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HYPOGLUCIDIC CONCENTRATED PRODUCTS FROM JERUSALEM ARTICHOKE TUBERS AND APPLES WITH ANTIOXIDANT POTENTIAL FOR PEOPLES WITH DIABETES

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Abstract

For diabetics, diet is a major therapeutic tool and a special nutrition form, in which food is adapted to metabolic disorders of disease. Achievement of the dietetic products to preserve the sweet taste but without altering the glycemic balance of patients with diabetes is an important objective both for the attention of the specialists from food industry and nutritionists. This paper presents the results of the performed research for achieving of hypoglucidic concentrated products from Jerusalem artichoke tubers and apples, with antioxidant potential for nutrition of peoples with diabetes. The achieved products were sensory, physic-chemical and microbiologically analysed. The hypoglucidic concentrated products are characterized by their inulin-type fructans (6.95% - White variety; 7.85% – Red variety), vitamin C content (22.65 mg/100g - White variety and 23.70 mg/100g - Red variety), 105.75...165.23 mg GAE/100 g, potassium (297.45 mg/100 g – White variety; 305.10 mg/100 g - Red variety) and phosphorus content (41.54 mg/100 g – White variety; 43.26 mg/100 g - Red variety). The hypoglucidic concentrated products are destined for diabetics, obesity and peoples who want to maintain their weight.

Key words*: Jerusalem artichoke, apple, tubers, diabetes, hypoglucidic.*

INTRODUCTION

Diabetes is a metabolic disease that occurs in the body when the pancreas does not produce enough insulin or when the body fails to effectively use insulin secreted by the pancreas in the bloodstream. In recent decades, lifestyle changes characterized by increased energy intake and decreased physical activity have favored overweight and obesity, which has increased the incidence of diabetes (Asif, 2014). According to the World Health Organization (WHO) report, the prevalence of diabetes in adults over the age of 18 was 8.5% in 2014 (Diabetes Fact sheet, 2016).

Also worrying are national statistics, where according to the National Survey concerning Prevalence of Diabetes, Prediabetes, Overweight, Obesity, Dyslipidemia, Hyperuricaemia and Chronic Kidney Disease (PREDATORR), Romania is among the countries with the highest prevalence of diabetes in Europe (11.6%), head of the list being Turkey (14.85%). The highest prevalence rate of diabetes is in the region of Dâmboviţa, Argeş, Prahova, Teleorman, Călăraşi, Giurgiu and Ialomiţa counties (13.39%) (http://www.ponderas.ro/prevalenta-diabetului-zaharat-romania/).

Diabetes mellitus is associated with an increased risk of cancer for the following tumors: breast, uterus, bladder, liver and pancreas, and surprisingly, a seemingly reduced risk for prostate cancer (Renehan et al., 2008; Renehan et al., 2010). Also, diabetes is an important cause of premature death in middle-aged women. About 1 to 7 deaths in the 50–59 years age group is due to diabetes (Roglic and Upwin, 2010). In this context, prevention of diabetes is particularly important. In the prevention of diabetes, diet plays a very important role. Also, in diabetes, diet is a major therapeutic tool and a special form of nutrition, in which food is adapted to the metabolic

disorders of the disease. Restricting consumption of sugar for diabetics often leads to an excessive desire to violate this food ban. In order to prevent this phenomenon, achievement of dietary products which preserve their sweet taste without altering the glycaemic balance of diabetic patients is an important objective both for the attention of food industry specialists and nutritionists (Catană et al., 2013).

Jerusalem artichoke tubers *(Helianthus tuberosus)* are characterized by their content in *proteins, minerals* (potassium, calcium, magnesium, iron, etc.) and *inulin.* Inulin can be used in the diet of diabetics as a sugar substitute without having an impact on glycaemia (Meyer and Blaauwhoed, 2009; Long et al., 2016). Jerusalem artichoke tuber (*Helianthus tuberosus* L.) is considered a functional food (Radovanovic et al., 2015).

Studies performed by Shoaib et al. (2016) have also shown that inulin does not cause increased blood sugar when it is consumed. In addition, a study performed by Chang et al. (2014) showed that due to inulin content, regular consumption of Jerusalem artichoke tubers can help to the prevention of type 2 diabetes. Another study performed by Gott, Williams and Antos (2015) showed that it was an increase in the incidence of type 2 diabetes in the case of Australians who renounced to the high inulin diet. Munim et al. (2017) mention that Jerusalem artichoke tubers have a high inulin content and that a diet rich in inulin may have beneficial effects in patients who have type 2 diabetes and, moreover, can prevent the occurrence of this disease.

