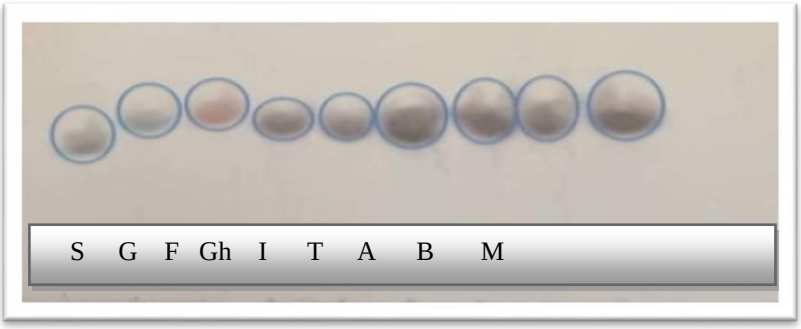
Fig. 2: A: Illustration of the calculation of an area under the curve (AUC) of the glycemic response (FAO / WHO, 1998), B: Calculation formula

3. Results and discussion

3.1. Qualitative characterization

The results of thin layer chromatography of extracts from different cultivars studied are shown in Figure. 3. TLC records Rf (Frontal Ratio) for the sucrose, glucose and fructose namely 0.49, 0.54, and 0.56 respectively. However, the Rf of the spots obtained from six extracts of dates from

different cultivars studied vary between 0.52 and 0.56 (greater than the Rf of sucrose) namely: Ghars 0.55, Itima 0.55, Tinissine 0.52, Aliwrached 0.53, Bentqbala 0.54 and Mizit 0.56.



S: Sucrose, G: Glucose, F: Fructose Fructose , **GH :** *Ghars* **I :** *Itima* , **T :***Tinissine*
A : *Aliwrached* , **B :** *Bentqbala* **M :** *Mizit*
Fig. 3: Qualitative analysis of the sugars of cultivars studied by TLC

3.2. Quantitative characterization

The six date cultivars studied recorded variable total sugar contents between 65.84% ± 0.61 (Mizit) and 89.89% ± 0.05 (Tinissine) (Fig. 4). Reducing sugars are mainly composed of glucose and fructose (Fig. 5). The reducing sugars contents of the dates of the cultivars studied vary from 58.38% ± 0.03 (Mizit) to 75.28% ± 0.05% (Ghars). The values obtained for sucrose are between 5.71% ± 0.1 (Ghars) and 17.66% ± 0.03 (Tinissine). Pectins vary from 1.88% ± 0.21 (Itima) to 4.43% ± 0.6 (Tinissine) with respect to the dry matter, for the six cultivars studied (Fig. 6).

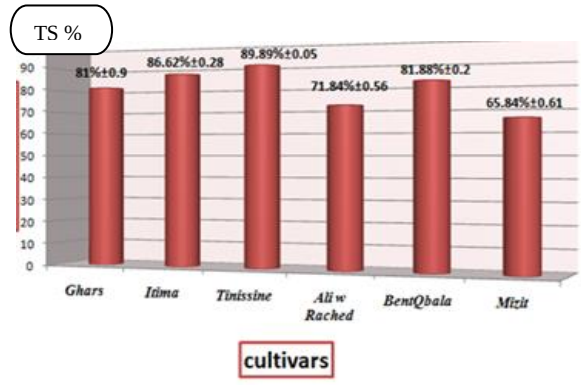


Fig. 3: Total sugar content in %

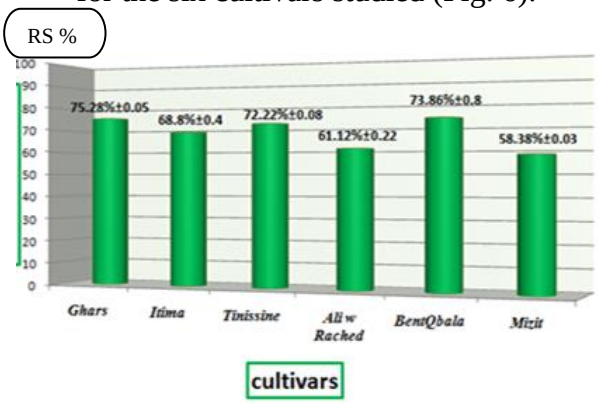
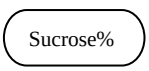
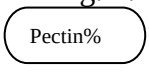


