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The comparisons about macro elements content in fruits collected from the Gotlob locality of Timis county

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Abstract

In this paper was evaluated the macro elements content in sodium (Na), potassium (K), calcium (Ca) and magnesium (Mg) in 18 fruit samples collected from three different areas (6 samples for each area), the locality Gotlob from Timis County. The samples analyzed were: Apples (*Malus domestica*), Watermelon (*Citrullus lanatus*), Plums (*Prunus*), Cherry (*Prunus avium*), Sour cherry (*Prunus Cerasus*) and Melon (*Cucumis melo*). The solutions obtained were analyzed using an Atomic Absorption Spectrometer - Varian 280 FS SpectrAAVariant. The macro elements content was expressed on dry weight (d.w.), obtained after drying process. The samples analyzed presented a high content in potassium element with the highest value recorded in sample Sour cherry source 3 (8.688 g/Kg dw), followed by sodium element with the highest value recorded in sample Melon source 3 (1.745 g/Kg dw), the magnesium element with the highest value recorded in sample Watermelon source 2 (0.567 g/Kg d.w), and the calcium elements with the highest value recorded in sample Melon source 2 (0.24 g/Kg d.w.).

Keywords: macro elements, atomic absorption, fruits

1. Introduction

Food safety testing includes the analysis of agricultural products and foods, with a focus on regulatory compliance and enforcement. This rapidly growing issue is being driven by the liberalization of global trade, an increasingly stringent regulatory environment and heightened public awareness of food safety issues [1-2].

Fruits are traditionally an important component of the human diet. They contain a lot of biologically active substances that have beneficial effects on human health as antioxidants, anticancerogens, antimutagens and antibacterial compounds [3-6]. Fruits and leafy vegetables are believed to occupy a modest place as a source of trace elements due to their high water content.

Most of nutrient requirements can be met by increasing the consumption of fruits and vegetables to 5–13 servings/ day [7]. Daily consumption of fresh fruits and vegetables (4400 g/day) is recommended to help prevent major non-communicable diseases such as cardiovascular diseases and certain cancers [8-9].

In developed countries, despite the large food supply, special attention to the intake levels of some of these nutrients is required. In fact in the more affluent societies, the development of chronic diseases such as anaemia and osteoporosis, due to inadequate dietary intakes of Fe and Ca in particular segments of a population, is still observable [10-12]. At the same time attention should be paid to the daily intakes of other elements such as Na because of the health risks related to a high consumption [13].

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Therefore to know and to up date data on the food-consumption patterns of a population and to evaluate the intake levels of both macro elements and trace elements in the total diet is of relevance for assessing the adequacy of the diet with respect to these nutritional elements and for evaluating a possible risk [12].

The aim of this paper is to evaluate the macro elements content in sodium (Na), potassium (K), calcium (Ca) and magnesium (Mg) in 18 fruit samples collected from three different areas (6 samples for each area), the locality Gotlob from Timis County. The samples analyzed were: Apples (Malus domestica), Watermelon (Citrullus lanatus), Plums (Prunus), Cherry (Prunus avium), Sour cherry (Prunus Cerasus) and Melon (Cucumis melo). The solutions obtained were analyzed using an Atomic Absorption Spectrometer - Varian 280 FS SpectrAAVariant

2. Materials and Methods

2.1. Chemicals: HCl (Merk - Germany), HNO_3 (Merk - Germany), C_2H_2 (Linde Gaz Romania).

2.2. Vegetable materials: 18 fruits - Cherry (*Prunus avium*), Sour cherry (*Prunus Cerasus*), Plums (*Prunus*), Apples (*Malus domestica*), Melon (*Cucumis melo*), Watermelon (*Citrullus lanatus*), from three source from Gotlob, Timis county, Romania.

2.3. Type of apparatus: Atomic Absorption Spectrometer - Varian 280 FS SpectrAA; Flame type: air/acetylene;

The elements calcium (Ca) and magnesium (Mg) were determined by analysis of the flame atomic absorption spectrometry. The elements sodium (Na) and potassium (K) were determined by analysis of the flame atomic emission spectrometry.