In this paper are presented the results of the research performed to achieve the hypoglucidic concentrated products from Jerusalem artichoke tubers (*Red* and *White* varieties) and apples with antioxidant potential for peoples with diabetes.

MATERIALS AND METHODS

Samples

Fresh Jerusalem artichoke tubers (*Red* and *White* varieties) were obtained from a farmer and *Jonathan* variety apples, were purchased from commerce. As a sweetening agent, a sweetener based on *Stevia rebaudiana* and erythritol, allowed in diabetic diet, purchased from commerce, was used with the inulin from Jerusalem artichoke tubers. The lemon juice and vitamin C were used in the products composition to ensure acidity (necessary to achieve a pleasant, balance taste and to ensure the optimal pH for pectic gel formation) and, at the same time, for the vitamin C fortification of hypoglycemic jams.

For gelling, low methoxyl pectin, with calcium reactivity, has been used to obtain low soluble dry jams (15-45 °Brix). The technological flow for obtaining of hypoglucidic concentrated products includes the following operations: sorting, washing, cleaning, dividing, sweetening syrup preparation, boiling-concentration, packages preparation, dosing, closing, pasteurization, cooling, conditioning containers, storage. Packaging of hypoglucidic concentrated products was done in glass jars (314 mL capacity) fitted with Twist-off system caps, which ensure a hermetic seal. Hypoglucidic concentrated products and control products were sensory, physic-chemically and microbiologically analyzed.

Figure 1. Hypoglucidic concentrated products from Jerusalem artichoke tubers (*White* variety) and apples

In Figures 1 and 2 are shown hypoglucidic concentrated products from Jerusalem artichoke tubers and apples.

Figure 2. Hypoglucidic concentrated product from Jerusalem artichoke tubers (*Red* variety) and apples

Methods

Sensory analysis

Sensory analysis (appearance, colour, taste and flavor) was performed by descriptive method and by *"Comparison method with unitary score scales"* method. Sensory quality of the fortified product was established based on the total average score by comparison with a scale from 0 to 20 points (18.1.....20 – qualyfing „very good"; 15.1...18 – qualyfing „good"; 11.1.....15 – „satisfactory"; 7.1....11 - „unsatisfactory"; 0...7 – „inadequate").

Measurement of the colour parameters of samples was performed at room temperature, using a CM-5 colorimeter (Konica Minolta, Japan), equipped with SpectraMagic NX software, to register CIELab parameters (the Commission Internationale de l'Eclairage - CIE), *L**, *a** and *b**: *L** - colour luminance (0 = black, 100 = white); *a** - red-green coordinate (-a = green, +a = red); *b** - yellow-blue coordinate (-b = blue, +b = yellow).

The textural properties of the hypoglucidic concentrated products and of control products were measured through a compression test using an Instron Texture Analyzer (model 5944, Illinois Tool Works Inc., USA). Using the curves recorded (time-dependent force), using *Bluehill 3.13* programme, the following texture parameters were calculated: firmness, cohesiveness, adhesiveness and gumminess.

Physic-chemical analysis

Total soluble solids were performed with refractometer. Protein content was determined by the Kjeldahl method with a conversion factor of nitrogen to protein of 6.25 (AOAC Method 979.09, 2005). Fat content was determined according to AOAC Method 963.15, and ash content according to AOAC Method 923.03 (AOAC, 2005).

In order to determine minerals samples were mineralized by calcination, with the addition of hydrochloric acid and hydrogen peroxide. The minerals potassium (K), calcium (Ca) and magnesium (Mg) were determined by Atomic Absorption Spectrophotometer (type *AAnalyst* 400, Perkin–Elmer). Iron (Fe) was determined by Graphite Furnace Atomic Absorption Spectrophotometer (type *AAnalyst* 600, Perkin–Elmer). Phosphorus was determined by spectrophotometric method (AOAC 2000).

The crude fibre content of the samples was determined using a Fibretherm-Gerhardt equipment. Crude fibres include cellulose, hemicelluloses, and lignin. Inulin-type fructans were determined by AOAC 999.03 method.