Fig. 4: Reducing sugars content in %





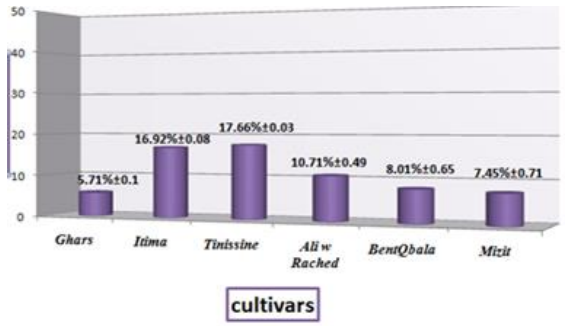


Fig. 5: Sucrose content in %

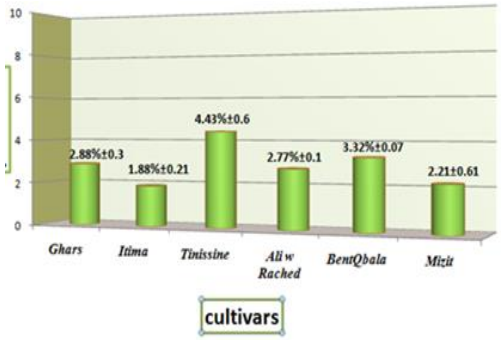


Fig. 6: Pectin content in %

3.3. Determination of the glycemic index

The glycemic index is a criterion for classifying foods containing carbohydrates. The evolution of glycemia for the reference food (glucose) is greater compared to that of the test food (date cultivars studied) (Table. 3), since glucose is a pure and simple sugar which does not need to be digested, therefore its absorption is very easy, while the date cultivars studied contain immediately absorbable carbohydrates and carbohydrates with delayed absorption, the immediately absorbable carbohydrates will very quickly pass into the bloodstream, while those of cultivars requiring prior digestion will be absorbed. more delayed.

The presentation of postprandial glycemic responses for date cultivars and glucose are shown in Table 3. The hyperglycemia peak of the reference food (glucose) reached at t_{30} is 1.47g/l, this peak is intense and early because glucose absorption is easy, thus the hyperglycemia peaks for the different cultivars studied are at t_{30} (except Mizit and Bentqbala t_{15}). These peaks are located from 1.10 to 1.41g / l. So the hyper glycemic peaks for the date cultivars studied are lower compared to that of the reference food. The food which has a low and late glycemic peak is all the more interesting from a dietary point of view compared to a carbohydrate food which has a high and early glycemic peak.

3.4. Hyper-glycemic peaks and post-prandials

Table 3: Post-meal glycemic responses in g / l for 120 minutes.

	t_0	t_{15}	t_{30}	t_{45}	t_{60}	t_{90}	t_{120}
Glucose	0.94	1.23	**1.47**	1.37	1.34	1.34	1.10
Ghars	0.94	1.19	**1.41**	1.14	1.05	1.05	1.06
Itima	0.94	1.07	**1.10**	1.10	1.05	1.01	1.04
Tinissine	0.93	1.23	**1.15**	1.08	1.03	1.00	1.01
Aliwrached	0.95	1.13	**1.16**	1.14	1.05	1.01	1.02

Bentqbala	0.97	**1.27**	1.15	1.03	1.07	1.05	1.03
Mizit	0.93	**1.31**	1.12	1.10	1.17	1.07	1.03

3.5. Classification of glycemic indexes

The results obtained show that the glycemic index varies between 31.01 to 51.80 (Table 4). We note for the cultivar Itima IG 31.01, this value is lower followed by that of the cultivar Aliwrached (36).

Table 4: Classification of cultivars studied according to their glycemic index.

