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# NUTRITIONAL EVALUATION OF GARDEN CRESS SEEDS (Lepidium sativum)

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Garden cress (*Lepidium sativum*) is widely cultivated in hot temperate climates throughout the world for various culinary and medicinal uses. It is loaded with nutrients and is an important source of iron, folic acid, calcium, vitamin C, E and A. In the present study, garden cress seeds were quantitatively analyzed as whole seeds and treated seeds (soaked+dried+roasted) for proximate principles, selected minerals and in-vitro iron content. The analyzed values of ash, fibre, fat and protein content which were 4.95, 24.96, 9.72 and 26.31% respectively in whole seeds reduced to 4.72, 23.34, 7.59 and 24.17% respectively in treated seeds. Treated seeds had higher moisture and total carbohydrate content as compared to whole seeds. Calcium, potassium, sodium and phosphorus content was assessed in whole (391.27, 1449.20, 24.63 and 613.17 mg per 100 g) and treated seeds (239.37, 1328.00, 36.86 and 514.30 mg per 100 g) respectively. Soaking, drying and roasting treatments led to 6.86, 11.05 and 49.41% increase for copper, zinc and sodium levels. Roasting of garden cress increased the total iron content as well as in-vitro iron profile in treated seeds. The total iron, ionisable iron, soluble iron and percent bio-availability of iron was analyzed higher in treated seeds and lesser in whole garden cress seeds, i.e.,138.37 mg/100 g, 32.43 mg/100 g, 120.00 mg/100 g, 15.85% and 109.10 mg/100 g, 21.37 mg/100 g, 81.22 mg/100 g, 10.77% respectively. The study concluded that soaking, drying and roasting treatments of garden cress seeds enhanced the bioavailability of different nutrients. Presence of high iron, protein and fibre content and appreciable bio-availability of garden cress can increase its utilization as a functional food ingredient.

***Keywords:*** Garden cress seeds, Treatment, Proximate, Minerals, Bio-available iron

## INTRODUCTION

Garden cress (*Lepidium sativum*) also known as pepper cress, is an annual herb, belonging to Brassicaceae family and is native to Egypt and West Asia but is widely cultivated in hot temperate climates throughout the world for various culinary and medicinal uses (Malleshi, 2004). Garden cress is a fast-growing edible plant and commonly referred to as 'Aliv' in Marathi, 'Halim' in Hindi, and 'Asali' in Malayalam (Rahman, 2004). The crop is mainly cultivated for seeds. It can be grown at all elevations, throughout the year, but the best crop is obtained in the winter season (Wealth of India, 1962). Garden cress seeds are small, oval-shaped, pointed and triangular at one end, smooth, about 3-4 mm long, 1-2 mm wide and reddish brown in color. A furrow present on both surfaces extending up to two thirds downward, a slight wing like extension is present on both the edges of seeds. On soaking in water, seed coat swells and gets covered with transparent, colorless, mucilage with mucilaginous taste.

Garden cress seeds are loaded with nutrition. They are an important source of iron, folic acid, calcium, vitamins C, E and A. They are rich source of iron containing 100 mg iron per 100 g. Garden cress seeds are high in calories. It has

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about 454 kcal and 33 gram of carbohydrate per 100 gram with a protein content of 25.3 grams. It is often given post-partum to lactating mothers. Minerals like calcium, phosphorus and vitamins like thiamine, riboflavin and niacin are abundantly present in cress seeds in addition to dietary fiber (Gopalan *et al.*, 2009). Its high nutritive value, low cost and readily availability makes it possible for people of all the sections of society to include in the diet and increase nutritive value of their meals without increasing the expense of their diet.

Garden cress seeds are loaded not just with protein, but also linoleic and arachidic fatty acids. Since they contain phytochemicals that resemble estrogen to some extent, intake of these seeds helps to regulate menstruation and stimulate milk production in lactating mothers.Garden cress seeds have the ability to speed up the metabolism and increase thermogenesis. They are used as herbal medicine to treat iron deficiency anemia. They are one of the richest vegetarian sources of iron along with good bioavailability. Consumption of up to 2 tsp/day of garden cress seeds along with vitamin C helps to boost the haemoglobin level over time (Gupta and Singhal, 2011). Supplementation of garden cress seeds incorporated *ladoo* has shown improvement in the haemoglobin level and clinical signs and symptoms of the selected moderately anaemic adolescent girls (Angel and Devi, 2015). Garden cress seeds have shown to boost milk production in nursing mothers. Often they are advised to have garden cress seeds kheer or the *laddoo*. Because of its high iron and protein content, it is often given post-partum to lactating mothers.Garden cress seeds are widely used in many traditional medicinal preparations including cough syrups. Seeds are recommended for the dispersion of chronic enlargement of spleen. Powder of garden cress seeds with sugar is also be used to cure diarrhea, indigestion and dysentery (Nadkarni *et al.*, 1954). Garden cress seeds show many medicinal properties such as antidiabetic, hypocholesterolemic, antihypertensive, antidiarrheal, antispasmodic and laxative activities. It also has fracture healing, hepatoprotective, diuretic, and nephrocurative, and nephroprotective, antinflammatory, antipyretic and analgesic potential.

