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# Preliminary research regarding the use of some vegetables (carrot, parsley, celery and tomato) as supplementary sources of bio minerals

**Gogoaşă I.[1*], Alda Liana Maria[1], Velciov Ariana[1], Bordean Despina Maria[1], Rada Maria[2], Moigradean Diana[1], Alda S.[1], Gergen I.[1]**

[1]University of Agricultural Sciences and Veterinary Medicine of Banat "Regele Mihai I al Romaniei" Timisoara; [2]University of Medicine and Pharmacy "Victor Babes" Timisoara

*Corresponding author. Email: ionelgogoasa@yahoo.com

**Abstract** The paper presents experimental results regarding the measurement of some essential minerals such as Ca, Mg, K, Fe, Zn and Cu in carrot, parsley, celery and tomato – to use them as supplementary sources of essential minerals. Results show that the mineral supply of the studied fresh vegetables in the recommended daily intake per gender varies within broad limits, i.e. between 4.82% (in Zn, in carrots) and 41.11% (in Cu, in parsley). The mineral supply in the daily diet is conditioned by both the importance of the bio element and the assortment of vegetables. Preliminary data of mineral supply in a certain vegetable or in associated vegetables (raw vegetable salad, for instance) confirm the possibility of using vegetables as an alternative supplementary source of bio elements.

**Key words**

vegetables, carrot, parsley, celery, tomatoes, minerals, supplementary sources of bio minerals

Vegetables, together with fruits, are staple foods in human diet. Nutritional reasons make it necessary to increase the consumption of such foods given that the modern human makes less and less physical efforts and more and more intellectual efforts, which asks for less amounts of sugars and fats and for larger amounts of vitamins and minerals. Such products cannot be removed from the third millennium human nutrition or from the prevention and treatment of digestive, circulatory, respiratory diseases, etc.

The nutritive and therapeutical importance of vegetables is due to the diversity and share of bioactive compounds they contain. Besides the hydric supply due to the high water content, vegetables are remarkable for their important content of sugars (glucose, fructose, saccharose), starch and cellulose, proteins (in small amounts in green vegetables and in considerable amounts in legumes), small amounts of fats (except for soy bean), as well as important amounts of vitamins (C, A, K, B group, etc.) and minerals (Na, K, Ca, P, I, Fe, Mg, Mn, S, Cu, I, Se) [1- 6]. Vegetables also contain important amounts of pigments, flavours, organic acids, tanning substances, etc., which confer them their specific flavour and taste.

Introducing fresh vegetables in sufficient amounts in our daily diet ensures a balanced nutrition from all points of view – energy, vitamins, minerals, cellulose, water, etc. Such products cannot be removed from the third millennium human nutrition because they play a considerable role in preventing and treating diseases of the digestive, circulatory, respiratory etc. systems. Carrot, parsley, celery and tomato – vegetables common in human nutrition – belong to this category.

*Carrot* is a root vegetable important for the optimum functioning of the human body not only due to its particular nutritive quality but also due to its beneficial effects on health. The beneficial effects of this vegetable is due to the diversity of the bioactive compounds that compose it: proteins, carbohydrates, numerous vitamins (A, B1, B2, carotenes, niacin, C) and minerals (Na, K, Ca, P, Fe etc.) etc. [7]. The diversity of these constituents confer this vegetable numerous therapeutic uses: tonic, remineralising, antianemia, and growth factor. It is also used as intestinal regulator, intestinal healer, antidiarrheic, laxative and depurative, bile, and lung and kidney fluidiser [8]. Last but not least, it is used in cosmetics since it rejuvenates tissues and skin and it heals wounds.

*Parsley* is a vegetable with pleasant flavour and taste; it is used in nutrition (aromatic, aperitif). This medicine-food is to be noted for its highly diversified vitamin and mineral content – as well as for other active principles – that make it a remarkable healer. Parsley root contains, among other bioactive compounds, vitamins, proteins, sugars, volatile oils, etc. and important amounts of minerals (Na, K, Ca, P, I, Fe, Mg, Mn, S, Cu [9]. The diversity of bioactive compounds make parsley a good therapeutic vegetable: tonic, antianemia, antirahitic, antiscorbutic, antixerophtalmic, antiastmatic, anticancerigenic, anti-

inflammatory, antifebrile, aphrodisiac, soothing, depurative, diuretic, expectorant, mineralising, secretolitic, nervous tonic, capillary tonic, uterine tonic, vermifuge, vitaminising, vasodilatatory [10].

