# THE DOSAGE OF THE IONS OF CALCIUM IN THE JUICE OF SPINACH, WHITE CABBAGE, RED CABBAGE. CELERY AND CARROTS

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***Abstract***

*Calcium is the most abundant and one of the most important minerals in the human body. Approximately 99% of body calcium is found in bones.A decrease in albumin level causes a decrease in serum calcium. Low levels of calcium are found in hypoparathyroidism, pseudohypoparathyroidism, vitamin D deficiency, malnutrition and intestinal malabsortion. Among causes of hypercalcemia are cancers, large intake of vitamin D, enhaced renal retention, osteoporosis.*

*This paper intends to determine the concentration of the ions of calcium in fresh spinach, white cabbage, red cabbage, celery and carrots juice, thermally unprocessed, using the titrimetric method. We have also determined the concentrations of these ions in this legumes juice obtained after boiling.*

**Key words**: calcium, titrimetric method, legumes

## INTRODUCTION

Calcium is a major constituent of bones and teeth and also plays an essential role as second messenger in cell-signalingpathways. Circulating calcium concentrations are tightly controlled by the parathyroid hormone (PTH) and vitamin D at the expense of the skeleton when dietary calcium intakes are inadequate. (Wesseling-Perry K, Wang H, 2014)

Adequate calcium intake is critical for maintaining a healthy skeleton. Calcium is found in a variety of foods, including dairy products, tofu, beans, and vegetables of the kale family. Yet, content and bioavailability vary among foods, and certain drugs are known to adversely affect calcium absorption.( Gibson, RS., 2005, Bailey RL, Fulgoni III VL, Keast DR, Dwyer JD.,2011)

Calcium is the most abundant mineral in the human body. About 99% of the calcium in the body is found in bones and teeth, while the other 1% is found in the blood and soft tissue. Calcium concentrations in the blood and fluid surrounding the cells (extracellular fluid) must be maintained within a narrow concentration range for normal physiological functioning. The physiological functions of calcium are so vital to survival that the body will stimulate bone resorption (demineralization) to maintain normal blood calcium concentrations when calcium intake is inadequate. Thus, adequate intake of calcium is a critical factor in maintaining a healthy skeleton (Tucker KL.,2009, Gallagher JC, Yalamanchili V, Smith LM,2012).

Calcium plays a role in mediating the constriction and relaxation of blood vessels (vasoconstriction andvasodilation), nerve impulse transmission, muscle contraction, and the secretion of hormones likeinsulin . Excitable cells, such as skeletal muscle and nerve cells, contain voltage-dependent calcium channels in their cell membranes that allow for rapid changes in calcium concentrations. Within the cell, these calcium ions bind to activatorproteins, which help release a flood of calcium ions from storage vesicles of the endoplasmic reticulum (ER) inside the cell. The binding of calcium to the protein troponin-c initiates a series of steps that lead to muscle contraction. The binding of calcium to the protein calmodulin activates enzymes that break down muscle glycogen to provide energy for muscle contraction. Upon completion of the action, calcium is pumped outside the cell or into the ER until the next activation. (Calvez J, Poupin N,2012)

However, the bioavailability of the calcium must be taken into consideration. The calcium content in calcium-rich plants in the kale family (broccoli, bok choy, cabbage, mustard, and turnip greens) is as bioavailable as that in milk; however, some food components have been found to inhibit the absorption of calcium. Oxalic acid, also known as oxalate, is the most potent inhibitor of calcium absorption and is found at high concentrations in spinach and rhubarb and somewhat lower concentrations in sweet potatoes and dried beans.( Kerstetter JE, O'Brien KO,2005, Kemi VE, Karkkainen MU,2010).

**MATERIAL AND METHOD:**

The determination of calcium ions from the samples was carried using one complexometric titration method in present the Murexid indicator. This indicator is used which offers a certain selectivity for Calcium ions from the samples which contain other cations too. Is known the fact that with calcium exist magnesium ions which interfear with calcium ions leading to dosage errors.To avoid this inconvenience, the sample is treated in advance with sodium hydroxide because the magnesium ions to be removed as a magnesium hydroxide precipitate.