2.4. Working conditions

Analysis by atomic absorption spectrometry was performed under the following conditions:

- For sodium (Na): Lamp current 6 mA; Wavelength 589 nm; Band width 0,2 nm; Air flow 13,5 L/min, C_2H_2 flow rate 2,9 L/min; Standards 5/10/15/20/25 mg/L;
- For potassium(K): Lamp current 6 mA; Wavelength 766,5 nm; Band width 1,0 nm; Air flow 13,5 L/min, C_2H_2 flow rate 2,0 L/min; Standards 2/4/6/8/10 mg/L;
- For calcium (Ca): Lamp current 6 mA; Wavelength 422,7 nm; Band width 0,5 nm; Air flow 13,5 L/min, C_2H_2 flow rate 2,0 L/min; Standards 5/10/15/20/25;For
- For magnesium (Mg): Lamp current 6 mA; Wavelength 202,6 nm; Band width 1,0 nm; Air flow 13,5 L/min, C_2H_2 flow rate 2,0 L/min; Standards 5/10/15/20/25

The fruits samples were analyzed immediately after harvesting, were removed the impurities mechanical (ground, vegetation, debris, etc.), by washing, followed by removal of adherent water with filter paper to full drying.

The primary samples thus obtained were mixed together, and the material obtained - medium samples were obtained after the quartering method. To determine dry matter and macro and trace elements content of each variety were selected 100 ± 0.001 g edible part.

Dividing fruits with plastic utensils are made by cutting into small pieces after removing the shell. They are introduced in the oven to 105 ° C until a constant weight (when the loss of mass is the same one hour after the last weighing). Place in oven proof capsules at 50-60 ° C where they remain 6 hours. It then raises the temperature at 105 ° C and held for 6 hours.

The fruits organic matter is oxidized by oxygen in the air in a calcinations furnace, heated gradually to 550°C temperature, which is maintained for 6-8 hours. The method used was that described in STAS 5954/1-86, [14] adapted to the specific analysis of plant products.

*2.5. Determination of macro elements by atomic absorption spectrometry.*The method is based on measurement by atomic absorption spectrometry, the concentration of macro elements in the acid extract obtained from the ashes of the fruit sample. Analytical process includes two steps: digestion, dry route and dosage, by atomic absorption spectrometry.

Macro elements distribute the hydrochloride solution spray mineralization obtained in air-acetylene flame and measuring absorbance at a wavelength characteristic of each element analyzed.

Following the analysis made in terms of load in macro elements (sodium, potassium, calcium and magnesium) samples of primary horticultural products (fruits) Collected from three sources Gotlob

locality, Timis county, were obtained the following results presented in Table 1.

3. Results and discussion

Table 1 illustrates the results obtained by atomic absorption analysis of samples of fruit from three sources, Gotlob locality.

In Figure 1 are represented the values of macro elements content from fruit samples analyzed, from source 1, Gotlob.

The analyses performed for sodium element led to obtain the equal results of Melon (*Cucumis melo*) and Watermelon (*Citrullus lanatus*) samples with a value of 0.62 g/Kg d.w. The two samples of fruit showed maximum sodium content for source 1. The lowest sodium content was determined in samples Cherry (*Prunus avium*) and Sour cherry (*Prunus cerasus*) with values of 0.196 g/Kg d.w or 0.207 g/Kg d.w. Samples Plums (*Prunus*) and Apples (*Malus domestica*) presented a sodium content of 0.53 g/Kg d.w. and 0.435 g/Kg d.w. The potassium element was determined in the highest content, in all the elements analyzed. The sample with the highest potassium content was Sour cherry (*Prunus cerasus*) 5.599 g/Kg d.w. The lowest content in this element was determined in samples of Apples (*Malus domestica*) (2.914 g/Kg d.w.) and Plums (*Prunus*) (3.795 g/Kg d.w).

