DETERMINATION OF SOME ESSENTIAL MINERAL ELEMENTS FROM DIFFERENT TROPICAL FRUITS

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Abstract
The purpose of this paper is to determine the concentration of some essential macro and micro elements, from tropical fruits and the role that these minerals play in health benefits. The concentrations of Ca, Mg, Fe, Mn, Zn and Cu in bananas, grape fruits, kiwi, lemons, mandarins, oranges, pineapples and pomelo sold in Timisoara markets were determined by flame atomic absorption spectrometry method. The obtained results show that the distribution of the essential mineral elements in the analyzed fruits presents non-uniformity, depending on the fruit species and the nature of the analyzed element. The best represented among the analyzed elements are Ca and Mg (59.1-358 mg/kg Ca, respectively 92-287 mg/kg Mg). Fe, Zn, Cu and Mn were determined in much lower concentrations (1.12-3.26 mg/kg, 0.75-1.53 mg/kg, 0.45-1.21 mg/kg respectively 0.34-7.12 mg/kg), but sufficient considering the requirement of these essential microelements in the human body. However, it can be stated that the studied tropical fruits contain important amounts, especially of calcium and magnesium, but also appreciable amounts of essential microelements: Fe, Zn, Cu and Mn.

Introduction
Tropical fruits, originating from tropical and subtropical areas are particularly appreciated not only due to their organoleptic characteristics including their exclusive taste, sensory properties, and mouthfeel, but due to their particularly high nutritional values, a fact for which they are recommended for curative purposes, being considered as medicinal food [1,2]. Fruits have a significant contribution in human health and nutrition being a natural source, full of precious nutritional constituents. They contain vitamins, fatty acids, dietary fiber and essentials minerals available in various quantities and qualities. The beneficial effects of these fruits are due to the main constituents, which include the mineral substances in the form of essential macro and micro elements [5].Among the most important minerals available in fruits are calcium, potassium, iron, phosphorus, magnesium, zinc. Due to the curative effects in a range of acute and chronic diseases, the exotic fruit diet is used in modern medicine. It is recommended, prophylactic and curative, as an adjuvant, when the body accumulates significant amounts of acids; which has repercussions such as diabetes, aging, gout, and so on [1,4]. Consumption of the fruit with pulp is prescribed in the treatment and prevention of cardiovascular diseases, liver diseases, etc., that provides a high percentage of vitamins and minerals in the daily dose [5]. In South Africa, the banana is the main food, basic for about 50% of the population and the most popular fruit in industrialized countries [6]. Pineapple is a perennial herbaceous plant of the *Bromeliaceae* family with the botanical name *AnanasSativus* or *Bromelia* pineapple, originates in the tropical regions of America and the Far East [3].

The specialized literature includes numerous references regarding the beneficial effects of consuming exotic fruits obtained in tropical and subtropical areas, as well as the techniques for analyzing some mineral elements from such vegetable products.

Experimental

The paper presents data related to the distribution of some mineral elements in different imported tropical fruits, also known as exotic fruits. In order to achieve the proposed objective, exotic fruit were purchased from different local markets in Timișoara (banana fruit, grape fruits, kiwi, lemons, mandarins, oranges, pineapples and pomelo). To perform the experiment, three fruit samples were prepared for analysis, corresponding to each variety of fruit under study. The determination of the mineral elements in the analyzed fruits required two steps: mineralization, by calcination, followed by the solubilization of the inorganic matter in 0.5 M HNO_3 and the spectrophotometric determination of the absorbances of the essential elements.
The device used for this purpose was atomic absorption spectrophotometer in air flame - acetylene, brand Varian AA 240 FS, a laboratory water bath and a thermal regulation electric stove. Also, the Reagents used are Nitric acid Merck, 65% (ρ = 1.39 g/cm3) to prepare the nitric acid solution 0.5 N; standard solutions for the analyzed elements: Ca, Mg, Fe, Mn, Zn and Cu, obtained from the concentrated standard solution Merck Darmstadt - Germany, 1.000g/ml;
For each analysed element were prepared six sets of standard solutions to cover the concentration range of each element analysed; distilled water. The working parameters of the apparatus – wave length, air and acetylene pressure, burner height, etc. – were selected in accordance with the recommendations of the Varian AA 240 FS. Simultaneously with the measurement of the absorbance of analyzed samples, the absorbance of the working standards solutions were determined in the same working conditions.