## MATERIAL AND METHODS

**Collection of Material:** Garden cress seeds (Plate-1) were collected in bulk from local market.

### Preparation of Sample

1. Whole garden cress seeds - Garden cress seeds were sorted and cleaned to remove impurities and they were ground in mixer and stored in airtight container.
2. Treated garden cress seeds - Garden cress seeds were sorted and cleaned to remove impurities. Seeds were soaked in water for 3 hours and drained the superficial water. After that, seeds were dried in tray drier at temperature of 60 °C and kept for drying until they were completely dried. Then they were ground in mixer. The flour thus obtained was roasted and stored in airtight container.

The prepared samples were evaluated for various nutritional characteristics. Data for nutrition analysis of different parameters is reported as average of triplicate determinations.

### Proximate Analysis

Proximate principles were determined and computed on dry weight basis according to AOAC (2005). The moisture content of samples was determined by drying the samples at 105 °C until a constant weight was obtained. Dried samples were analyzed to determine the total nitrogen content using micro Kjeldahl method. A conversion factor of 6.25 was used to calculate protein content. The ash content was determined by burning 2.5 g of oven-dried sample in a crucible in a muffle furnace at 550 °C for 8 hour. The total lipids were isolated using the Soxhlet method. Crude fiber was measured by digestion with 1.25% sulphuric acid followed 1.25% of sodium hydroxide. Carbohydrates content was determined by the difference method.

### Minerals Analysis

The dried samples were wet digested in 25 ml of diacid mixture (nitric acid and perchloric acid; 9:4) as per method given by Ranganna (2007). The digested samples were analyzed for sodium, potassium and calcium by using Flame Photometer, Model Mediflame 128 and for iron, zinc and copper, Atomic absorption spectrophotometer, AAS-4129 was used. Phosphorus was determined by spectrophotometer. *In vitro* iron bioavailability (Rao and Prabhavati, 1978) were also determined in samples.

### Statistical Analysis

Mean and standard deviation were calculated for each studied variable. The interpretation of data so obtained was done by analysis of variance (ANOVA) test. Level of significance was accepted at $p \leq 0.05$.

## RESULTS AND DISCUSSION

### Proximate Composition

The data presented in Table 1 shows the proximate composition of the whole and treated garden cress seeds on dry weight basis. The percent moisture content of whole seeds was analyzed as 4.82 and of treated seeds as 5.13 respectively which may be attributed to production of mucilage during soaking treatment and its retention later on after drying. Soaking, drying and roasting of seeds had significant effect on the selected parameters. Processing of seeds i.e. soaking the seeds, draining of superficial water, drying and further roasting decreased the ash, fat, fibre and protein content and increase the moisture content as well as total carbohydrates. Values of ash, fibre, fat and protein content analyzed 4.95, 24.96, 9.72 and 26.31% respectively in whole seeds reduced to 4.72, 23.34, 7.59 and 24.17% respectively after treatments. The percent reduction was calculated in limits of 4.64, 6.49, 21.91 and 8.13 respectively. On contrary, treated seeds had higher moisture and total carbohydrate content as 5.13 and 35.03% as compared to whole seeds as 4.82 and 29.25% respectively. Percent increase was calculated 6.43 and 19.76. The results are supported by study of Mathews et al (1993) who reported 24.3 ± 0.67% protein, 14.9 ± 0.79% fat, 55.4 ± 1.8% carbohydrate, 27.3 ± 0.43% acid detergent fiber and 35.7 ± 0.82% neutral detergent fiber in *L. sativum* seeds. Andersson *et al.* (1999) analyzed 19% protein, 20% crude fat and 40% dietary fiber in *L. campestre*. Gokavi *et al.* (2004) found that protein and fat were concentrated in endosperm whereas dietary fibre, minerals and carbohydrate were in bran fraction of garden cress.The high protein, fat, dietary fibers, calcium, phosphorous and iron contents in this seeds bring out its high nutritive value which may be making it useful in post pregnancy diets. Agarwal and Sharma (2013) studied garden cress seeds and quantitatively analyzed whole, husk removed, husk, roasted and microwave processed forms for proximate principles. Their results reported that moisture content was highest in husked garden cress seeds powder, i.e., 6.01%, protein and fat content was highest in husk removed garden cress seeds powder, i.e., 27.61% and 25% respectively. Ash in value of 6.50% and total carbohydrates of 38.11% were found highest in micro waved processed garden cress seeds powder while fibre in value of 15.11% found highest in roasted garden cress seeds powder.