The samples Cherry (*Prunus avium*), Melon (*Cucumis melo*) and Watermelon (*Citrullus lanatus*) had a very similar potassium content in the range (4.066 - 4.676 g/Kg d.w.). The fruit samples analyzed presented the lowest assimilation for the calcium element. The samples Sour cherry (*Prunus cerasus*) and Watermelon (*Citrullus lanatus*) had the highest content of this element values (0.093 g/Kg d.w.) and (0.087 g/Kg d.w.). The lowest contribution to this element was recorded samples Melon (*Cucumis melo*), Cherry (*Prunus avium*) and Plums (*Prunus*) with very similar values in the range (0.036 - 0.039 g/Kg d.w.). The average content of this element was obtained in sample Apples (*Malus domestica*) (0.041 g/Kg d.w.). Lanauskas and Kvikliene, N., [15] obtained a calcium content, in the range of 50 - 460 mg/kg d.w. The results were similar those obtained by us, in this paper. The fruit samples analyzed presented a higher assimilation of magnesium element in the sample Watermelon (*Citrullus lanatus*) (0.512 g/kg d.w.). The lowest content in magnesium element was determined in samples of Apples (*Malus domestica*), Plums (*Prunus*) and Cherry (*Prunus avium*) with very similar values in the range (0.127 - 0.169 g/kg d.w.). The samples of Melon (*Cucumis melo*) and Sour cherry (*Prunus cerasus*) presented an average content of this element with values of 0.206 g/Kg d.w. or 0.259 g/Kg d.w.

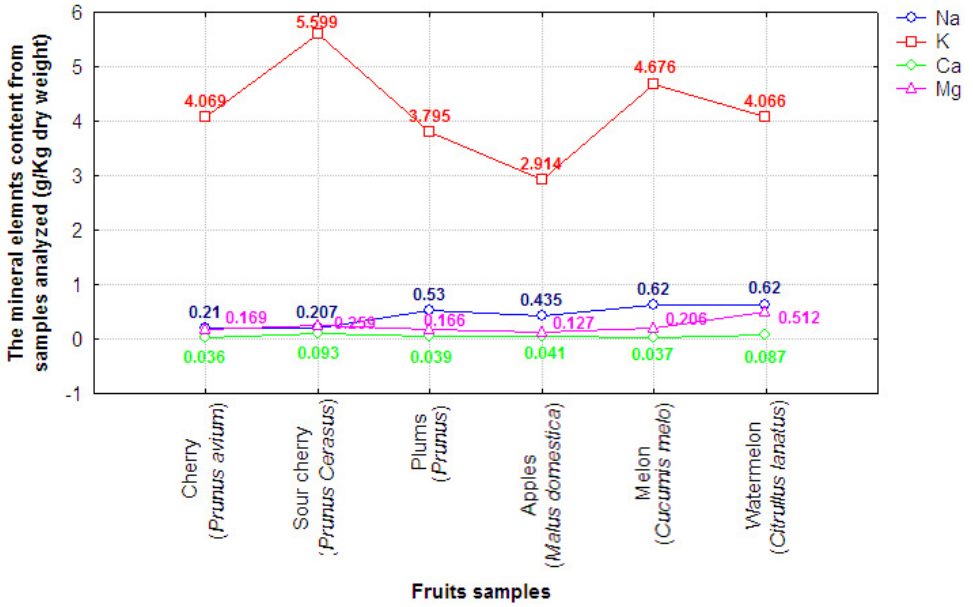

Figure 1. Graphical representation of macro elements content in Na, K, Ca and Mg of fruit samples analyzed, source 1 – Gotlob

Table 1. Macro elements content of Na, K, Ca and Mg in the samples of fruit analysis (dry weight) of the three sources from Gotlob locality.

