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Mineral qualities of Isabella grapevine (Vitis labrusca L.) leaf

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A B S T R A C T

The goal of the present paper was to identify the content of heavy metals, also macro - and micro-nutrients, which play very important roles in human health in Isabella grapevine (Vitis labrusca L.) leaves as a raw material to produce a tonic drink rich in vitamins and active substrates. Samples of leaves and soils were analyzed by flame atomic absorption spectroscopy. The leaves of Isabella do not contain any heavy metals and are suitable for our purposes.

Keywords: Grape leaves, Nutrient content, Vitamins, Heavy metals, Soil samples, Analysis by FAASPS.

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Introduction

With the aim of keeping the population healthy and fit for work, usage of plant-based concentrates enriched with food vitamin complexes became very popular [1]. Taking this into the account, we studied the secondary product, such as grapevine leaf, which is enriched with vitamins, antioxidants, and is a dietary product. It is used in medicine and perfumery. Studies have shown that from the green grapevine biomass we can produce the following products: 1. grapevine poly vitamin and granular dragée; 2. liquid food concentrates; 3. dry, easily soluble food concentrates of the grapevine; 4. natural food dyes; 5. Green, yellow, red, and black granules vitaminized by the young offshoots of the grapevine; 6. protein and vitamin-enriched food for stockbreeding [2].

In Georgia, one of the widespread breeds of the grapevine is Isabela (Adesa). This is a natural hybrid with the qualities of cold resistance, phylloxera resistance, and fungi-related disease resistance, therefore it doesn't require spraying with pesticides. Usage of the leaf of this grapevine and producing tonic, vitamins, and useful substances-enriched drinks will play a significant role in the food economy [3].

In the list of the most useful products, published by the dietologists and gastroenterologists of the European research association, Isabella takes fourth place in the terms of its biochemical content.

Our aim was to study the leaf of the Isabela grapevine for the production of tonic, non-alcoholic refreshing drinks.

As a result of the research, it was shown that the leaf of the Isabela grapevine contains metals. These observed metals don't include heavy metals such as lead, cadmium, and mercury.

Object and methods

As research material, the leaf of the Isabela grapevine was taken from the East Georgia (Ga-

chiani) and West Georgia (Chokhatauri) regions. Also, soil samples were taken from the place, where the raw material was collected. The soil samples were tested to study the presence of the significantly important micro and macroelements. Additionally, the seasonal variability (Spring, Autumn) of the grapevine leaf mineral composition was studied.

Reagents: high purity nitric acid, deionized water, especially pure air-like acetylene, metal composition standard models (standard solutions of the Perkin Elmer company)

Testing the presence of metals in samples was conducted with Buck Model 210VGP atomic absorption spectrophotometer [4-6]. Atomic absorption spectroscopy (AAS) is a physical analysis method. AAS is based upon the principle that free atoms in the ground state can absorb light of a certain wavelength. Absorption for each element is specific, no other elements absorb this wavelength. When the metals from the solution end up in flame, metal ions are transitioning to the atomic state and an aerosol is produced. The metals, which are to be determined, don't interfere with each other. From the spectral lightbulb of the metals, which are to be researched in the samples, the light crosses the flame, the atomic cloud will light up and atoms will absorb the part of the radiation. The relationship between the concentration of absorbed atoms and the beam of light is described by The Beer-Bouguer-Lambert law: A=Lg(1/T)=Lg(l0 /l), where T is the conductance of the flame, 10/1 is the intensity of the radiation which has been dropped and then passed. A is a quantity of absorbed light beams. Then the light beam will end up in the monochromator detector. In the detector will be measured the energy of the light beam which was absorbed by atoms in flame. The intensity of the light beam absorption depends on the presence of a free, ground state number of atoms in flames.

Experiment

Since the Isabela grapevine is not a subject of pesticide usage, firstly we measured the heavy metal presence in the soil samples. Additionally, we measured the presence of micro and macroelements, necessary for viability.

The work was carried out in the Laboratory of Food Safety of Grocery department (Faculty of Agricultural Sciences and Biosystems Engineering GTU). During the work, the used samples were the spring leaves of the Isabela grapevine from Eastern (Gachiani) and western (Chokhatauri) parts of Georgia, the samples of autumn leaves, and the soil samples.

Various solutions containing different concentrations of metals were made on the deionized water to measure absorption index and to create the relevant mathematical model. For different metals, the corresponding lightbulb was chosen. Measuring the absorption wave was achieved by the manual atomic absorption spectrophotometer. The mode of the device is chosen by the recommendations of the enterprise which has produced the spectrophotometer. After turning on the spectrophotometer, the atomization method is chosen by the computer program WinLab32 (setting up the atomizer and adjustment is achieved automatically). The data which is presented in the following table is corresponding to the samples of: 1 (Chokhatauri, Spring leaf), 2 (Gachiani, Spring leaf), 3 (Chokhatauri, Autumn leaf), 4 (Gachiani, Autumn Leaf), 5 (Chokhatauri, soil), 6. (Gachiani, soil).

Table 1. *The concentration of metal in the samples (mg/kg)*

Metals	M.A.C.	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6
Cu	3,0	0,04	0,11	0,03	0,10	0,07	0,13
Zn	23	4,1	4,78	4,23	4,69	4,25	4,79
Pb	6,0	0,06	0,07	0,05	0,07	0,07	0,08

M.A.C. –maximum allowable concentrations - maximal concentration, when the substance does not affect (neither directly nor indirectly) the health of the population.

According to the results, there was almost no difference between the soil samples and leaf samples in terms of heavy metal presence. In the samples, there were practically no Cd, As, Hg, Ag, Ni, Cr, Sn present.

The samples were tested for the presence of several metals, significant for the development:

Table 2. *The presence of several significant metals (mg/kg)*

Metals	sample 1	sample 2	sample 3	sample 4	sample 5	sample 6
K	7,61	7,59	7,62	7,61	6,9	6,9
Na	1,7	1,68	1,69	1,66	0,8	0,8
Ca	5,69	4,99	5,66	5,0	4,09	4,09
Mg	3,01	3,01	2,62	2,61	1,0	1,11
Fe	2,37	2,87	2,4	2,75	2,0	2,0
Mn	0.2	0.11	0.13	0.12	0.11	0.12

In the grapevine leaves most of the elements are entering the leaf as a salt, as an ion, or as a complex/organic substance. Therefore, they're crucial components (nutrients). Even though mineral substances don't have energetic value as proteins, lipids or polysaccharides do, they are essential substances for viability [7-11].

Conclusion

1.The leaf of the Isabela grapevine doesn't contain heavy metals and it can be used for produc ing raw tonic drinks.

2. Usage of the leaves of this species and producing tonic, vitamin-enriched drinks will play a significant role in the food production economy.

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