

# Comparative Study in The Presence of Calcium Content in Green Vegetables [Broccoli, Spinach]

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## **ABSTRACT**

*Calcium is a chemical element, it is a common constituent of multivitamin dietary supplements, and it allows bodily movement by keeping tissues rigid , strong and much flexible .Intestine absorbs almost 1/3<sup>rd</sup> of calcium taken as free ions and the calcium level in the plasma is regulated by the kidneys. Parathyroid hormone and vitamin D help in bone formation by allowing the deposition of calcium ions. Calcium is found in some foods, in some medicines and also available as dietary supplement. The ionic particle of calcium in the body is responsible for numerous reactions carried out by different body systems. Calcium deficiency can lead to finger and toe numbness muscle cramps, lethargy, convulsions, loss of appetite and abnormal heart rhythm. In this experiment we estimated calcium content from selected green vegetables. Samples were centrifuged with ammonium oxalate and titrated against with potassium permanganate and determined the calcium content in Brassica oleracea[broccoli]- 50.1mg/100g, Spinacia oleracea[spinach] -24 mg /100g.*

**Keywords:** Calcium, Brassica oleracea, Spinacia oleracea, Ammonium oxalate, Ammonium hydroxide, sulfuric acid, oxalic acid, Potassium permanganate

## INTRODUCTION

Calcium is the most important and abundant element in the body is necessary for maintenance and growth of teeth and bones , signaling of nerves, muscle contraction and certain enzyme and hormone secretion [Beto JA. ,2015]. Calcium which is a key element for the physiology and biochemical reaction different organism cells. They play a principal role in signal transduction pathways, where they act as a secondary messenger, in neurotransmitter release by neurons, in contraction of all muscle and in fertilization process [10.Cooper D, Dimri M,2010]. Enzymes are essential for calcium as an important factor including many coagulation factors. Extracellular calcium maintains the significant change throughout the cell membranes, and in bone formation [Yu E, Sharma S,2022] calcium levels in mammals is controlled, by the bone which is acting as the main source as they are the mineral storage site.  $Ca^{2+}$  is released from bone into the circulatory system under controlled conditions [Udith Blaine, Michel Chonchol, Moshe Levi ,2015]. Calcium is supplied through the circulatory system as dissolved mineral particle or membrane bound to proteins such as serum albumin. Parathyroid hormone which is secreted by the parathyroid gland regulates the absorption of  $Ca^{2+}$  from bone, reabsorption in the kidney back into circulation, and increases in the activation of vitamin D3 to calcitriol[Khan M, Jose A, Sharma S,2022]. Calcitriol, the active form of vitamin D3, which enhances the absorption of calcium from the storage sites.[Christakos S, Dhawan P, Porta A, Mady LJ, Seth T,2011]. Calcitonin which is gathered from parafollicular cells of the thyroid gland which is responsible for effects of calcium levels by opposing parathyroid hormone however, for its physiological response in humans is dubious [Felsen Feld AJ, Levine BS,2015]. Calcium which is stored in the body of organelles which regularly release and accommodate through  $Ca^{2+}$  ions in response to all cellular events include mitochondria and endoplasmic reticulum [Bagur R, Hajnóczky G. A,2017]. Deficiency of calcium can lead to numbness in the finger and toes, muscles cramps, convulsions, lethargy, loss of appetite, and abnormal heart rhythm [Good DC ,1990]. The oxalate present in vegetables can hinder calcium absorption they are still a good source of calcium [Shkempi, Blerina , and Thom Huppertz ,2022]. Body gets the calcium in two ways, one by eating foods or the supplements that contain calcium, and form drawing calcium in the body [Ross AC, Taylor CL, Yaktine AL ,2011]. If the calcium content is low the body remove calcium from the bones. Usually, the calcium that is taken from the bones is put back at a later point, but this usually doesn't take place every time, and can't always be sufficient just by including more calcium in daily diet [Ross AC, Taylor CL, Yaktine AL ,2011]. Vitamin D is also important to allow the body in calcium absorption, this vitamin which usually present naturally in only a few sea foods, such as fatty fish (salmon, sardines) and egg yolks [Zhang, R., Naughton, D.P,2010]. In addition to dietary sources, can be provide the body with Vitamin D as it is absorb through the skin naturally [Wacker M, Holick MF,2013]. Vegetables high in calcium includes Bok choy, spinach , broccoli , green beans and different other calcium rich vegetables in your diet can not only support good for health but also provide your body with many vital nutrients , and better functionality of organs along with strengthened skeletal system , there are so many vegetables that you add to your diet that are loaded with calcium the daily value of calcium is 1300mg[Ebabhi,A. Adebayo, Yildirim, , Ekinici, M.,2022] .Cooking vegetables usually always increases the

amount of calcium available in the vegetables for the body absorbs and this difference can be big [Ross AC, Taylor CL, Yaktine AL, 2011. Calcium influences H<sub>2</sub>O movement in cells . It is used in cell division and growth . It helps in N<sub>2</sub> and other mineral uptake , promotes formation of solids and high-quality leads in Broccoli . [Backer R, Rokem JS, Ilangumaran G, Lamont J, Praslickova D, Ricci E, Subramanian S and Smith DL 2018] . Calcium is taken as diet in the form of calcium phosphate , carbonates and oxalates . Actively absorbed in small intestine. Calcium with phosphorus is the principal source for the formation and development of bones and teeth. Ionized calcium is required in coagulation of blood , it controls excitability of nerve fibers and is essential for nerve impulses and muscle contraction.