Samples	Na, g/Kg	K, g/Kg	Ca, g/Kg	Mg, g/Kg
Source 1				
Cherry (*Prunus avium*)	0.210	4.069	0.036	0.169
Sour cherry (*Prunus Cerasus*)	0.207	5.599	0.093	0.259
Plums (*Prunus*) – source 1	0.530	3.795	0.039	0.166
Apples (*Malus domestica*)	0.435	2.914	0.041	0.127
Melon (*Cucumis melo*)	0.620	4.676	0.037	0.206
Watermelon (*Citrullus lanatus*)	0.620	4.066	0.087	0.512
Source 2				
Cherry (*Prunus avium*)	0.196	4.214	0.053	0.221
Sour cherry (*Prunus Cerasus*)	0.200	6.292	0.146	0.359
Plums (*Prunus*)	0.203	5.628	0.051	0.188
Apples (*Malus domestica*)	0.196	3.579	0.062	0.181
Melon (*Cucumis melo*)	0.339	6.985	0.24	0.225
Watermelon (*Citrullus lanatus*)	0.704	4.326	0.144	0.567
Source 3				
Cherry (*Prunus avium*)	0.207	3.838	0.041	0.200
Sour cherry (*Prunus Cerasus*)	0.243	8.688	0.174	0.444
Plums (*Prunus*)	0.549	5.307	0.032	0.188
Apples (*Malus domestica*)	0.315	1.265	0.020	0.108
Melon (*Cucumis melo*)	1.745	3.694	0.033	0.227
Watermelon (*Citrullus lanatus*)	0.592	2.738	0.043	0.377

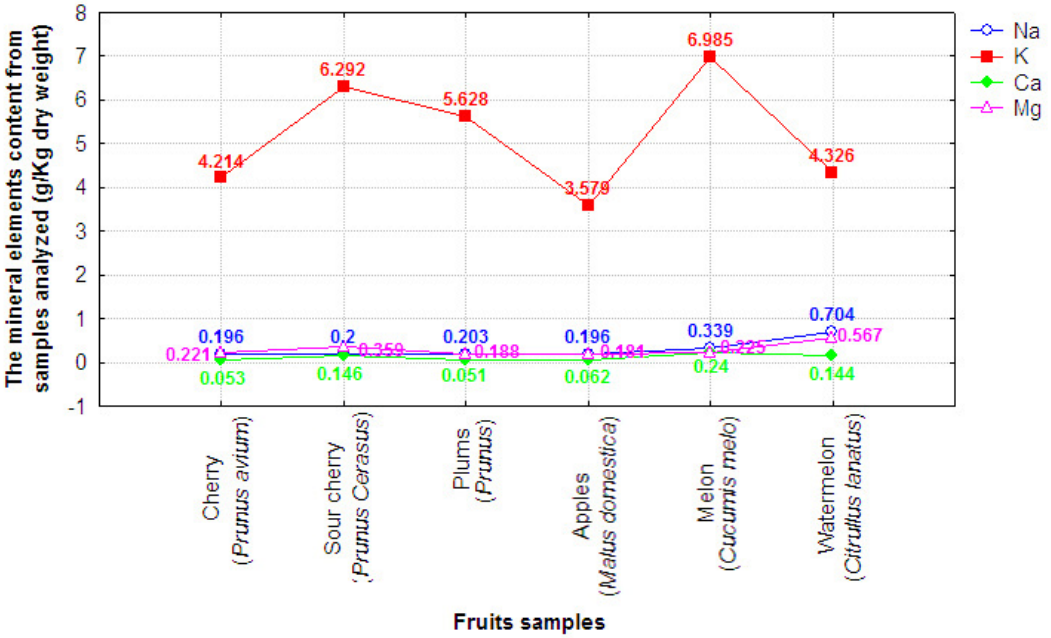

Figure 2. Graphical representation of macro elements content in Na, K, Ca and Mg of fruit samples analyzed, source 2 – Gotlob

