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The effects of glucose from natural apple juices versus industrial on the diabetic diets

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Abstract

This experiment aimed to highlight the nutritional characteristics of apple juices obtained from organic apple varieties - the apple variety Auriu de Bistrita, Pionier, Starkinson, Romus I, Idared, Florina, as well as the characteristics of industrially obtained apple juices Santal, Ana are, Hortex, Mellow Drinks, Fresco Jugo. Through this comparative study, it was found that the apple juice obtained by pressing apples had a soluble dry matter content of 10-14.2%, as follows: Auriu de Bistrita apple juice -14.1%, Pionier apple juice 14.2%, Starkinson apple juice 13.4%, Romus I apple juice 12.4%, and Idared apple juice 10%. In the apple juices obtained by manufacturing, the dry substance content was: 15.2% for Ana are apple juice, 14.1% for Santal juice, 11.6% for Ana are juice, 9.7% for Hortex juice, 11% for Mellow juice Drinks, 11.6% at Fresco Jungo. Through the comparative analysis of natural apple juices compared to industrial ones, it was found that natural apple juices obtained from apple varieties had a high glucose level of 23.3-30.5 mg/100 g, which recommends them to be consumed as juices with slow metabolism of glucose. In the case of juices obtained by reconstitution of concentrated juice, i.e. industrial juices, it is observed that two of them, Santal -1.6 mg/100 g and Ana are -5.76 mg/100 g had an unexpectedly low level of glucose, their sweetening being done with sweeteners, i.e. a falsification of the sweet taste. The glucose level of natural juices was the highest, even higher than the glucose level of industrially obtained juices. So it the research tracked the glycaemic index of natural juices versus the GI glycaemic index of industrial juices to recommend juices for their nutritional effects.

Keywords: organic vs industrial apple juices

1. Introduction

The fruits and vegetables have a high and varied content of carbohydrates, monosaccharides, disaccharides and polysaccharides being present. Monoglycerides are represented by pentoses and hexoses. Pentoses are found in combined form and do not participate in the respiration process and do not accumulate as reserve substances in the plant. Hexoses represent, through glucose and fructose, the main substrate of energy processes [8,9]. Mannose and galactose are in a combined state as mannans and galectins, respectively. Glucoses contain: rhamnose, anthocyanins, flavones, saponins, vegetable gums [15]. The presence of sorbose was reported in apples and cherries. Glucose and fructose are found in all horticultural products, but sucrose only in some. There is no sucrose in currants, antlers, blueberries, and little in grapes. The distribution of sugars in the fruit is not uniform, the sugar concentration increases from the inside to the outside of the fruit. Free and semi-bound organic acids determine the acidity of the products and greatly influence the pH, having an important role on: sensory qualities - taste; physical-chemical reactions that take place in tissues, the development of microorganisms, technological processing. Acid content and pH vary widely, depending on the species, variety and pedoclimatic conditions: fruits 0.1-7%, pH=2.5-5 [10,11]. Thus, malic, citric, tartaric acids predominate and succinic, salicylic, oxalic, formic acids are present in small quantities. Their distribution in the fruit tissue is inversely proportional to that of sugars; acidity increases from the outside to the inside. During the growth of the fruits, the accumulation of organic acids occurs, and at maturity there is an important decrease in acidity, as a result of the different metabolism of the acids [12,13,14]. The acidity of juices especially influences the heat preservation treatments, because the pH correlated with the temperature determines the inactivation of

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enzymes and microorganisms, juices with a pH < 4.5 undergo a milder heat treatment, and those with a pH > 4.5 require an advanced heat treatment, sterilization [6].

2. Materials and Method

Determination of glucose by the Schoorl method. Reducing carbohydrates reduce Fehling's solution in an alkaline medium and at boiling, causing the transformation of Cu(OH)2 into Cu2O. The excess of Cu2+ is determined by treatment with KI in an acidic environment, the released I2 being treated with Na2S2O3 (Na thiosulphate). The total amount of Cu2+ is determined on a control sample in which the carbohydrate solution is replaced by distilled water. The difference between millilitres of sodium thiosulphate solution used for the titration of the control sample and those used for the titration of the sample to be analysed allows the quantitative evaluation of reducing carbohydrates, by using the table corresponding to the Schoorl method. Reagents: Fehling I solution: 69.2g of Cu sulphate per 1000 ml, Fehling II solution: 346g of Seignette salt and 100 g of NaOH per 1000 ml; KI solution, 10%, Na2S2O3 solution, 0.1n; H2SO4 solution d= 1.11; 1% starch solution. A control sample is made as follows: 10 ml of Fehling I solution and 10 ml of Fehling II solution are introduced into an Erlenmeyer flask. Add 10 ml of distilled water and boil for 2 minutes. It is cooled in a stream of water. Add 20 ml of 10% KI and 15 ml of sulfuric acid d=1.11 and immediately titrate the released iodine I2 with Na2S2O3 0.1n, using starch as an indicator. The number of millilitres of Na2S2O3 solution used to titrate the control samples corresponds to the amount of copper sulphate taken in the Vm analysis. To determine carbohydrates, take 10 ml of Fehling I, 10 ml of Fehling II solution in an Erlenmeyer, to which 10 ml of the solution to be analysed is added. The contents of the flask are boiled for 2 min, then treated in the same way as the control sample. The value of Na2S2O3 used to titrate the sample to be analysed corresponds to the amount of CuSO4 in excess Vp [1,7].

