*Ramalakshmi K, et. al. International Journal of Engineering Research and Applications*
*www.ijera.com*
*ISSN: 2248-9622, Vol. 11, Issue 2, (Series-II) February 2021, pp. 31-35*

RESEARCH ARTICLE OPEN ACCESS

# Impact of Cooking On Nutrients in Selected Vegetables

Ramalakshmi K[a]*, Subhapriya P [b], Ananthavalli K[c] , Sarada K[c], and Shanmugapriya D[c]

[a]*Rajalakshmi Engineering College, Department of food technology ,Thandalam-602105, Tamil Nadu, India*
[b]*Bannari Amman Institute of Technology , Department of chemistry, Sathyamangalam-638401, Tamil Nadu, India*
[c]*A.P.C. Mahalaxmi College for women, Department of chemistry ,Thoothukudi-628002, Tamil Nadu, India*

**ABSTRACT**
Commonly used vegetables were analyzed for selected nutrients such as protein, vitamin C, iron, calcium and magnesium content before and after cooking to determine the retention of nutrients during cooking in water followed by draining the excess water. Retention of proteins in the vegetables ranged from 100 - 51. 86%. In all the vegetables the loss of ascorbic acid is significantly ($p<0.01$) more on cooking the raw vegetables followed by draining the water. Retention of vitamin C in the vegetables is in the order of green beans > cabbage > snake gourd > white melon > cluster beans > carrot > bitter gourd > raw banana. Compared to vitamin C, the loss of minerals during cooking is less in the vegetables studied. The retention of magnesium (>90%) was more compared to iron and calcium after cooking. Loss of calcium was maximum in raw banana followed by bitter gourd and that of iron was maximum in cluster beans followed by raw banana.
**Keywords:** Nutrient; Vegetables; Ascorbic acid; Iron; Calcium.

---

Date of Submission: 24-01-2021 Date of Acceptance: 08-02-2021

---

## I. INTRODUCTION

Health is a key to success, good citizenship and happy life. According to Health Organization, health is defined as a stage of complete physical, mental and social well-being and not merely an absence of disease or infirmity. Proper food is needed for a healthy life. Healthy food supplies the necessary nutrients to maintain the tissues to sustain a healthy immune system and to have abundant energy which will enable the body to execute all daily tasks with ease[1].The major components of food are carbohydrates, proteins, fats, vitamins and minerals. Besides these, water is an important constituent of our food, and makes up for two- thirds of our body weight. Our diet usually contains all the nutrients in varying amounts [2].

Human body needs a constant supply of energy. Carbohydrates serve as the chief source of energy in the food of humans and many other animals. Protein plays the vital role for the growth and repair of tissues along with providing energy. Vitamins, though required in minute amounts, are necessary for key body functions like eyesight, hearing, oxygen transfer in the body, development of strong bones etc. which cannot be synthesized by an organism but nevertheless all essential for the maintenance of normal metabolism and therefore must be included in the diet [3].

A large number of our people do not have the resources to buy enough food. This is a major cause of nutrient deficiency in our country. Large families with low income are particularly subject to this condition. However, this deprivation can be partly offset by eating simple, inexpensive but wholesome food such as groundnut, ground pulses, jaggery, and soyabean. Banana or spinach gives us more nutrient for the money spent as compared to grapes, apples and cauliflower [4]. Many vegetables lose their nutrient value due to our wasteful method of cooking or processing. Deep frying or prolonged heating leads to the loss of nutrients and vitamins. Some vitamins such as vitamin C are oxidized when cut fruits and vegetables are left in the open for long. Also, water soluble vitamins such as vitamin C are washed away when vegetables are repeatedly washed or soaked for long periods.

Similarly, the water in which the vegetables or green leaves are boiled is rich in nutrient content. In this context, selected commonly used vegetables were subjected to boiling with excess of water, the loss of nutrients was estimated and the results are summarized in this paper.

## II. MATERIALS AND METHODS

Good quality fresh, young and tender vegetables were purchased from the local market in Thoothukudi, TamilNadu. The vegetables such as bitter gourd (*Momordica charantia*), snake gourd (*Trichosanthes cucumerina*), green beans (*Phaseolus vulgaris*), cluster beans (*Cyamopsis tetragonolobus*), cabbage (*Brassica oleracea*), Carrot (*Daucus carota*), white melon (Cucumis melo), raw banana (*Musa paradisiaca)* were cut into pieces of 1 cm length and kept in the airtight container till use. The solvents and chemicals were procured from Merck, Mumbai, India.

### *2.1 Preparation of the extract*

The selected vegetables (10 g) were added to boiling water (100 ml) and allowed to stand for 15 min. The contents were removed from the heat sources and drained. The drained water (filtrate) was analyzed for the nutrients.

