World Academy of Science, Engineering and Technology
International Journal of Nutrition and Food Engineering
Vol:6, No:11, 2012

Study of the *Glucidic* Fraction of *Celtis Australis L, Crataegus Azarolus L, Crataegus Monogyna Jacq., Elaeagnus Angustifolia L. and Zizyphus Lotus L. Fruits*

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***Abstract*—**In Algeria, some fruit trees produce fruits in free nature. Such trees are *Celtis australis, Crataegus azarolus, Crataegus monogyna and Zizyphus lotus.* In spite of their appreciable consumption, their nutritional value remains unknown.

The objective of this study is the determination of sugars in the pulpe and almond of the above fruits. The biochemical analysis shows that these fruits present interesting contents of soluble sugars which confers significant caloric intakes to them. As well as significant fibres which give them therapeutic and industrial benefits? The analysis of the almonds shows that it contains considerable contents of sugars which enable them to be an energetic food.

***Keywords*—**Celtis australis, Crataegus azarolus, Crataegus monogyna, Zizyphus lotus, Fibres, Soluble sugars.

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I. Introduction

IN the world and in Algeria, certain fruit trees grow in a spontaneous state and adapt to multiple ground and climate. Certain species produce fruits such as:

*Celtis australis,*a vigorous tree which grow in the wild state in Algeria [1]. It is especially localized in the east of the country, known under the name "n'chem, tegza, meiss" [2]. It is also found in the Mediterranean region [3]-[6], as well as in the north of Mexico [7]. The fruits called micocoules, are about the size of a large black purple pea (10 to 12 mm diameter). The pulp is reddish, dry and thin of insipid savour [6]. These fruits are rich in fibres, proteins and minerals [5].

*Crataegus azarolus, t*he hawthorn shrub with a height of 5 to 10 m [8]. It resists the dryness and the cold [9]. In

Algeria, it is especially localized in the tell algero-constantinois region, and known under the name of "zaaroura" [10].

The fruit called the azerole, is a small fruit in the apple shape, from 1 to 3 centimeters diameter. When it matures, its skin color changes from white cream to yellow. Its flesh is delicately fruity [11,12]. It is rich in sugars, minerals and vitamin C [13].

Crataegus monogyna, a dense shrub [14]. It is found in all Europe, the Occidental Asia and in north Africa [15].

Elaeagnus angustifolia, a vigorous shrub, it is remarkable by its great resistance to the dryness [1]. The fruits are ovoid drupes of 1 cm length, of yellow color [1]-[11]. It is a spontaneous plant, which grow in the Mediterranean zone [16]. In Algeria, the tree is mainly localized in the high regions. It is rich in soluble and reducing sugars, fibres, minerals and vitamins [17]-[18].

Zizyphus lotus, the jujube tree is 2 to 3 m in height, with many ramifications [1]-[19]. Its fruits are round from 1 to 2 cm in diameter. At maturity, it has a brown skin, a very sweetened and farinaceous ochre flesh, wrapping a small seed with a diameter of 4 to 5 mm [20]-[21]. It is found in the south of Spain, Portugal, Greece and mainly in North Africa [19]. It is very common in North of Algeria. It is known under the name of "sedra", "nbeg", "azar". Fruits are rich in amino acids, sugars, phosphorus and ascorbic acid [4].

Although, these fruits are very appreciated by the Algerian population and in particular the children, their consumption remains seasonal and their nutritional values are unknown.

Up to date, the scientific work done on these species relates primarily to the study of their botanical characteristics. The biochemical characterization of the fruits is incomplete. The references which relate to the processing of the fruits are scarce. Hence, this work is aimed to study the glucidic fraction of these fruits.

II. Material and Methods

The vegetable material used in this work is composed of five fruits from five different areas in Algeria. *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus,* coming respectively from the areas of Batna, Mila, Ain touta, Tazoult and Boumia. The harvest of these fruits was made during the year 2006, between September and December. Fruits were stored in a freezer at (-4C) until analysis.

A. Moisture Content

The moisture content was determined by heating at 103 °C until stabilization of sample weight [22].

B. Total Sugars

The proportioning of total sugars was carried out by the method of Dubois in the presence of a standard range of glucose at 470 nm [23].

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C. Reducing Sugars

The proportioning of reducing sugars, was carried out by the method of Fehling [24].

D. Sucrose

Sucrose content is obtained by the difference between the soluble sugar content and reducing sugars [25].

E. Energetic Contribution

The energetic contribution of the fruits at summer is calculated by multiplying the soluble sugar content for each fruit by the coefficient of Atwater which is: 3.6kcal [25].