## CHEMICALS

Ammonium oxalate solution 4% (w/v) ii) Ammonium hydroxide solution 2% (w/v) iii) potassium permanganate (0.01N) iv) sulfuric Acid (1N) (v) Sulfuric acid (vi) Oxalic acid (0.01N) solution.

## METHODOLOGY

Samples Brassica oleracea , Spinacia oleracea [Broccoli , Spinach] were purchased from local markets and thoroughly washed with distilled water followed by surface sterilization using HgCl<sub>2</sub> [Mercuric chloride] . Taken 2ml of sample solution into a graduated glass centrifuge tube and 2ml of deionized solution of ammonium oxalate and vortexes added . centrifuge tube is left for 30min in room temperature. Which contents at 2500 rpm for 10min in a top clinal centrifuge . supernatant is discarded without disturbing the precipitate . residual supernatant is drained by inverting the tube onto blotting paper .precipitate is washed thoroughly with 3ml of 2 of ammonium hydroxide solution and vortex . after each wash detailed of the centrifuge the content is detailed above . The washing step is essential in order ensure complete removal of ammonium oxalate . to the washed precipitate 2ml of 1 N H<sub>2</sub>SO<sub>4</sub> is added and mixed thoroughly .Then placed the tube in a water bath , until all the precipitate is dissolved and the titrated against the hot solution with standardized potassium permanganate solution taken in a micro burette to a pale pink end point which persist at least for a minute .conducted a blank titration using water [2ml] and 1 N H<sub>2</sub>SO<sub>4</sub> [2ml] only and calculated calcium content in the following vegetable can be calculated using the following formula.

$$\text{Ca [mg]} = X \times 0.2004 / 2 \times 100$$

Where , X = sample titer value – blank titer value

One ml of 0.01 N potassium permanganate = 0.2004 mg of calcium

## RESULT

The calcium content in selected green vegetables they are Brassica oleracea [[Broccoli] is 50.1mg /100g , Spinacia oleracea [ spinach] 24mg/100g was determined by titrimetric method.

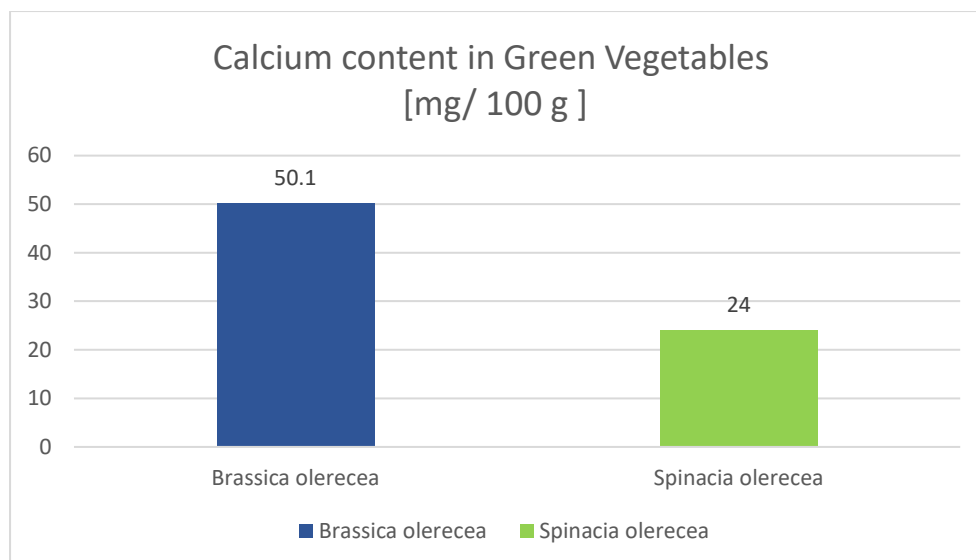


Figure : Calcium content in green vegetables [mg/100g]

## DISCUSSION

As we have taken green colored vegetables. One is Spinach and another one is Broccoli.

In these leafy vegetable Spinach having less content of calcium i.e., 24mg/100gm fresh weight.

Whereas in green vegetable Broccoli we have determined highest concentration than the Spinach i.e., 50mg/100gm fresh weight . Calcium content in broccoli and green leafy vegetables is similar to calcium content found in milk and dairy foods . Although not nearly as high in calcium as dairy products, spinach does have more calcium than most vegetables.

## CONCLUSION

The obtained result is also in good agreement with data reported in literature regarding the content of calcium in vegetables. The result obtained in the study show that titrimetric can be successfully used as a part of quality management in food industry , for accessing the calcium content in vegetables. Calcium found in vegetable is useful for the body for building stronger bones, maintaining healthy cell function, nerve function, regulate blood pressure, hormone levels and to facilitate communication between cells. It also decreases the risk of kidney stones by decreasing absorption of oxalates. Our body needs calcium to build strong bones when you're young and to keep bones strong as you get older. Everyone needs calcium, but it is specially important for women and girls. Many people including more than half of all women don't get enough calcium. Calcium can help prevent osteoporosis (weak bones). Osteoporosis is a disease that makes your bones weak and likely to break. Some people don't know they have osteoporosis until they break a bone. Some studies suggest that calcium, along with vitamin D, may have benefits beyond bone health: perhaps protecting against cancer, diabetes and high blood pressure . Some studies suggest that calcium, along with vitamin D, may have benefits beyond bone health: perhaps protecting against cancer, diabetes and high blood pressure .

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From the result of this experiment, we conclude that consumption of these green vegetables [ Broccoli and Spinach ] can prevent calcium deficiency diseases which is not possible to supply through their daily diet mainly in the children's and the pregnant women's .

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