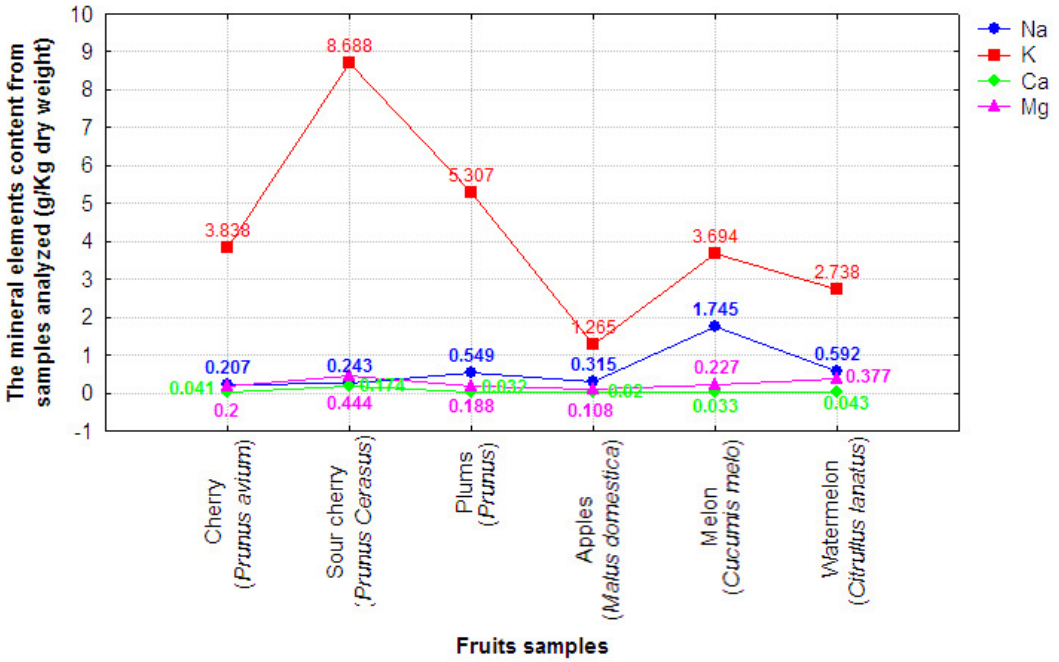

Figure 3. Graphical representation of macro elements content in Na, K, Ca and Mg of fruit samples analyzed, source 3 - Gotlob

In Figure 2 are represented the values of macro elements content from fruit samples analyzed, from source 2, Gotlob.

The sodium element in samples from source 2, Gotlob presented a higher assimilation in Watermelon (*Citrullus lanatus*) with a value of 0.704 g/Kg d.w. The samples Cherry (*Prunus avium)*, Apples (*Malus domestica*), Sour cherry (*Prunus cerasus*) and Plums (*Prunus*) recorded the lowest sodium content and very similar in the range (0.196 - 0.203 g/Kg d.w.). The average content of this element was determined for the sample of Melon (*Cucumis melo*) (0.339 g/Kg d.w.). The largest potassium content was recorded in the sample Melon (*Cucumis melo*), 6.985 g/Kg d.w., the value obtained very close for the sample Sour cherry (*Prunus cerasus*) 6.292 g/Kg d.w., and in sample Plums (*Prunus*) the value obtained was more higher (5.628 g/Kg d.w.). The samples Cherry (*Prunus avium*) and Watermelon (*Citrullus lanatus*) had a contribution in this element with values very close to 4.214 g/Kg d.w. and 4.326 g/Kg d.w. The lowest content of potassium element was recorded in sample Apples (*Malus domestica*) with value of 3.579 g/Kg d.w.

For potassium content in cherry, Jaroszewska, A., [16] obtained the values in the range 12.8 - 13.4 g/kg d.w, values much higher than those obtained by us (0169-0221 g / kg dw).

The calcium content in the source 2, Gotlob presented the largest content in Melon (*Cucumis melo*), (0.24 g/Kg d.w.). Average values of this element and very close were recorded in samples of Watermelon (*Citrullus lanatus*) (0.144 g/Kg d.w.) and Sour cherry (*Prunus cerasus*) (0.146 g/Kg d.w.). The samples of Apples (*Malus domestica*), Plums (*Prunus*) and Cherry (*Prunus avium*) presented the lowest assimilation for this element values in the range (0.051 - 0.062 g/Kg d.w.). The magnesium element for Watermelon (*Citrullus lanatus*) sample recorded the highest value of 0.567 g/Kg d.w. The samples of Apples (*Malus domestica*), Plums (*Prunus*), Cherry (*Prunus avium*) and Melon (*Cucumis melo*) recorded the lowest values of magnesium content in the range (0.18.1 - 0.225 g/Kg d.w.). For magnesium content in cherry, Jaroszewska, A., [16] obtained the values in the range 0.61 - 0.90 g/kg d.w, similar values to those obtained by us (0.169-0.221 g/kg dw).