Determination of vitamin C content was performed by high performance liquid chromatography (Accela, Thermo Scientific) coupled with high resolution mass spectrometry (LTQ Orbitrap XL Hybrid Ion Trap-Orbitrap Mass Spectrometer, Thermo Scientific) using hippuric acid as internal standard (Catană et al., 2017).

Total polyphenol content

Total polyphenol content was conducted according to Horszwald and Andlauer (2011) with some modifications (concerning extraction media, time and mode of extraction, extract volumes of the used sample and reagents, using UV-VIS Jasco V 550 spectrophotometer), based on calibration curve of gallic acid achieved in the concentration range 0 to 0.20 mg/mL. The extraction of phenolic compounds was performed in three extraction media (methanol: water = 1:1; ethanol: water = 1:1; acetone: water = 7:3) and the absorbance of the extracts was determined at a wavelenght λ = 755 nm. Results were expressed as mg of Gallic Acid Equivalents (GAE) per g product.

Antioxidant capacity

The DPPH scavenging radical assay was conducted according to Horszwald and Andlauer (2011) with some modifications (concerning extract volumes of the used sample and reagents, using UV-VIS Jasco V 550 spectrophotometer). The reaction was performed in dark for 30 min (at ambient temperature) and after this time the absorbance was read at 517 nm. It was achieved the calibration curve Absorbance = f(Trolox concentration), in the concentration range 0-0.4375 mmol/L and the results were expressed as mg Trolox Equivalents per g product.

Microbiological analysis

Microbiological analysis was performed according to SR 8924:1995. Canned food in hermetically sealed containers. Microbiological analysis.

Also, *Enterobacteriaceae* were determined according to the SR EN ISO 21528-2:2017

method and *Escherichia coli* by SR ISO 16649-2:2007 method. *Salmonella* was determined by the method SR EN ISO 6579-1:2017.

RESULTS AND DISCUSSIONS

Sensory analysis

After sensory analysis it was found that the hypoglucidic concentrated products from Jerusalem artichoke tubers and apples are well-gelled, have light brown to dark brown colour and a pleasant, balance taste, characteristic, with cinnamon specific flavour, mixed with noodles of Jerusalem artichoke tubers and apples, well-sourced by the sweetener syrup.

Following colour instrumental analysis (Figure 3) it was found that hypoglucidic concentrated product obtained from Jerusalem artichoke tubers – *Red* variety is the darkest, recording the minimum value of luminance (L* = 36.20), and that obtained from *White* variety is the lightest (L* = 40.16).

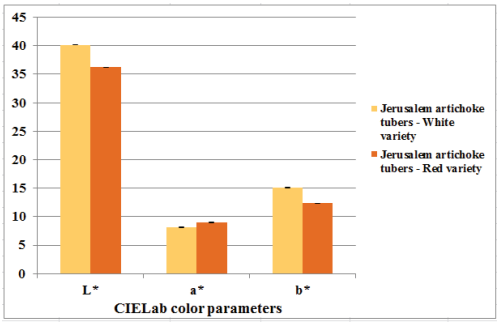

Figure 3. Colour parameters of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

Also, the maximum positive value of parameter a* (red colour coordinate) was recorded for the hypoglucidic concentrated product obtained from the Jerusalem artichoke tubers –*Red* variety (9.00), and the maximum value of the parameter b* (yellow colour coordinate) was recorded for the hypoglucidic concentrated product obtained from the Jerusalem artichoke tubers - *White* variety (15.12).

Following the sensory evaluation, using "*Comparison method with unitary score scale*", the hypoglucidic concentrated products from Jerusalem artichoke tubers and apples, obtained "*very good"* qualifying, recording the following scores: 19.44 points (Jerusalem artichoke tubers-*White* variety) and 19.84 points (Jerusalem artichoke tubers-*Red* variety) (Figure 4).

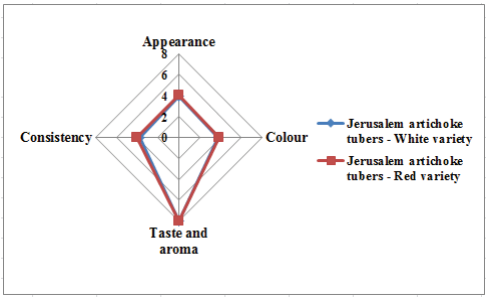

Figure 4. Sensory evaluation ofhypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

The textural properties of the hypoglucidic concentrated products are presented in Table 1, and the compression curves in Figure 5.