Results and discussion

The experimental results obtained in the analysis of the essential mineral elements, average values, are presented in tables 1.

Table 1. The concentration (mean values) of some essential element from exotic fruits

Fruits	Bioelement, mg/kg					
	Ca	Mg	Fe	Mn	Zn	Cu
Banana	59.1	287	1.12	3.22	1.53	1.21
Grapefruit	253	94.4	1.78	0.87	1.12	0.45
Kiwi	358	128	2.92	0.58	1.14	0.68
Lemon	226	92	2.91	0.51	1.26	0.51
Mandarin	224	101	1.98	0.63	0.75	0.52
Orange	306	106	2.38	0.27	1.46	0.55
Pineapple	179	126	2.03	7.12	0.97	1.10
Pomelo	332	165	3.26	0.34	0.87	0.64

From the analysis of the experimental data obtained for the evaluation of some essential macro and micro elements: shows that the distribution of the essential mineral elements in the analyzed fruits presents non-uniformity. This depends on the fruit species and the nature of the analyzed element. The best represented elements are the macro-elements, calcium and magnesium which has the highest concentration values between 59.1-358 mg/kg Ca, respectively 92-287 mg/kg Mg. Among microelements, the best represented bioelement was iron (1.12-3.26 mg/kg Fe) followed - in slightly lower concentrations by Mn, Zn and Cu : (0.27-7.12 mg/kg Mn),

Zn (0.75-1.53 mg/kg Zn) and Cu (0.45- 1.21 mg/kg Cu). A ranking of the analyzed fruits according to their mineral intake is difficult to achieve. Calcium (Ca^{2+}), important

macroelement in formation and stability of cell walls, in maintenance of membrane structure and permeability, activates some enzymes was determined in the highest concentration, between 59.1ppm - in bananas and 358 ppm - in kiwi. Higher Ca contents were determined in kiwi, pomelo and oranges. Magnesium (Mn^{2+}), an essential macroelement, was determined in much lower concentrations than calcium, but much higher than iron, zinc, manganese and copper. Increased magnesium content is recorded in pineapples, bananas and kiwis. Iron (Fe^{3+}, Fe^{2+}), an essential microelement in plant growth and development, it was determined in the highest concentration of all the analyzed microelements from all the fruits studied, between 1.12-in bananas and- 3.26 ppm in pomelo. Zinc (Zn^{2+}), essential microelement for plants, this, participating in the formation of chlorophyll, activates some enzymes, help to maintain the health of the reproductive and immune systems. Among the analyzed fruits, the richest in Zn are: bananas– 1.53 ppm, orange – 1.46, lemon – 1.26 and kiwi – 1.14 ppm. Cooper (Cu^{+}, Cu^{2+}) is an essential microelement for plants which participates in redox processes, photosynthesis it was determined in low concentrations (between 0.45 – 1.21), but close, with the exception of pineapple, where it was detected in an amount of 1.10ppm and for banana 1.21ppm.

Conclusion

The obtained results show that the distribution of the essential mineral elements in the analyzed fruits samples presents non-uniformity, depending on the fruit species and the nature of the analyzed element. The best represented among the analyzed elements are Ca and Mg (59.1-358 mg/kg Ca, respectively 92-287 mg/kg Mg). Fe, Zn, Cu and Mn were determined in much lower concentrations (1.12-3.26 mg/kg, 0.75-1.53 mg/kg, 0.45-1.21 mg/kg respectively 0.34-7.12 mg/kg), but sufficient considering the requirement of these essential microelements in the human body. However, it can be stated that the studied tropical fruits contain important amounts, especially of calcium and magnesium, but also appreciable amounts of essential microelements: Fe, Zn, Cu and Mn. This category of fruits is important, as an additional supply of micro and macro elements, contributing at the same time to the completion of the palette of bio-elements from local fruits.

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