F. Cellulose

Cellulose content at summer was determined by the method of Weende according to Iso-AFNOR (Nf-v-03-040,1977) [26].

G. Pectin

Pectin content at summer was carried out by the method of Lopes and Rao (2006) [27].

H. Chromatography

Soluble sugar profile at summer was evaluated by thin layer chromatography [28].

III. Results and Discussion

A. Moisture Content

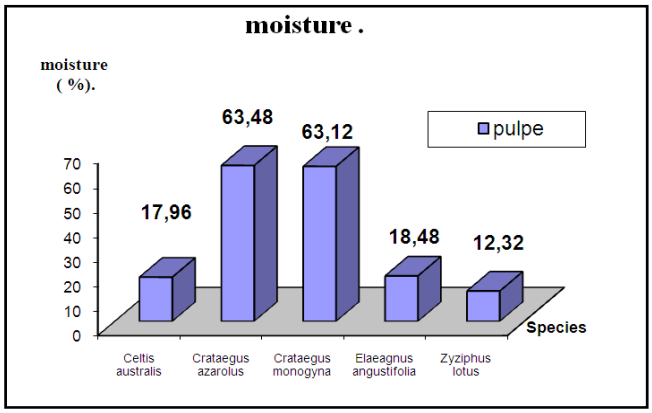

Fig. 1 Moisture of the fruit of *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus*

The fruits of *Crataegus azarolus and Crataegus monogyna* presented high moisture content similar to that of dry dates, which confirms the juicy state of these fruits and allows them to be classified as intermediate fruits between the moist fruits (80 to 90 %) and the dry fruits (20 to 40 %).

As for the other species *Celtis australis, Elaeagnus angustifolia and Zizyphus lotus*, they have average moisture contents and are regarded as dry fruits.

B. Total Sugars

The interesting contents presented by the fruits of *Elaeagnus angustifolia* (17.02 %) and of *Celtis ausralis* (16.71 %) are rather close to those of grape (16.5 %) and cherry (15 %) given by Régal [29]. While the fruit of *Crataegus monogyna(11.45 %), Zizyphus lotus(10.55 %)* and Crataegus azarolus (9.86 %) contain average contents which are close to apricot (10 %) given by Régal [29]. The variation of the sugar contents could be due to several factors such as differences in variety, age of the plant, load of the trees and environmental factors. According to the obtained results, these fruits could constitute a considerable source of soluble sugars.

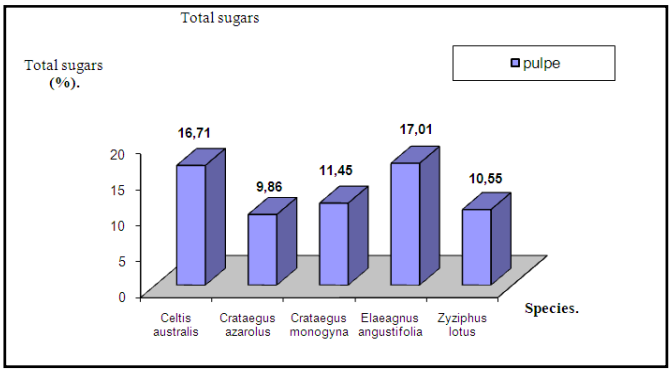

Fig. 2 Total sugars of the fruit of *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus* (g/100g of matter dries)

C. Reducing Sugars

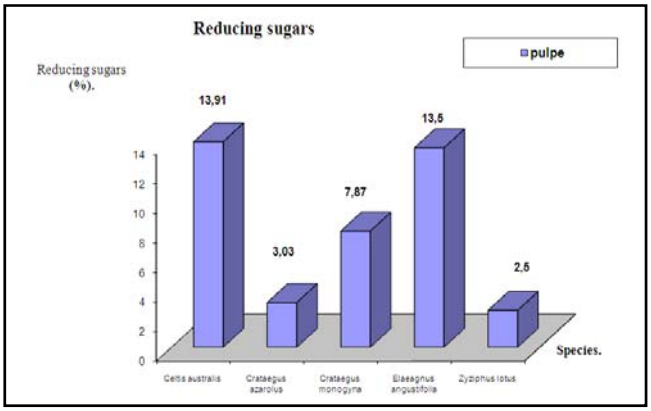

Fig. 3 Reducing sugars of the fruits of *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus* (g/100 g of matter dries)

The prevalence of reducing sugars for the fruits of *Celtis australis* and *Elaeagnus angustifolial* return them near to the grenade, apple, blueberry, and raspberry. Its carbohydrate is mainly composed of fructose, glucose and small proportions of sucrose. As for the other fruits *Crataegus azarolus, Crataegus monogyna, and Zizyphus lotus*, their composition in sugars is close to melon, prickly pear, whose carbohydrate part is divided in majority by sucrose, glucose and fructose being present in less proportions.