**Table 1: Proximate Composition (% Dry Weight Basis) of Whole and Treated Garden Cress Seeds**

| Parameters | Garden Cress Seeds | | | |
|---|---|---|---|---|
| | Whole | Treated | Percent Increase | CD ($p \leq 0.05$) |
| Moisture | 4.82±0.09 | 5.13±0.01 | 6.43 | 0.02 |
| Ash | 4.95±0.00 | 4.72±0.01 | -4.64 | 0.08 |
| Crude fat | 24.96±0.02 | 23.34±0.03 | -6.49 | 0.26 |
| Crude fiber | 9.72±0.32 | 7.59±0.20 | -21.91 | 1.69 |
| Crude protein | 26.31±0.03 | 24.17±0.02 | -8.13 | 0.13 |
| Total Carbohydrate | 29.25±0.27 | 35.03±0.22 | 19.76 | 1.89 |

**Note:** Data are expressed as the mean ± standard deviation.

**Table 2: Mineral Compositions (mg per 100 g Dry Weight Basis) of Whole Seeds and Treated Garden Cress Seeds**

| Parameter | Garden Cress Seeds | | | |
|---|---|---|---|---|
| | Whole | Treated | Percent Increase | CD ($p \leq 0.05$) |
| Copper | 7.83±0.02 | 8.37±0.01 | 6.86 | 0.06 |
| Zinc | 9.77±0.00 | 10.85±0.01 | 11.05 | 0.05 |
| Calcium | 391.27±0.00 | 239.37±0.15 | -38.82 | 0.51 |
| Sodium | 24.63±0.26 | 36.80±0.00 | 49.41 | 1.23 |
| Phosphorus | 613.17±0.00 | 514.30±0.00 | -16.12 | 1.56 |
| Potassium | 1449.20±0.01 | 1328.00±0.02 | -8.36 | 1.87 |

**Note:** Data are expressed as the mean ± standard deviation.

### Mineral Compositions

The mineral profile of whole and treated garden cress seeds is presented in Table 3. Scrutiny of data revealed that both whole and treated garden cress seeds are good sources of minerals especially potassium, phosphorous and calcium. The copper, zinc and sodium content of whole and treated seeds were 7.83 mg, 9.77 mg, 24.63 mg and 8.37 mg, 10.85 mg, 36.80 mg per 100 g sample respectively and these minerals were highest in treated garden cress seeds which may be attributed to retention of minerals by the mucilage present inside the seeds and as well as by roasting treatment which increase minerals content.Calcium, phosphorus and potassium were high in whole garden cress seeds, i.e., 391.27 mg, 613.17 mg and 1449.29 mg per 100 g and slightly less in treated garden cress seeds, 239.37 mg, 514.30 mg and 1328.00 mg per100 g respectively. Treatment of seeds led to percent increase of 6.86, 11.05 and 49.41 for copper, zinc and sodium. On the other hand soaking, drying and roasting steps involved in treatment to percent reduction of 38.82, 16.12 and 8.36 to value of calcium, phosphorus and potassium.

**Table 3: Total, Ionisable, Soluble Iron Content and Percent Bio-Availability of Iron Content in Whole Seeds and Treated Garden Cress Seeds**

| Parameter | Garden Cress Seeds | | | |
|---|---|---|---|---|
| | Whole | Treated | Percent Increase | CD ($p \leq 0.05$) |
| Total iron (mg/100 g) | 109.10±0.06 | 138.37±0.02 | 26.82 | 0.24 |
| Ionisable iron (mg/100 g) | 21.37±0.09 | 32.43±0.09 | 51.75 | 0.15 |
| Soluble iron (mg/100 g) | 81.22±0.00 | 120.00±0.00 | 47.74 | 0.04 |
| Percent bio-availability iron (%) | 10.77±0.01 | 15.85±0.01 | 47.16 | 0.03 |