### *2.2 Parameters analysed*

The vegetables and the extracts were analyzed for the following quality parameters.

Protein content was estimated by Lowry's method using peptone as a standard protein. Sample solution (4 ml) was treated with a mixture of Fehlings A and B (5.5 ml) and then Folin Ciocalteau reagent (0.5 ml) and allowed to stand at room temperature for 30 min. Optical density of the solution was measured at 640 nm [5].

Vitamin C was analyzed using an oxidizing agent 2,6-dichloroindophenol dye. An equal quantity of experimental solution and oxalic acid (3%) was mixed thoroughly and titrated against dye solution (100 mg dye and 84 mg of $NaHCO_3$ in 100 ml water) to get the end point of pink color which exists atleast for 10 seconds[5].

Iron content of the samples were estimated by o-phenathroline method in which $Fe^{3+}$ was reduced to $Fe^{2+}$ by $NH_2OH.HCl$. pH of the extract was made acidic by the addition of sodium acetate. o-phenathroline solution was added and the optical density was measured at 510 nm. Ferrous ammonium sulphate was used as standard for the estimation of iron and the total amount of iron present in the sample was calculated [6].

Calcium and magnesium were estimated by titrimetric method using EDTA reagent [5]. Sample solutions were treated with ammonia buffer and titrated against standardized EDTA with Eriochrome black T as an indicator. Volume of EDTA consumed was noted when colour of the indicator changed from pink to blue and calculated as total calcium and magnesium. Calcium was estimated by treating the sample solution with NaOH and titrated against EDTA using P&R (Pattinsons and Reeder) indicator. Magnesium was calculated by subtracting calcium from the total amount of calcium and magnesium [7].

### *2.3 Statistical analysis*

The experiments were carried out in triplicate. The results are expressed as mean with standard deviation. The significant difference between the mean values are tested by student 't' test at 1% and 5% level wherever needed.

## III. RESULTS AND DISCUSSION

Cooking, which is important in food processing, can be both detrimental and beneficial to the nutrient content of food. Excessive losses however, can be reduced through careful pre-preparation and during the cooking process. The loss of nutrients on cooking depends on the temperature, duration of cooking and the nutrient involved. Loss of protein and carbohydrate during cooking is generally small [8].

Proteins are present in all living matter indicating that they have very important functions. Since protein is indispensable for building new tissue, the need for adequate amounts is especially important during the growing years of childhood and adolescence. Food and Nutrition Board of the National Research Council has declared the daily requirement of protein to 56 gm for men and 46 gm for women in the latest revision. Scientific evidence proves that some of our major health problems, such as coronary heart disease and certain types of cancer associates with a high animal – protein intake, and more particularly with the high content of saturated fats in these foods.

Loss of protein in the vegetables ranged from 0-48.14% during cooking the vegetables in water followed by draining the excess water (Table. 1). Raw plantain experienced more loss of proteins compared to all the vegetables. There is no change in protein content in snake gourd and melon even after cooking (Fig.1). In general loss of protein and carbohydrate during cooking was generally small compared to other nutrients. In general proteins are not lost in cooking however they get denatured if the food materials are overcooked [9].

It is known that cutting vegetables into small pieces, exposing them to air and cooking results in loss of vitamins particularly vitamin C [10]. In all the vegetables the loss of ascorbic acid was more than 75% (Fig. 1). Though vitamin C content was more in cabbage and bitter gourd, cooking led to the loss of 75.87 and 89.18% respectively which were similar to the values reported [11] in both unbalanced and blanched bitter gourd slices.

The vitamin C content in the raw and cooked carrot was 11.09 and 1.33 mg/100 g, similar

to the values observed by earlier works [10]. In general, water soluble vitamins are lost during cooking and the loss depends on the quantity of water, the surface area to volume ratio and the time of cooking [12]. Vitamin C is easily destroyed by cooking and also by exposure to light and air. Retention of vitamin C in the vegetables is in the following order - green beans > cabbage > snake gourd > white melon > cluster beans > carrot > bitter gourd > plantain. It is also reported that though raw banana is one of the good source of vitamin C, its loss was more than 70% during preparing banana flour [13].

Minerals such as calcium, zinc and potassium are needed by the body for a number of processes such as breaking down, digesting and releasing energy from food, strengthening bones, nails and teeth and regulating fluid and cholesterol in the body. Calcium, iron and zinc are the most commonly deficient minerals in the diets of infants and children in many developing countries. The principal minerals in foods that are lost during cooking are the salts of sodium, potassium, calcium, magnesium, phosphorus, sulfur, iron, chlorine and iodine [3].