The average content for this element was determined to Sour cherry (*Prunus cerasus*) samples, value of 0.359 g/Kg d.w.

In Figure 3 are represented the values of macro elements content from fruit samples analyzed, from source 3, Gotlob.

The sodium element in samples from source 3, Gotlob presented a high content in the sample Melon (*Cucumis melo*), 1.745 g/Kg d.w. The lowest content in this element was recorded in Cherry (*Prunus avium*), Sour cherry (*Prunus Cerasus*) and Apples (*Malus domestica*) samples with values in the range (0.207 – 0.315 g/Kg d.w.).The samples of Plums (*Prunus)* and Watermelon (*Citrullus lanatus*) had sodium content in the range 0.549 - 0.592 g/Kg d.w. The higher assimilation in potassium element was presented in the Sour cherry (*Prunus Cerasus*), (8.688 g/Kg d.w.) and Plums (*Prunus*) samples - 5.307 g/Kg d.w. The samples of Cherry (*Prunus avium*) and Melon (*Cucumis melo*) had a potassium content values close to 3838 - 3.694 g/Kg d.w. The lowest content in this element was determined in sample Watermelon (*Citrullus lanatus*), (2.738 g/Kg d.w.), respectively, in sample Apples (*Malus domestica*), (1.265 g/Kg d.w.). The sample Sour cherry (*Prunus Cerasus*) recorded the highest calcium content element with the value of 0.174 g/Kg d.w. The lowest calcium content was recorded in sample Apples (*Malus domestica*) with value of 0.02 g/Kg d.w. The samples of Plums (*Prunus*), Melon (*Cucumis melo*), Cherry (*Prunus avium*) and Watermelon (*Citrullus lanatus*) have showed assimilation for this element with values in the range 0.032 - 0.043 g/Kg d.w. Jaroszewska, A., [16] obtained a calcium content in cherry, in the range of 0.65 – 0.70 g/kg d.w. The our results were lower with values between 0.036 - 0.053 g/kg d.w. The analyzes for magnesium element had a higher content in samples of Watermelon (*Citrullus lanatus*) and Sour cherry (*Prunus Cerasus*) with values in the range 0.377 - 0.444 g/Kg d.w. The samples of Apples (*Malus domestica*) presented the lowest content of magnesium (0.108 g/Kg d.w.). The average content for this element was determined in samples of Plums (*Prunus*), Cherry (*Prunus avium*) and Melon (*Cucumis melo*) with values in the range (0.188 – 0.227 g/Kg d.w.). Jaroszewska, A., [16] obtained a calcium content in plums, in the range of 0.51 – 0.61 g/kg d.w., magnesium content in plums, in the range of 0.60 – 0.61d.w. g/kg and the potassium content in plums, in the range of 11.7 – 12.0 g/kg d.w. Our results for plums were much lower: potassium (3.795 - 5.628 g/kg d.w.), calcium (0.032 – 0.051 g/kg d.w.) and magnesium (0.166 - 0.188 g/kg d.w.).

4. Conclusion

The analysis by atomic absorption and graphs realized for fruit samples collected from the three sources, Gotlob locality from Timis county presented a higher load in macro elements for the zone 2 Gotlob followed by zone 3 Gotlob, respectively zone 1 Gotlob. The element potassium presented the highest content of the analyzed elements. The lower the content of the component determined for calcium. The highest values obtained in the case of analysis from the six samples for macro elements of fruits samples depending on the elements were: for the sodium element the high content being determined from the sample by Melon (*Cucumis melo*) source 3, Gotlob, 1.745 g/Kg d.w., for potassium element in sample Sour cherry (*Prunus Cerasus*) source 3 Gotlob, 8.688 g/Kg d.w., for calcium element the highest value was recorded in sample Sour cherry (*Prunus Cerasus*), source 3 Gotlob, 0.174 g/Kg d.w., respectively the magnesium element in sample Watermelon (*Citrullus lanatus*), source 3 Gotlob, 0.567 g/Kg d.w.

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Compliance with Ethics Requirements

Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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