**Note:** Data are expressed as the mean ± standard deviation.

There was significant difference found in whole seeds and treated seeds with regard to all reported mineral content. The results are in lines with the findings of Gokavi *et al.* (2004) who analyzed more phosphorus (652 mg/100 g) content in endosperm of garden cress than whole meal. However, calcium content was found more in bran (556.32 mg/100 g) as compared to endosperm and whole meal. Muhammad *et al.* (2012) found the mineral contents in garden cress which are in agreement with the present study. Gopalan *et al*. (2000) reported 377 mg calcium and 723 mg phosphorous in *L. sativum.* The difference between the reported values and the values obtained in the present study may be attributed to the varietal variations and also to the agronomical conditions. All the fractions have low sodium and high potassium content which makes it beneficial as an ingredient in health foods. High potassium diet is recommended for athletes who are involved in hard exercise and also for disorders related to high blood pressure (Luft, 1987).

## Total, Ionisable, Soluble Iron Content and Percent Bioavailability of Iron Content

Table 3 depicts the total iron, ionisable, soluble iron content and percent bioavailability of iron in whole seeds and treated garden cress seeds. Soaking, drying and roasting treatment of garden cress had significant effect on analyzed parameters.

The total, ionisable and soluble iron content of 109.10, 21.37 and 81.22 mg per 100 g enhanced to values of 138.37, 32.43 and 120.00 mg per 100 g respectively. Percent increase of 26.82, 51.75 and 47.74 was calculated thereafter. Percent bio availability of iron analyzed as 10.77% increase to 15.85% with percent increase of 47.16 by the simple step of processing. Statistically significant difference was found between whole and treated seeds for total iron and *in-vitro* iron profile. Processing of seeds led to considerable deviations. The results were confirmed by the findings of

**Plate 1: Garden Cress Plant and Seeds**

Parmar (1996) and Reddy *et al.* (1997) on soluble iron content of different wheat varieties that ranged between 1.32 to 2.30 mg/100 g. Gopalan *et al.* (2000) reported 100 mg iron per 100 g of iron in *L. sativum*. Das *et al.* (2005) determined the *in vitro* availability of iron and found that rice had total iron content of 0.61 mg/100 g, and ionisable iron as 29.50%. The total iron content of *L. sativum* leaves was determined as 63.47±5.27 mg/100 g on dry weight basis by Hassan *et al.* (2011). Kaur (2011) reported percent bioavailability of some selected legumes in the range 2.49 to 3.94%. The study done by Agarwal and Sharma (2012), analyzed the total iron content of 127.10 mg/100 g in roasted garden cress followed by husk removed (121.46 mg/100 g), microwaved (117.65 mg/100 g), whole (112.66 mg/100 g) and husked seeds (73.03 mg/100 g). The processing techniques viz. soaking and germination could increase the bioavailability of iron by 5.24% and 37.17% respectively, in niger seeds sample (Baranwal and Bhatnagar, 2013) in germination treatment leaching of anti-nutritional content cause increase bioavailability of niger seeds.

## CONCLUSION

It can be concluded that garden cress seeds are rich source of protein, dietary fiber and minerals along with better bioavailability of iron. Household processing (soaking, drying and roasting) increased minerals content of seeds. Garden cress seeds can be used as food supplement in human diet as it contains considerable amounts of iron and calcium. Presence of low carbohydrates, high minerals and better iron bioavailability would increase its utilization. Garden cress seeds with high nutritional value can be exploited therefore as a functional food ingredient.