Determination of the titratable acidity was made on the principle of neutralizing the total acidity of the sample to be analysed, by titration with NaOH 0.1 n, in the presence of phenolphthalein, until the pale pink turn. The results were calculated according to the formula A= 3.35xV/V1. (V is the volume of NaOH 0.1n taken in the experiment, and V1 is the volume of the sample to be analysed).

The soluble dry substance was determined refractometrically at the optimal temperature, recording variable values from 10% to 17% soluble dry substance, experimentally validated values [7].

3. Results and Discussion

The soluble dry substance of natural apple juices varied between 10% for the Idared apple variety, the lowest value up to 17.8% for the Romus I apple variety. As for the industrially obtained apple juices, the variation of the soluble substance was 9.7 -14% .

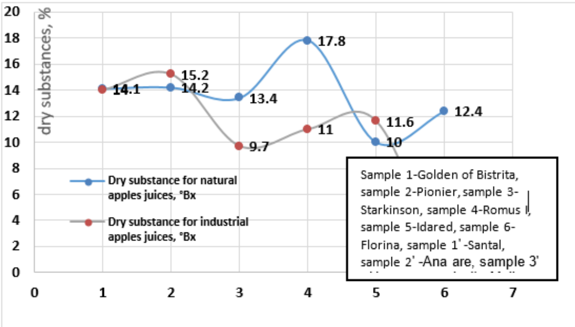

Figure 1. Dry matter dynamics of juice assortments

The lowest soluble substance was recorded in Hortex juice, and the highest value in Santal juice. By comparison, it is observed that the level of soluble dry matter is higher in natural apple juices than in those obtained industrially according to manufacturing recipes. Statistical interpretation of the data reflects a high confidence level of 0.9617 for industrial juices and an even higher confidence level for natural juices of R^2=0.9936. The results can be explained by the fact that natural juices can have a higher frequency of variation than industrial ones because the latter respect a sugar content imposed by the manufacturing recipe, studied for keeping and preserving juices for 12 months.

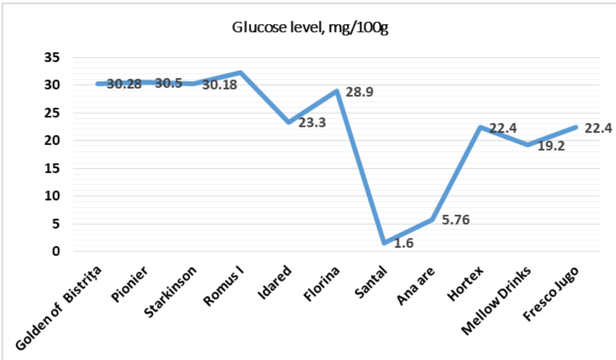

Figure 2. Glucose level in natural versus industrial apple juices

Through the comparative analysis of natural apple juices compared to industrial ones, it was found that natural apple juices obtained from apple varieties had a high glucose level of 23.3-30.5 mg/100 g, which recommends them to be consumed as juices with slow metabolism of glucose. In the case of juices obtained by reconstitution of concentrated juice, i.e. industrial juices, it is observed that two of them, Santal -1.6 mg/100 g and Ana are -5.76 mg/100 g had an unexpectedly low level of glucose, their sweetening being done with sweeteners, i.e. a falsification of the sweet taste. Compared to Idared apple juice, precisely the one recommended for diabetics, Hortex juices with 22.4% mg/100g, Mellow Drinks -19.2 mg/100 g and Fresco Jugo with 22.4 mg/100 g glucose from sugar can be consumed by people with conditions diabetics, but with caution.