*Celery* is a flavour tasty vegetable much appreciated for its nutritive and therapeutic values: tonic, aphrodisiac, antipyretic, antiscorbutic, antiseptic, aperitif, stomachic, carminative, depurative, liver drainer, emenagogue, blood regenerator, hypoglycaemic, hypotensive, ocitocic, vermifuge, healer [11]. This medicine-food is a precious source of vitamins, antioxidants, pigments, flavours, organic acids, tanning substances, etc.; it also contains large amounts of minerals – macro- and micro-elements – among which Na, K, Ca, Mg, P, Fe, Zn, Cu, etc. [12].

*Tomato* is a vegetable that supplies essential nutrients for the human body. It has a high content of antioxidants (lycopene), sugars, vitamins, etc., and high contents of mineral bio elements (K, Ca, P, Mg, Fi, S, Zn, Cu, etc.) [2, 13]. Such high contents of bioactive compounds make tomato a good medicine: it is recommended in the prevention and treatment of asthenia, atherosclerosis, rheumatism, and chronic intoxication. Tomato is also among the most recommended vegetables in the fight against cancer; it also has energising, remineralising features [14].

Given the important content of minerals contained by tomato, it is of high importance to assess its mineral supply in the daily diet recommended by nutritionists.

In this study, the authors aimed at assessing the essential mineral supply by some fresh vegetables that are staple foods in human nutrition. To carry out the experiment, we first determined the concentrations of Ca, Mg, K, Fe, Zn and Cu of four assortments of fresh vegetables – carrot, parsley, celery and tomato. Based on the recommendations by nutritionists, we determined by calculus the mineral supply in each of these vegetables. Moreover, we also determined mineral supply by certain amounts of assorted fresh vegetable (carrot, parsley, celery, and tomato) salads as volume ratios: 150:50:50:50.

## Materials and Methods

The studied vegetable assortments were sampled from the fresh markets of Timisoara, Romania. The vegetables were produced by private market gardeners from the Banat's Plain, Romania. To determine metal elements, we sampled each assortment by sampling three homogeneous samples of fresh vegetable (50 g of edible vegetable).

Aqueous standard solutions for Ca, Mg, K, Fe, Zn, Cu, were prepared by appropriate dilution of 1,000 $gL^{-1}$ stock solutions (Merck Darmstadt, Germany).

To calcinate the samples, we used a Nabertherm Model le 6/11 calcination oven.

Determining the elements proper requested two steps: mineralisation through calcination followed by solubilisation of inorganic matter in nitric acid 0.5 N and determining spectro-photometrically the absorbance of elements [15]. In the first step, the samples weighing 50±0.0002 g were calcinated at $550^0$C in two sessions of 4 h each. After cooling, the ashes were solubilised with 25 mL solution of $HNO_3$ 0.5 N, and then dried up to almost dry; the last operation was repeated twice.

After the complete solubilization the samples solution was filtered and made up to 50 ml with bidistiled water and was submitted for analysis.

The determination of elements in the fresh vegetables was performed by atomic absorption spectrometry in air-acetylene flame (FAAS). Measurements were carried out using a Varian Atomic Absorbtion Spectrometer Instruments tip AA 240 FS. As working parameters, we chose optimum parameter according to apparatus specifications.

## Results and Discussions

Experimental results of determining Ca, Mg, K, Fe, Cu and Zn in the assortments of fresh vegetables are shown in Table 1.

Table 1

**Share of some minerals in carrot, parsley, celery and tomato**

| Vegetable | Mineral content- average values (mg/kg fresh vegetable) | | | | | |
|---|---|---|---|---|---|---|
| | Ca | Mg | K | Fe | Zn | Cu |
| **Carrot** | 364 | 121 | 3250 | 8.51 | 2.65 | 0.29 |
| **Parsley** | 451 | 326 | 5610 | 10.12 | 4.103 | 1.85 |
| **Celery** | 549 | 108 | 3140 | 6.10 | 4.78 | 0.68 |
| **Tomato** | 195 | 252 | 2510 | 3.41 | 4.05 | 0.45 |

As shown in Table 1, the share of analysed elements in the four analysed assortments of fresh vegetables is uneven. The best represented are macro-elements, which range between 2,510 and 5,610 mg/kg in K, 195 and 549 mg/kg in Ca and 108 and 326 mg/kg in Mg. As expected, the analysed minerals – Fe, Zn

and Cu – were identified in much smaller concentrations (mg/kg), their values decreasing Fe > Zn > Cu. A hierarchy of the distribution of the analysed elements of the four assortments of vegetables would be rather relative since their concentrations would be of the same size order. However, we should mention that all four vegetable assortments have important concentrations of mineral macro- and micro-elements and are hence recommended as high mineral supply foods. This is why we aimed at assessing the essential mineral supply in the daily diet after introducing certain amounts of fresh vegetables in human nutrition. Trial results regarding the concentration of mineral elements in the analysed vegetables (shown in Table 1) allowed us to determine the amounts of Ca, Mg, K, Fe, Zn and Cu per 200 g of each assortment of fresh vegetable (Table 2). We chose the amount of 200 g because it is about the equivalent of a medium-size edible apple.