Compared to vitamin C the loss of minerals during cooking of vegetables is less in all the vegetables studied. The retention of magnesium (>90%) in the vegetables was more compared to iron and calcium after cooking (Table 2 & Fig 1). Loss of calcium was maximum in raw banana followed by bitter gourd and that of iron was maximum in cluster beans followed by raw banana. In general salts of calcium are not as soluble as the other salts of sodium and potassium and loss of calcium is about one-fourth of the total calcium of the food [1]. Peterson et al reported that loss of calcium was about 30% of the total calcium, using medium and large quantities of water for cooking vegetables[14]. Magnesium salts are more soluble than those of calcium [15].However; Shahnaz et al reported the loss of calcium (32.15%) was more than the loss of magnesium (14. 96%) in bitter gourd [8]. In vegetables, the solubility of most of the mineral salts increases with increasing temperature of the water. Also, the loss of calcium depends on the nature of water which was used for cooking [16].

## IV. CONCLUSION

Cooking is not only an art of culinary process but also a source of nutrition, taste and good health. Cooking often leads to destruction of some amount of nutrients. From the results, it is concluded that though there is not much loss of protein during cooking, over cooking may lead to denaturation. Vitamin C, the water soluble vitamin is enormously lost on cooking the vegetable with excess water. Minerals leach out from vegetables but their loss is lesser than vitamins. Excessive losses however, can be reduced through careful pre-preparation, proper cooking methods and avoiding the draining of excess water.

## REFERENCES

[1]. Bernard L.O., Daniel M., Mona O., Influence of cooking procedure upon retention of vitamins and minerals in vegetables. *J Food Sci.,* **8**, 115- 122**(2006)**.

[2]. Jean Sinpson .I., Home practices and the nutritive value of fruits and vegetables., *J Food Sci.,* **8(5)**, 353-376 **(2006)**

[3]. Susan M., Grayscott D., Chen J.J., Bergman C., Review of the dietary reference intake for calcium: Where do we go from here?, CRC Crit. *Rev Food Sci Nutri*,**48**, 378-384**(2008)**.

[4]. Selman J.D., Vitamin retention during blanching of vegetables, *Food Chem* ., **9**,137-147**(1994)**.
Ranganna S., Hand Book of Analysis and Quality Control for fruit and Vegetable Products, Tata McGraw-Hill,New Delhi, **(1985)**.

[5]. Official Methods of Analysis (AOAC) – 14th Edn, Association of Analytical Chemist, Inc., USA,**(1984).**

[6]. Kramer A., Twigg B.A., Quality Control for the Food Industry, 3rd Edn, The AVI Pub. Co., New York,**2(1973).**

[7]. Shahnaz A., Khan K.M., Munir A.S., Muhammad S., Effect of Peeling and Cooking on Nutrients in Vegetables. *Pakistan J Nutri.*, **2,**189-191**(2003)**.

[8]. Habiba R.A.,Changes in anti-nutrients, protein solubility, digestibility, and HCl-extractability of ash and phosphorus in vegetable peas as affected by cooking methods, *Food Chem.,* **77**,187–192 **(2002)**.

[9]. Bernhardt S., Schlich E ., Impact of different cooking methods on food quality: Retention of lipophilic vitamins in fresh and frozen vegetables. *J Food Engg.,* **77(2),** 327-333**(2006)**.

[10]. Myojin C., Enami N., Nagata A., amaguchiT.Y, Takamura H., Matoba T., Changes in the radical-scavenging activity of bitter gourd (*Momordica charantia* L.) during freezing and frozen storage with or without blanching, *J Food Sci.,* **73**,C546 - C550**(2008)**.

[11]. Szamosi C.S., Nemethy U.H., Balazs G., EStefanovits B., Nutritional values of traditional open-pollinated melon (Cucumis melo L.) and watermelon (Citrullus lanatus

[Thumb]) varieties. *Int J Horti Sci.,* **13**, 29–31**(2007)**

[12]. Suntharalingam S., Ravindran G., Physical and biochemical properties of green banana flour. *Plant Foods Hum Nutr,* **43(1)** ,19-27**(1993)**.

[13]. Peterson W.H., Elvehjem Jamison C.A., Lida A.,Variations in the mineral content of cabbage and sauerkraut. Soil Science **20**,451-457,(**1925**).

[14]. Greger J.L., Marhefka S., Geissler A.H.,Magnesium content of selected foods,*J Food Sci.,* **43(5),** 1610–1612, **(2006)**.

[15]. Isabel N., Evelyn G., Halliday. Influence of calcium in cooking water upon mineral content of vegetables., *J Food Sci.,* **2**,499-503**(2006)**.