Table 1. Textural properties of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

Hypoglucidic concentrated product	Firmness (N)	Cohesiveness	Adhesiveness, (N)	Gumminess (N)
White variety	0.95 ± 0.05	0.36 ± 0.03	-0.82 ± 0.1	0.28 ± 0.06
Red variety	0.76 ± 0.01	0.33 ± 0.06	-2.48 ± 0.38	0.21 ± 0.04

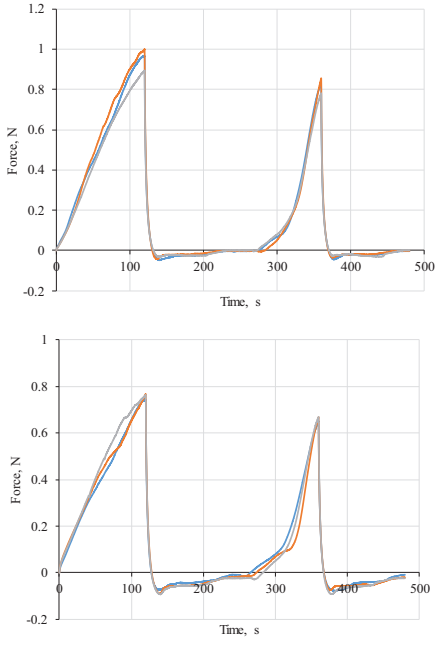

Figure 5.Compression curves of hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples (a) – *White* variety; (b) – *Red* variety

Hypoglucidic concentrated product obtained from Jerusalem artichoke tubers - *White* variety had higher firmness (0.95N) compared to that of the product achieved from Jerusalem artichoke tubers - *Red* variety (0.76N).
It is worth noting that the firmness of the products (which is given by the degree of gelling) was obtained due to the pectic substances contained in the raw materials used, the optimal pH, ensured by the addition of vitamin C and lemon juice and low methoxyl pectin. The other parameters (cohesiveness, gumminess) showed relatively close values for the two hypoglucidic products achieved with Jerusalem artichoke tubers (*Red* and *White* varieties) and apples.

Physic-chemical analysis

Composition of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers (*Red* and *White* varieties) and apples is presented in Table 2.

Physic-chemical parameters of hypoglucidic concentrated product obtained from Jerusalem artichoke tubers - *Red* variety, have higher values compared to those of the product achieved from Jerusalem artichoke tubers - *White* variety.

Table 2. Physic-chemical composition of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

Parameters	Hypoglucidic concentrated product	
	White variety	*Red* variety
Total soluble solids (°Brix)	31.5±0.02	32.5±0.02
Acidity (g citric acid/100g)	0.67±0.01	0.70±0.01
Total sugar (%)	6.35±0.02	6.47±0.02
Inulin type-fructans (%)	6.95±0.14	7.85±0.16
Protein (%)	1.28±0.01	1.37±0.01
Fat (%)	0.36±0.004	0.40±0.004
Crude fibers (%)	2.64±0.047	2.95±0.053
Ash (%)	0.80±0.010	0.95±0.011
Vitamin C (mg/100g)	22.65±0.86	23.70±0.90