Table 2

**Content of essential elements in 200 g of fresh vegetables**

| Vegetable | Mineral content (mg/200 g fresh vegetable) | | | | | |
|---|---|---|---|---|---|---|
| | Ca | Mg | K | Fe | Zn | Cu |
| **Carrot** | 72.80 | 24.20 | 650.00 | 1.70 | 0.53 | 0.06 |
| **Parsley** | 90.20 | 65.20 | 1122.00 | 2.02 | 0.82 | 0.37 |
| **Celery** | 109.80 | 21.60 | 628.00 | 1.22 | 0.96 | 0.14 |
| **Tomato** | 39.00 | 50.40 | 502.00 | 0.68 | 0.81 | 0.09 |

Data presented in Table 2 above and recommendations of nutritionists in Table 3 below allowed the assessment of the supply in the six essential elements per 200 g of each vegetable. The mineral supply in each 200 g of fresh vegetable (%) in the daily diet is shown in Table 4.

Table 3

**Dietary Reference Intake (DRI): Recommended for individuals elements [16]**

| Mineral | Dietary reference intake (mg/day) | |
|---|---|---|
| | Men | Women |
| **Calcium** | 1000 | 1000 |
| **Magnesium** | 420 | 320 |
| **Potassium** | 4700 | 4700 |
| **Iron** | 8 | 18 |
| **Zinc** | 11 | 8 |
| **Cooper** | 0.900 | 0.900 |

Table 4

**Contribution of some vegetables to the daily diet recommended per 200 g of fresh vegetables**

| Vegetable | Gender | Mineral supply (%) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Ca | Mg | K | Fe | Zn | Cu |
| **Carrot** | Men | 7.28 | 5.76 | 13.83 | 21.28 | 4.82 | 6.44 |
| | Women | 7.28 | 5.76 | 13.83 | 21.28 | 4.82 | 6.44 |
| **Parsley** | Men | 9.02 | 15.52 | 23.87 | 25.30 | 7.46 | 41.11 |
| | Women | 9.02 | 20.38 | 23.87 | 11.24 | 10.26 | 41.11 |
| **Celery** | Men | 10.98 | 5.14 | 13.36 | 15.25 | 8.69 | 15.11 |
| | Women | 10.98 | 6.75 | 13.36 | 6.78 | 11.95 | 15.11 |
| **Tomato** | Men | 3.90 | 12.00 | 10.68 | 8.53 | 7.36 | 10.00 |
| | Women | 3.90 | 12.00 | 10.68 | 8.53 | 7.36 | 10.00 |

As shown in Table 4, the contribution with minerals to the daily diet recommended depends not only by the assortments of vegetables used in nutrition but also by the nature and importance of each element in the human body. A hierarchy of the mineral supply in a certain consumption of such foods is rather difficult. In the particular case we chose, there are increased supplies of Fe – in carrot and parsley (11.24-25.3%), K and Mg – in parsley (15.52-20.38% and 23.87%, respectively), Ca – in celery and parsley

(9.02-10.98%), Zn – in celery and parsley (8.69-11.95% and 7.46 -10.26%, respectively), Cu – in parsley (41.11%).

Since the ingestion of a single assortment of vegetables is not always tasty and appealing, and because a single assortment is rich in certain bioelements alone, we need to associate several vegetables in different raw vegetable salads prepared according to certain recipes recommended by the specialists in nutrition. In this case, we aimed at assessing the mineral supply per 300 g of salad containing 150 g carrots, 50 g parsley, 50 g celery and 50 g tomatoes. The amounts of minerals in the salad are shown in Table 5.

Table 5

**Concentration of certain mineral in fresh vegetable salads**

| Salad made of carrot, parsley, celery and tomato | Mineral element (mg/300 g of fresh vegetable salad) | | | | | |
|---|---|---|---|---|---|---|
| | Ca | Mg | K | Fe | Zn | Cu |
| | 114.35 | 52.45 | 1050.50 | 2.26 | 1.04 | 0.19 |

Table 6

**Mineral supply in the recommended daily diet for 300 g of fresh vegetable salad**

| Specification | Mineral supply (%) | | | | | |
|---|---|---|---|---|---|---|
| | Ca | Mg | K | Fe | Zn | Cu |
| **Men** | 11.44 | 12.49 | 22.35 | 28.23 | 9.49 | 21.39 |
| **Women** | 11.44 | 16.39 | 22.35 | 12.54 | 13.05 | 21.39 |

As shown in Table 6, in the 300 g of salad we determined important amounts of essential elements whose concentration has an ascending trend: Cu < Zn < Fe < Mg < Ca < K.