Reagents: Complexon III (Merk)
Sodium hydroxide (Merk)
Ammonium chloride (Merk)
Ammonium hydroxide (Chimopar)
Murexid ( Merk)

**RESULTS AND DISSCUSIONS:**

For the titration using a volumetric solution of Complexon III 0.01 M (F=1.000) with calcium ions forms stable complexes at pH=12.5 ammonia buffer provided supplemented with sodium hydroxide until reaching the corresponding value. More exactly,was weighed amount of sample wich contains 10 g product

was titrated with Complexon III to the point of equivalence (blue violet color). The volume and calculations can be found in the following table.

*Table 1*

The consumption volumes for the samples analyzed

| No. crt | Sample | Quantity of sample, g | V CIII consumed (mL) | mg $Ca^{2+}$/10g sample | mg $Ca^{2+}$/100g sample |
|---|---|---|---|---|---|
| 1 | Spinach | 10 | 19.5 | 7,8 | 78 |
| 2 | White cabbage | 10 | 11.25 | 4.5 | 45 |
| 3 | Red cabbage | 10 | 11.75 | 4.7 | 47 |
| 4 | Celery | 10 | 11.5 | 4.6 | 46 |
| 5 | Carrots | 10 | 8.75 | 3.5 | 35 |

After the boiling the results are:

*Table 2*

The results after the boiling

| No. crt | Sample | Quantity of sample, g | V CIII consumed (mL) | mg $Ca^{2+}$/10g sample | mg $Ca^{2+}$/100g sample |
|---|---|---|---|---|---|
| 1 | Spinach | 10 | 11.4 | 4,6 | 46 |
| 2 | White cabbage | 10 | 7.7 | 3.1 | 31 |
| 3 | Red cabbage | 10 | 5.8 | 2.3 | 23 |
| 4 | Celery | 10 | 6.9 | 2.7 | 27 |
| 5 | Carrots | 10 | 6.4 | 2.5 | 25 |

*Table 3*

The results after the boiling regarding

| No. crt | Sample | mg $Ca^{2+}$/100g sample | mg $Ca^{2+}$/100g sample after boiling | Amount |
|---|---|---|---|---|
| 1 | Spinach | 78 | 46 | 58.97% |
| 2 | White caggage | 45 | 31 | 68.88% |
| 3 | Red cabbage | 47 | 23 | 48.93% |
| 4 | Celery | 46 | 27 | 58.69% |
| 5 | Carrots | 35 | 25 | 71.42% |

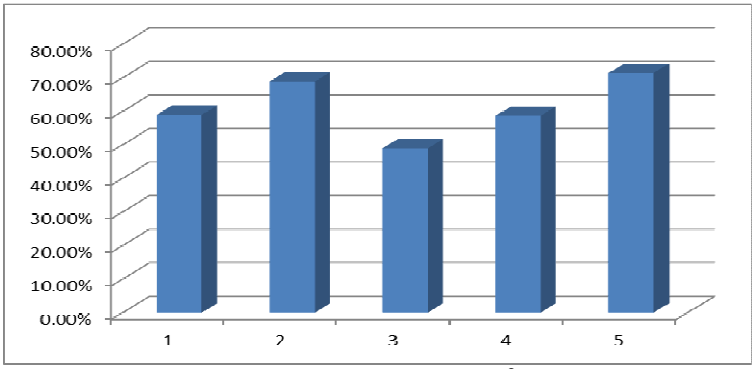

Fig. 1 Decrease of the amount of $Ca^{2+}$ after boiling

## CONCLUSIONS

The spinach,white cabbage, red cabbage, celery and carrots are a good source of calcium which is important for health.

The concentrations obtained using titrimetric test were much lower, which proves that thermal processing has negative effects on the chemical composition, causing a decrease in the concentration of the ions of calcium.

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