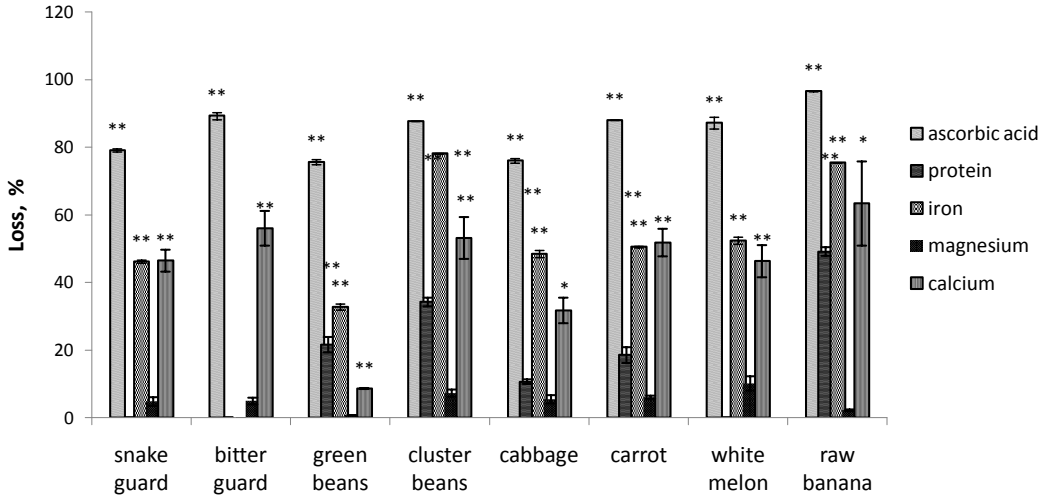


**Figure. 1.** Loss of nutrients during cooking vegetables
** significantly different ($p<0.01$)
* significantly different ($p<0.05$)

**Table 1.** Nutrients in fresh vegetables and in the drained extract

| Vegetables | pH of the extract | Protein g/100g | | L-ascorbic acid mg/100g | |
|---|---|---|---|---|---|
| | | fresh | extract | fresh | extract |
| Snake gourd | 7.75 | 0.51±0.02 | traces | 11.99±0.05 | 9.49±0.03 |
| Bitter gourd | 7.67 | 1.01±0.03 | traces | 35.40±0.45 | 31.57±0.03 |
| Green beans | 7.42 | 1.82±0.03 | 0.39±0.04 | 18.11±0.25 | 13.66±0.05 |
| Cluster beans | 7.31 | 1.15±0.03 | 0.39±0.03 | 24.92±0.05 | 21.92±0.04 |
| Cabbage | 6.94 | 3.26±0.04 | 0.35±0.03 | 36.61±0.40 | 27.77±0.06 |
| Carrot | 7.37 | 1.28±0.03 | 0.24±0.04 | 11.09±0.05 | 9.76±0.05 |
| White melon | 7.20 | 0.98±0.04 | Traces | 0.99±0.05 | 0.86±0.05 |
| Raw banana | 7.44 | 1.89±0.07 | 0.91±0.03 | 19.19±0.02 | 18.53±0.03 |

Values are mean ± SD of triplicates

**Table 2.** Minerals present in the fresh vegetables and in the drained extract

| Vegetable | Iron µg/100g | | Calcium mg/100g | | Magnesium mg/100g | |
|---|---|---|---|---|---|---|
| | fresh | extract | fresh | extract | fresh | extract |
| Snake gourd | 1510±5.03 | 699±4.51 | 26±2.52 | 11.9±0.35 | 15±2.51 | 0.71±0.05 |
| Bitter gourd | 430±3.51 | Traces | 20±2.52 | 10.9±0.45 | 17±3.5 | 0.83±0.82 |
| Green beans | 610±±3.51 | 199±4.04 | 186±1.53 | 16.0±0.25 | 108±0.07 | 0.78±0. |
| Cluster beans | 999±4.51 | 780±4.51 | 35±3.5 | 18.3±0.25 | 13±1.02 | 0.96± |
| Cabbage | 570±3.51 | 276±4.51 | 49±2.5 | 15.3±0.25 | 15±1.50 | 0.83± |
| Carrot | 912±4.51 | 460±4.51 | 37 ±2.52 | 19.3±0.25 | 12±0.46 | 0.75± |
| White melon | 956±4.51 | 501±4.00 | 30±2.52 | 13.9±0.31 | 8±2.75 | 0.84± |
| Raw banana | 1060±4.16 | 800±2.52 | 15 ±2.52 | 9.5±0.35 | 33±0.25 | 0.74± |

Values are mean ± SD of triplicates

Ramalakshmi K, et. al. "Impact of Cooking On Nutrients in Selected Vegetables." *International Journal of Engineering Research and Applications (IJERA)*, vol.11 (2), 2021, pp 01-17.