The total soluble solids (TSS) content of hypoglucidic concentrated products achieved in this experimental study was higher than that obtained by Sutwal et. al. (2019) for apple hypoglucidic jam (sweetener Stevia – concentration 0.6%; TSS = 23.30°Brix), but comparable to that reported by Abolila et al. (2015) in the case of orange hypoglucidic jam achieved with a mix of sweeteners (fructose = 50%, sucralose = 33.5%, stevioside = 16.5%; TSS = 31.97±0.05°Brix) and, respectively, orange (75%) and papaya (25%) jam, achieved with the same sweetener mix (TSS = 30.2±0.02°Brix). Acidity and vitamin C content of hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples recorded higher values than those reported by Sutwal et al. (2019) in the case of apple hypoglucidic jam (Acidity = 0.57%; Vitamin C = 6.90 mg/100g). The differences obtained for these two physic-chemical indicators can be explained by the addition of lemon juice and vitamin C in the composition of the products. Also, total sugar content of hypoglucidic concentrated products achieved within this study is about 2.6 times lower than that obtained by Sutwal et al. (2019) in the case of apple hypoglucidic jam (Total sugar = 16.64%). The lower total sugar content is due to the original composition of the products (apples and Jerusalem artichoke tubers mix) and the apple variety used (*Jonathan* variety).
Proteins and crude fibres content of hypoglucidic concentrated products achieved in this study recorded values less than about 2 times in the case of proteins, respectively 1.32 times in the case of crude fibres, compared to those obtained by Perumpuli et al. (2019) for low sugar Beetroot (*Beta vulgaris* L.) jam (Crude protein = 2.6±0.03%; Crude fibres = 3.5±0.04%).
It is distinguished the content in inulin type-fructans of the achieved products: 6.95% (Jerusalem artichoke tubers – *White* variety) and 7.85% (Jerusalem artichoke tubers – *Red* variety). A diet rich in inulin may has beneficial effects in the case of patients who are suffering from type 2 diabetes and, moreover, can prevent this disease (Munim et al., 2017).
Fermentation of inulin resulted in a significantly greater ratio of *Lactobacillus* or *Bifidobacteria* to *Enterobacteria* strains as an index of the human intestinal health and, also, a high concentration of butyrate that shows improvement of gut health (Jung et al., 2015). It is also important to note that oligofructose-enriched inulin (10g/d) has determined a significantly decrease plasma LPSs, compared to maltodextrin, for women with type 2 diabetes (Dehghan et al., 2014). LPSs are a bacterially derived endotoxin, are an inflammatory reagent that plays a role in the development of inflammatory metabolic

disorders and are found mainly in gram-negative bacteria (Knaapen et al, 2013).
In a study, Ho et al. (2016) demonstrated that the administration of oligofructose-enriched inulin in the case of young children aged between (8–17 years) determined the following effects: develops into severe hypoglycaemia, decreases endotoxemia and reduced insulin resistance, improves glycemic control, changes gut microbiota, permeability and inflammation. Based on the obtained results, the authors of the study concluded that oligofructose-enriched inulin is a potential and novel agent for treating of type 1 diabetes.
The hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples are sources of minerals (K, Ca, Mg, Fe, and P). Their content in minerals is presented in Figures 6 and 7.
Mineral content of hypoglucidic concentrated products achieved from Jerusalem artichoke tubers – *Red* variety and apples is higher than that recorded for the product obtained from processing of Jerusalem artichoke tubers - *White* variety and apples.
Hypoglucidic concentrated products are noted for their potassium content (297.45±33.61 mg/100g for Jerusalem artichoke tubers – *White* variety, 305.10±34.48 mg/100g for Jerusalem artichoke tubers – *Red* variety) and their phosphorus content (41.54±3.53 mg/100g for Jerusalem artichoke tubers – *White* variety, 43.26±3.68 mg/100g for Jerusalem artichoke tubers – *Red* variety).

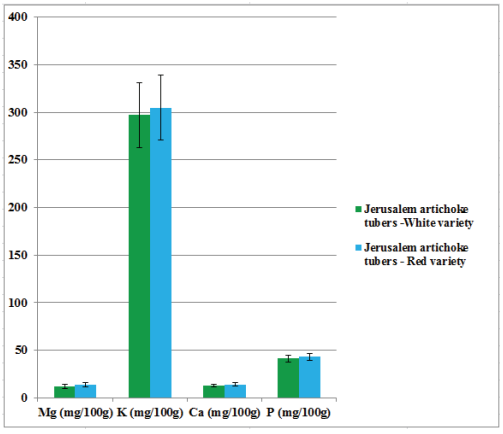

Figure 6. Mineral content (Mg, K, Ca and P) of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

The potassium content of the products is about 13 times higher than that reported by Perumpuli et al. (2019) for low sugar Beetroot (*Beta vulgaris* L.) jam (223.78±2.32 mg/kg). This difference can be explained by the low potassium content of raw beetroot used in jam preparation compared to those of Jerusalem artichoke tubers and apples, used in experiments in this study (Jerusalem artichoke tuber: 438.32–453.20 mg/100g; apple: 162.67 mg/100g). Potassium is very important in maintaining of cellular function. Enzymes that are involved in oxidative stress affect potassium activities. Both oxidative stress and potassium imbalance can cause various diseases (such as neurodegenerative diseases) (Udensi & Tchounwou, 2017).
Content in calcium and magnesium of hypoglucidic concentrated products recorded values in a small range (12.15–14.23 mg/100g). The calcium content of these products is higher than that of low sugar Beetroot (*Beta vulgaris* L.) jam (65.98±3.81 mg/kg).
The hypoglucidic concentrated products recorded an iron content of 1.8 mg/100g (Jerusalem artichoke tubers – *White* variety) and 1.95 mg/100g (Jerusalem artichoke tubers – *Red* variety).