The data shown in Tables 3 and 5 allow the assessment of the daily diet supply of minerals per 300 g of fresh vegetable salad. These values are shown in Table 6.

Results regarding the assessment of the mineral supply of fresh vegetable salad shown in Table 6 and Figure 1 show that vegetable assortments can be an alternative of mineral supplements.

The supply of minerals in the daily recommended diet estimated according to the data presented above has a descending trend: K > Cu > Fe > Mg ≅ Ca ≅ Zn.

To mention that, when eating fresh vegetables on a systematic basis as supplementary sources of essential bioelements, we must not eat more than the daily recommended amount. Improper (excess) consumption can lead to an overload of the body with certain minerals above recommended limits or with supplementary loads of other food principles with unwanted side effects in the human body.

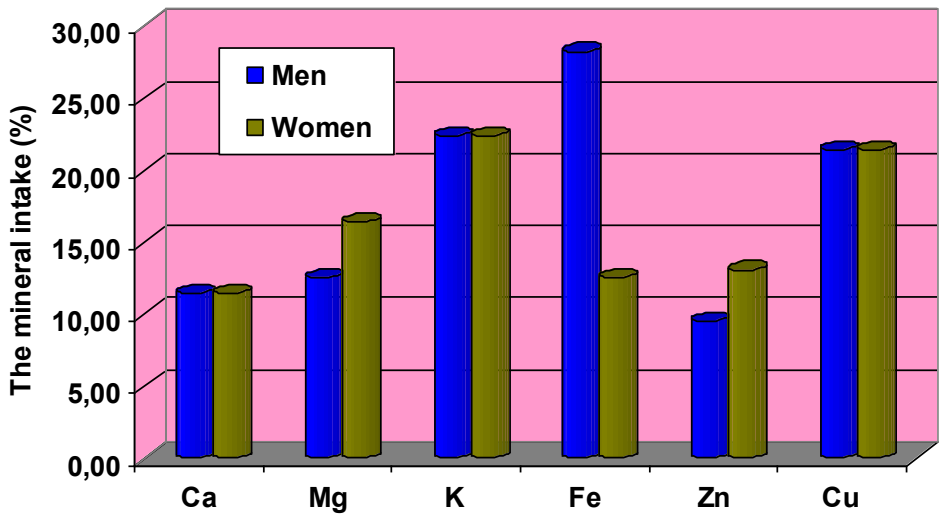


Fig. 1. Mineral supply (%) of the daily recommended diet for 300 g of fresh vegetable salad

The supply of minerals in the daily recommended diet estimated according to the data presented above has a descending trend: K > Cu > Fe > Mg ≅ Ca ≅ Zn.

To mention that, when eating fresh vegetables on a systematic basis as supplementary sources of essential bioelements, we must not eat more than the daily recommended amount. Improper (excess) consumption can lead to an overload of the body with certain minerals above recommended limits or with supplementary loads of other food principles with unwanted side effects in the human body.

All this allows us to state that fresh vegetables could be used as an alternative of supplementary essential minerals given their high contents of minerals.

## Conclusions

Vegetables, foods with an important share in human nutrition, are characterised by a high nutritive density corresponding to a low energy supply and for a wide range of bioactive compounds. Together with vitamins and mineral salts, a large number of essential elements (Ca, P, Fe, K, Mg, S, Cl, Zn, Cu, etc.) are among the important constituents that determine their nutritive and therapeutic features.

Preliminary results in the determination of Ca, Mg, K, Fe, Zn and Cu in carrot, parsley, celery and tomato as well as the calculus to estimate the mineral supply in human daily diet, show that the mineral supply from fresh vegetables to the daily diet recommended per gender varies within wide limits, i.e. 4.82% (in Zn, in carrot) and 41.11% (in Cu, in parsley). The supply in minerals is conditioned by both the importance of the bioelement and the assortment of vegetables.

Calculus show that a daily intake of 300 g of raw vegetable salad containing 150 g carrots, 50 g parsley, 50 g celery and 50 g tomatoes point out mean values of the mineral supply ranging between 11% (in Ca and Mg) and 22% (in K). The contribution in bioelements to the daily diet, in this case, has the decreasing trend K > Cu > Fe > Mg ≅ Ca ≅ Zn.

In conclusion, we can say that preliminary results in the assessment of mineral supply by a certain assortment of vegetables or by the association of several vegetables as a raw vegetable salad confirm the possibility of using vegetables as an alternative supplementary source of mineral bioelements.

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