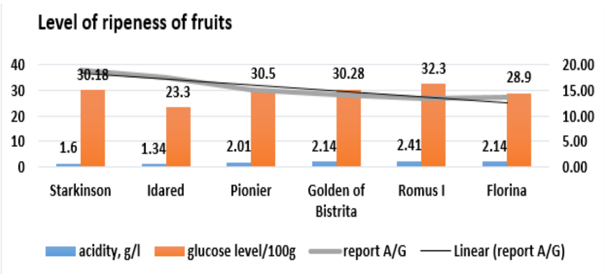

Figure 3. The dynamics of the acidity/glucose ratio according to the level of ripeness of the apples

The degree of ripeness of the apples picked to obtain the natural apple juices gave us a glucose/acidity ratio with a very high R^2 confidence level of 0.9884, which means obtaining good results. As a consequence, the glucose level of natural juices was the highest, even higher than the glucose level of industrially obtained juices.

The glycaemic index of different fruit juices obtained from organic fruits varies quite a lot from 22 glycaemic index GI for cherries, 38 GI for apples, 42 GI for oranges and at most 46 GI for grapes [2].

The experimental research has shown that not all simple carbohydrates raise blood sugar or the glycaemic index. The human body can only use glucose as an energy source. So once glucose is removed from sucrose, fructose remains. This reaches the liver where it is transformed into glucose, this process happens slowly, that is why this type of biochemical compounds are called slow-release substances [3].

Thus, the glycaemic index of the fastest glucose is 100, and the glycaemic index of fructose is 19, and the glycaemic index of fruit sucrose is 68 [4]. The dynamics of the glycaemic index in natural fruit juices shows a logarithmic increase in the glycaemic index GI =22 for cherry juice to GI =38 for apple and pear juice, respectively GI =46 for grape juice, with a confidence level of R^2 =0.8987 (figure 4). It is also observed that the level of carbohydrates in the fruits studied is variable and does not respect the increasing recurrence from cherry juice to grape juice. The significance of this aspect is related to the ratio between glucose/fructose different from one fruit to another, so this ratio is higher in cherry juice 17.9, and the GI is the lowest 22, so it contains less glucose, while the ratio glucose/fructose in strawberries is only 5.6, the glycaemic index is 40, so it contains more glucose than cherries. In the case of apples with a glycaemic index of 38, the carbohydrate content is also maximal, at 15.9 g/100 g carbohydrates [5].

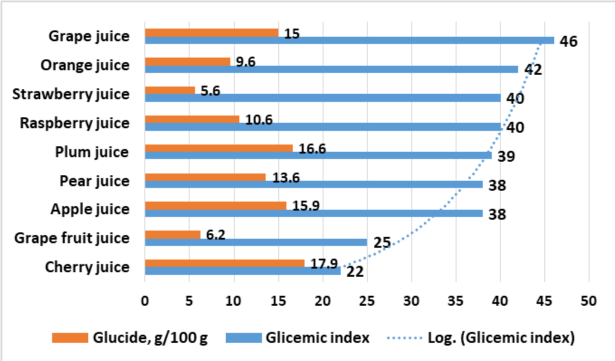

Figure 4. The dynamics of the glycaemic index in natural fruit juices

In the case of this experiment, the glycaemic index of the studied apple juices leads us to the conclusion that diets for diabetics can include organic, natural apple juices better than manufactured apple juices because the glucose level of apple juices obtained from fruits fresh between 23.3 mg/100 g Idared variety and 30.5 mg/100 g Pionier variety will have a slow metaboliser with a GI of 68 for sucrose, while commercial Hortex and Fesco Jugo apple juices with 22.4 mg /100 g representing 16% added sugar will have a glycaemic index of the fastest-releasing sugar glucose of 100. Hence the controversy that from a scientific point of view, only the time of transformation of glucose from sugar by the plasma insulin resulting from the added sugar in apple juice, separately from the natural glucose from fruits or sugar-free juices, cannot be precisely controlled.

In this context, nutritionists recommend the consumption of Idared apples with the lowest glucose content of 23.3 mg/100 g, as well as an optional and rare consumption, in the case of industrially obtained apple juices, because the technique of obtaining them by adding sugar to fruit to obtain concentrated syrup or by adding crystalline sugar to extend the preservation of organic apple juices for enzymatic inhibition of enzymes and preventing alcoholic fermentation.

The minimum level of acidity of Idared apples 1.34 g/l is also an indication of the quality of this variety and a food safety for diabetics, since acidity is a conversion factor of the sucrose in the fruit, changing the ratio between glucose and fructose that make up the molecule of sucrose in a more acidic environment.

4. Conclusions

In the case of this experiment, the glycaemic index of the studied apple juices leads us to the conclusion that diets for diabetics can include organic, natural apple juices better than manufactured apple juices because the glucose level of apple juices obtained from fruits fresh between 23.3 mg/100 g Idared variety. The minimum level of acidity of Idared apples 1.34 g/l is also an indication of the quality of this variety and a food safety for diabetics, since acidity is a conversion factor of the sucrose in the fruit, changing the ratio between glucose and fructose that make up the molecule of sucrose in a more acidic environment.

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