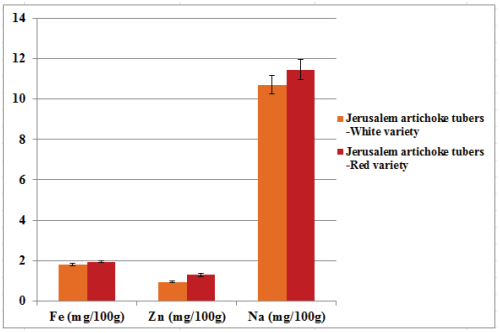

Figure 7. Mineral content (Fe, Zn, and Na) of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

The zinc content of the products is about 2 times lower than their iron content. The sodium content of the products is higher than that reported by Perumpuli et al. (2019) for low sugar Beetroot (*Beta vulgaris* L.) jams (13.56±1.11 mg/kg).

Total polyphenol content

The hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples are sources of phenolic compounds. The total polyphenol content of these is presented in Figure 8.

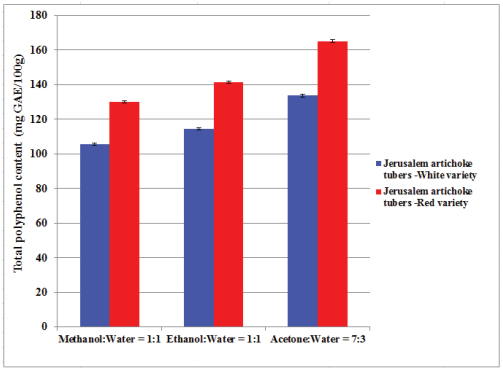

Figure 8. Total polyphenol content of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

The total polyphenol content of products varied in the range 105.75...165.23 mg GAE/100g (the minimum value was recorded in case of product obtained from Jerusalem artichoke tubers - *White* variety and apples, and the maximum value in the case of that obtained from Jerusalem artichoke tubers - *Red* variety and apples. It is worth noting that in the case of use of acetone: water =7:3, as extraction medium, were obtained higher values of total polyphenol content: 133.75 mg GAE/100g (Jerusalem artichoke tubers - *White* variety), respectively, 165.23 mg GAE/100g (Jerusalem artichoke tubers - *Red* variety).

The total polyphenol content of hypoglucidic concentrated products achieved in this study is lower than that obtained by Abolila et al. (2015) in the case of orange-based formulated low calories jams (100% orange, 75% orange/25% pumpkin, 75% orange/25% papaya) sweetened with fructose, stevioside and sucralose, which varied in the range: 167.66...383.60 mg GAE/100g.

Polyphenols are one of the most important functional components found in plant-derived foods (Danilcenko et al., 2017). Fruits and vegetables are important sources of polyphenols and antioxidant capacities which have beneficial effects into human body, against damage induced by reactive species (Álvarez et al., 2016). Polyphenols intake has been associated with beneficial effects on health, such as reduced incidence of cardiovascular diseases, diabetes and cancers (McDougall, 2017).

Antioxidant capacity

Due to their content in phenolic compounds the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples have antioxidant capacity. Their antioxidant capacity is presented in Figure 9.

Antioxidant capacity of products varied in the range 4.63...10.12 µmolTrolox Equivalents/g, taking into account the three extraction media used (the minimum value was recorded in case of product obtained from Jerusalem artichoke tubers - *White* variety and apples, and the maximum value in the case of that obtained from Jerusalem artichoke tubers - *Red* variety and apples.

In the case of use of acetone: water = 7:3, as extraction medium, were obtained higher values of antioxidant capacities: 7.20 µmol Trolox Equivalents/g (Jerusalem artichoke tubers - *White* variety), respectively, 10.12 µmol Trolox Equivalents/g (Jerusalem artichoke tubers - *Red* variety).