D. Sucrose

Sucrose content of the fruits of *Celtis australis (2,8 %)* is identical to that of apple red Joly variety (2.8%) given by Levaillez [30]. Whereas the fruits of *Crataegus azarolus and Zizyphus lotus* present contents in the interval of (6 to 9 %) given by Apfelbaum and Roman [31]. As for the fruits of *Crataegus monogyna and Elaeagnus angustifolia*,their sucrose content is close to that of apple varieties, sweet Auvergne (3.8 %) given by Levaillez [30].

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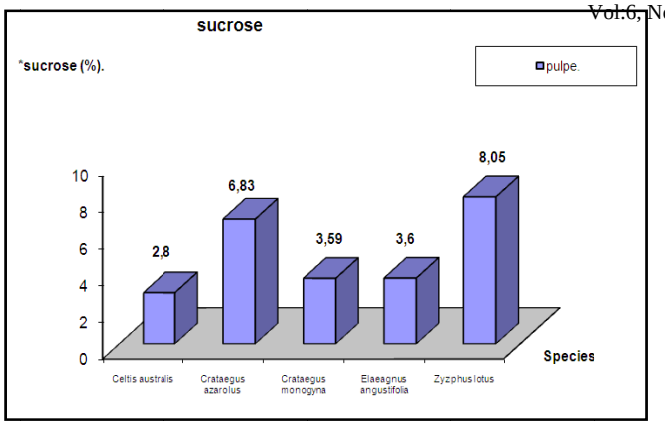


Fig. 4 sucrose of the fruits of *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus (g/100 g of matter dries)*

E. Energetic Contribution

TABLE I
ENERGETIC CONTRIBUTION OF FRUITS OF *CELTIS AUSTRALIS, CRATAEGUS AZAROLUS, ELAEAGNUS ANGUSTIFOLIA, ZIZYPHUS LOTUS* [29]

Fruit	Energetic contribution	
	Kcal	Kj
Elaeagnus angustifolia	63,03	263,46
Celtis australis	60,15	251,42
Crataegus monogyna	40,14	167,78
Zizyphus lotus	37,98	158,75
Crataegus azarolus	35,49	148,34

The fruits of *Elaeagnus angustifolia and Celtis australis* provide energetic contributions which place them at the level of apple (54 Kcal) or cherry (68 Kcal). In addition, the fruits of *Crategus azarolus, Crategus monogyna and Zizyphus lotus* provide moderate caloric intakes which place them at the same level as raisberry (38 Kcal).

F. Cellulose

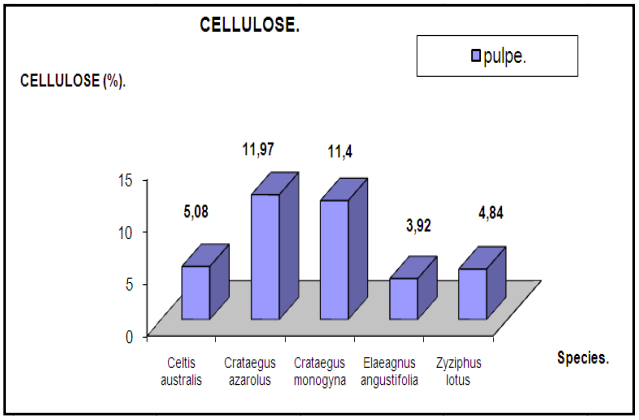


Fig. 5 cellulose of the fruits of *Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus ((g/100 G of matter dries).)*

The fruit of *Celtis australis* contains cellulose content close to that mentioned by Demir [5], the varieties of *Celtis australis* cultivated in Turkey with a value of 4.40 %. For the fruit of *Zizyphus lotus*, the cellulose content is close to the interval (5.24-7.81 %) reported by Li [32].