## REFERENCES


- Agrwal N and Sharma S (2013), "Garden Cress (*Lepidiumsativum* L.)—A Non Conventional Traditional Plant Item for Food Product", *Indian J Traditl Know*., Vol. 12, No. 4, pp. 699-706.
- Andersson A A M, Merker A, Nilsson P, Sorensen H and Aman P (1999), "Chemical Composition of the Potential New Oilseed Crops *Barbarea vulgaris*, *Barbareaverna* and *Lepidiumcampestre*", *J. Sci. Food Agr*., Vol. 79, No. 2, pp. 179-186.
- Angel M and Devi K P V (2015), "Therapeutic Impact of Garden Cress Seeds Incorporated Ladoo Among the Selected Anaemic Adolescent Girls (12-15 Years)", *JDDTBP*, Vol. 3, No. 3, pp. 18-22.
- AOAC (2005), "Official Methods of Analysis", *Association of Official Analytical Chemists*, 18th Edition, USA Limited, Washington DC.
- Baranwal D and Bhatnagar V (2013), "Effect of Processing on Niger Seeds: A Rich Source of Iron", *Asian Journal of Dairy and Food Research*, Vol. 3, No. 2, pp. 323-327.
- Chhavi G and Surbhi S (2011), "Effect of Garden Cress Seeds and Amla Intervention on the Haemoglobin Status of Non-Pregnant Women", *AJHS*, Vol. 6, No. 4, pp. 216-219.
- Das P, Raghuuramulu N and Rao K (2005), "Determination of *in vitro* Availability of Iron from Common Foods", *Jour Hum Eco*., Vol. 18, No. 3, pp. 13-20.
- Gokavi S S, Malleshi N G and Guo M (2004), "Chemical Composition of Garden Cress (*lepidiumsativum*) Seeds and its Fractions and Use of Bran as a Functional Ingredient", *Pl Food Hum Nutri.*, Vol. 59, No. 4, pp. 105-111.
- Gopalan C, Ramshashtri B V and Balasubramanian S C (2009), "Revised and Updated by Rao BSN", Deosthale Y G and Pant K C (Eds.), *Nutritive Value of Indian Foods*, NIN, Hyderabad.
- Hassan L G, Hassan S W, Hashim T, Uma K J and San N A (2011), "Determination of Nutritive Values of Garden Cress (*lepidium sativum* l.) Leaves", *Journal of Pure and Applied Sciences*, Vol. 4, No. 4, pp. 18-23.
- Kaur G (2011), "Development of Food Supplements to Combat Deficiency of Vitamin A and Iron PhD", Dissertation Punjab Agriculture University Ludhiana, India.
- Luft F C (1987), "Horticulture and Human Health: Contribution of Fruits and Vegetables", in Quebedeaux B and Bliss F A (Eds.), Proceedings of the 1st International Symposium on Horticulture and Human Health, April 12-15, pp. 127-134, Arlington, VA.
- Malleshi N and Guo M (2004), "Chemical Composition of Garden Cress Seeds and its Fractions and Use of Bran as a Functional Ingredient", *Indian J Traditl Know*., Vol. 12, No. 2, pp. 105-111.
- Mathews S, Singhal R S and Kulakrni P R (1993), "Some Physicochemical Characteristics of *Lepidium sativum* (Haliv) Seeds", *Die Nahrung*, Vol. 1, No. 3, pp. 69-71.

- Muhammad Z U H, Shakeel A, Luca C, Teresa M, Daniele D R, Nicoletta P and Vincenzo D F (2012), "Compositional Study and Antioxidant Potential of *Ipomoea hederacea* Jacq. and *Lepidiumsativum* L. Seeds", *Molecules*., Vol. 17, No. 2, pp. 10306-10321.
- Nadkarni K M and Nadkarni A K (1954), "*Lepidium sativum* L Inn", in *The Indian Material Medical with Ayurvedic, Unani and Home Remedies*, 3rd Edition, pp. 736-737, Popular Prakashan, Bombay, India.
- Parmar A (1996), "Iron and Zinc Availability from Different Wheat Varieties", M.sc. Thesis, Punjab Agriculture University, Ludhiana, Punjab, India.
- Piper C S (1996), "Method for the Ashing of Plant Materials (Chapter-II)", in *Soil and Plant Analysis*, pp. 258-275, Hans Publishers, Nicol Road, Bombay.
- Rahman M A (2004), "Medicinal Plant Diversity in Saudi Arabia—A Report on Seven Plant Family", Vol. 75, pp. 147-161.
- Ranganna S (2007), *Hand Book of Analysis and Quality Control for Fruits and Vegetables Products*, 3rd Edition, Tata Mc. Graw. Hill Publishing Company, New Delhi.
- Rao B S N and Prabhavati T (1978), "An *in vitro* Method for Predicting the Bioavailability of Iron from Foods", *Ameri Jour Clinic Nutri*., Vol. 31, No. 4, pp. 169-175.
- Reddy S, Kumari N and Nalwade V (1979), "Content and *in vitro* Availability of Proteins and Iron of Different Foods made from Wheat-Effect of Some Food Preparation Methods", *Ind Jour Nutr Diet*., Vol. 34, No. 4, pp. 150-154.
- The Wealth of India (1962), "Raw Materials", Vol. 6, Publication and Information Directorate, CSIR, New Delhi.


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