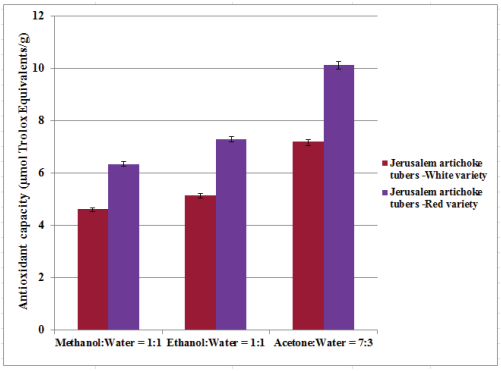

Figure 9. Antioxidant capacity of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

Antioxidant capacity of hypoglucidic concentrated products achieved in this study is low compared to that obtained by Abolila et al. (2015) in the case of orange-based formulated low calories jams (100% orange, 75% orange/25% pumpkin, 75% orange/25%

papaya) sweetened with fructose, stevioside and sucralose, which varied in the range: 17.63...39.15 µmol Trolox Equivalents/g.
For the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples between the total polyphenol content and antioxidant capacity it is a linear correlation, regression coefficient R^2 being 0.9786 (Figure 10).

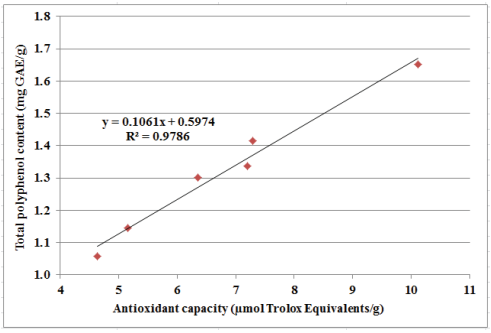

Figure 10. Correlation between the total polyphenol content and antioxidant capacity in case of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

There were used the values obtained for total polyphenol content and antioxidant capacity in the case of three extraction media (methanol: water = 1:1, ethanol: water = 1:1 and acetone: water = 7:3, respectively).
The results presented are consistent with those reported by Catană et al. (2018), which also obtained a linear correlation between total polyphenol content and values of antioxidant capacity, in case of the powders achieved from Jerusalem artichoke tubers (y= 6.6868x+2.7793; R^2 = 0.9533).

Microbiological analysis

Results of the microbiological analysis of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples are presented in the Table 3.

Table 3. Microbiological analysis of the hypoglucidic concentrated products achieved from Jerusalem artichoke tubers and apples

Microbiological indicators	**Hypoglucidic concentrated product**	
	***White* variety**	***Red* variety**
Yeast and mold (CFU/g)	Absent	Absent
Salmonella (CFU/25 g)	Absent	Absent
Enterobacteriaceae (CFU/g)	< 10	< 10
Escherichia coli (CFU/g)	< 10	< 10
Total viable count(CFU/g)	< 10	< 10

After thermostation at 37°C for 14 days, the achieved products did not show:

- ✓ external container changes and/or leakage of content
- ✓ content changes, odour changes and/or other changes caused by a microbial activity.

Microbiological analysis shown that the hypoglucidic concentrated products are in the frame of the provisions of the legislation into force. At the same time, on the basis of microbiological and sensory analysis, the shelf life of the products was established (18 months).
Hypoglucidic concentrated products must be stored in dark, dry, cool rooms at a temperature not exceeding 25°C.After opening, the products are stored in refrigeration conditions at 2-8°C and consumed within 7 days.

CONCLUSIONS

The hypoglucidic concentrated products achieved from Jerusalem artichoke tubers (*White* and *Red* variety) and apples, using a sweetener based on *Stevia rebaudiana* and erythritol have superior sensory characteristics (appearance, colour, flavor, taste and texture) similar to conventional jams (achieved with sugar).
The hypoglucidic concentrated products are sources of inulin, bioactive compounds (polyphenols, vitamin C) and minerals (K, P, Fe, Mg, Ca). Content in inulin type-fructans of products was: 6.95% (Jerusalem artichoke tubers – *White* variety) and 7.85% (Jerusalem artichoke tubers – *Red* variety). The hypoglucidic concentrated products are distinguished by total polyphenol content (105.75...165.23 mg GAE/100g) and vitamin C content (22.65 mg/100g – *White* variety and 23.70 mg/100g - *Red* variety). Also these products have antioxidant potential being beneficial in a healthy diet for prevention of diseases caused by free radicals.
The hypoglucidic concentrated products achieved in the present study are beneficial in the diet of diabetics, obese and peoples who want to maintain their weight.

ACKNOWLEDGEMENTS

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