G Pectin

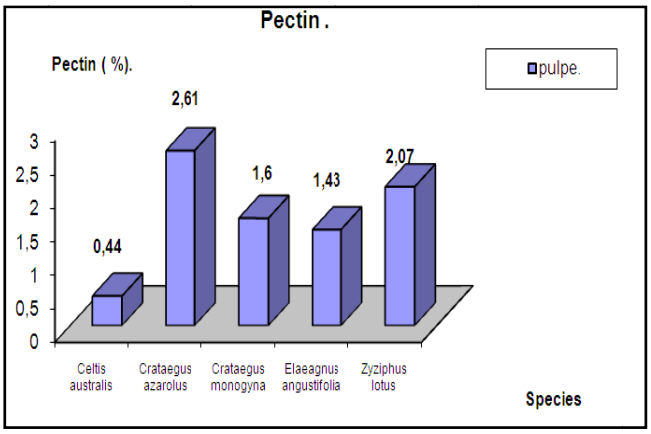
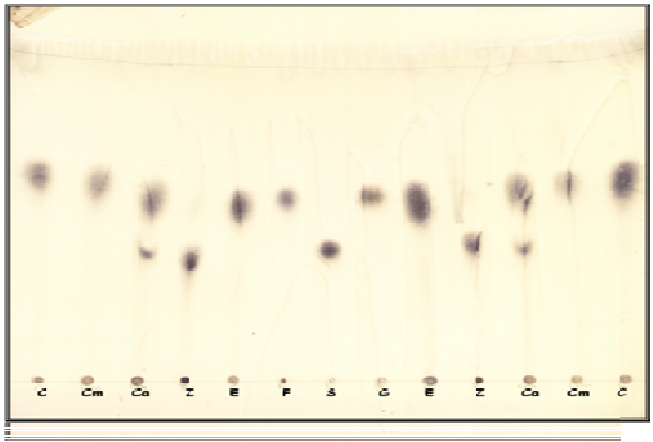


Fig. 6 pectin of the fruits of **Celtis** *australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus lotus (g/100 gof matter dries)*

The content of pectin present in the fruit of *Celtis australis* is similar to cherry (0.44). In addition, the high content of the others species (*Elaeagnus angustifolia, Crataegus monogyna, Crategus azarolus)* exceed those found in the best sources of pectin, such as cassis (1.2%), quince (0.6 to 0.7), including the interval of 0.57-0.79% found by Li [2], and similar with data for orange and even lower than that of dry prune (4.02 %) given by Bayle [33].

From of these results, one can say that our fruits are rich in pectin. This means that its possible to produce jams with these fruits or to exploit these pectins after extraction in order to increase the gelling capacity of certain fruits whose gelling capacity is weak.

H Chromatography



C Celtis australis
C : Crataegus monogyna
C : Crataegus azarolus
Z: Zizyphus lotus
E Elaeagnus angustifolia.

Fig. 7the separation of sugars of the fruits *of Celtis australis, Crataegus azarolus Crataegus monogyna.¶Elaeagnus angustifolia and Zizyphus lotus* by thin layer chromatography

The results obtained from the qualitative analysis of the fruit are in agreement with those of reducing sugars. The sugar composition of the fruits of *Celtis australis*, Elaeagnus angustifolia and Crataegus monogyna is close to those of

quince, blackcurrant, raspberry where the majority of sugars are glucose and fructose whereas the sudden sucrose has hydrolysis under the effect of invertase during maturity.

The sugar composition of the fruits of *Zizyphus lotus* and *Crategus monogyna* is close to that of sins; mango, prickly pear, whose its carbohydrate is divided into a majority of sucrose, while glucose and fructose are in small quantities. According to the results, these fruits contain simple sugars, directly assimilable.

IV. Conclusion

At the end of our research on the study of the carbohydrate fraction of the fruits of Celtis australis, Crataegus azarolus, Crataegus monogyna, Elaeagnus angustifolia and Zizyphus otus, we conclude that:

The high content in water of the fruits is due to the high contents recorded mainly by the fruits of Crataegus azarolus of Crataegus monogyna. This allows their transformation into juice.

As for the modest contents found in the fruits of Elaeagnus angustifolia, Celtis australis and Zizyphus lotus, they allow a better conservation during their storage

The significant contents of soluble carbohydrate presented by the fruit of Elaeagnus angustifolia, Celtis australis, Zizyphus lotus and crataegus azarolus confer an appreciable caloric intake to them.

The interesting pectin content of the fruits, in particular the fruit of Crataegus azarolus and Crataegus monogyna, combined with the high cellulose contents confer therapeutic virtues and hypocholestérolémiantes to them.

The high content in pectin of these fruits will widen and diversify their use as fruits and allow their application in cosmetic and food industries.

The qualitative analysis of these fruits shows that they are composed mainly of simple sugars: glucose, fructose and sucrose with different proportions.

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