	GI class		
Cultivars	Low	Moderate	High
Itima	31.01	-	-
Aliwrached	35.99	-	-
Tinissine	36.50	-	-
Bentqbala	42.42	-	-
Ghars	49.00	-	-
Mizit	51.80	-	-

- absence

4. Discussion

The results obtained show that all the extracts of different cultivars studied are rich in reducing sugars (glucose and fructose), which allows us to say that the six cultivars belong to the class of soft dates. In addition, cultivars contain other sugar but in a very low proportion (sucrose), this is justified by the inversion of sucrose into fructose and glucose under the action of the invertase produced by the species saccharomyces cerevisae which exists naturally in dates. In this case (soft dates), the invertase activity is high. Sugars are the main component of dates. There are major sugars (glucose, fructose and sucrose) and other minor sugars in small amounts (galactose and xylose) (Bensayah, 2014). These results are compatible with those found by other authors, whose sugar level is between 54% and 93% (Munier, 1973; Açourene et al., 2001; Al-gboori and Krepl, 2010), therefore total sugars constitute the major part of the pulp. These results are within the range cited by some authors (Manickavasagan et al., 2012; Baliga et al., 2011) where the rate of

reducing sugars in dates varies from 19% to 89% and 31% to 78.2% respectively. Reducing sugars are predominant in the different cultivars of dates studied, this can be explained by the inversion of sucrose by invertase into glucose and fructose, this phenomenon occurs during the ripening of the fruit and continues during its storage (Bensayah , 2014). In addition, reducing sugars promote the phenomenon of non-enzymatic browning which is probably responsible for the brown color of dates (Sayah and Oueld el hadj, 2010). The presence of these natural sugars can be a good source of immediate energy for the human body. In addition, the presence of high levels of fructose (GI: 20) in dates allows them to be incorporated into the diet of a diabetic (Al-msallem, 2018). The value of sucrose recorded during the present study for the cultivar Ghars (5.71%) is comparable to that given by Belguedj and Tirichi, (2011) (5.71%) for soft dates. The cultural treatments, temperature, humidity and rainfall during the maturation undoubtedly influence the quantity hydrolyzed (Harrak and Boujnah, 2012). According to Benchabane et al (2000), the cell wall of ripe dates contains up to 3% of pectins. The rate of pectins is variable according to the stages of maturation, it decreases from the Khl'al stage to the Tmar stage. Foods containing pectins reduce metabolic risk factors associated with diabetes (El-farsi & Lee, 2008). The glycemic index for the cultivar Ghars is equal to 48.99, this value is higher than that found by (Mimouni, 2015; Bouzid, 2016; Bensaci and Amirat, 2017) or 43.27, 32.04, 41.47 respectively. Foods are classified according to their glycemic index into three categories: High Glycemic Index (≥70), Moderate Glycemic Index (56 to 69) and Low Glycemic Index (≤55). We can therefore consider that the cultivars of dates studied present GI "Low" since they are totally below 55. This seems to be due to the presence of soluble fibers "pectin" which could be at the origin of the weak GI whose role is very beneficial because it forms a gel and decreases the rate of glucose absorption (Miller et al. al., 2003). In addition, the presence of fructose (very low GI 20) (David, 2011) does not require insulin for its metabolism. Thus, the variability of the GI may be due to several conditions, including environmental conditions, stage of ripening, sugar composition, growing conditions and geographic region (Ryan et al., 2018). All date cultivars studied have "low" glycemic GIs, so consumption of an amount equivalent to that used in this study is recommended and which could be incorporated into subjects' diet normal, sensitive and obese.

5. Conclusion

The GI of date cultivars recorded in this study appears to be low. Dates with a low GI do not cause a significant increase in postprandial blood sugar and can be considered an important and effective food, not only to meet daily nutrient requirements and also to develop an appropriate diet management strategy for normal, obese and even diabetic subjects to reduce the risk of chronic diseases such as diabetes, heart disease and obesity. Based on this study, we can classify these cultivars as non-hyperglycemic or even "hypoglycemic" foods. Finally, we believe that this work deserves to be generalized to all Algerian cultivars.

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