



Nutritional composition of Raw and Roasted Garden Cress Seed (*Lepidium sativum* L.) Flour

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ABSTRACT

Background: Garden cress is one of the traditional medicinal plants packed with nutrients. In India, garden cress seeds are consumed either raw or in processed forms. The different processes employed such as roasting may provide palatability, acceptable colour, and texture and raise the nutritional composition.

Methods: The present study was conducted to assess the nutritional composition of raw and roasted garden cress seed flour. Raw garden cress seed flour was developed by drying the seeds in oven at 60°C for 45 minutes, followed by grinding and sieving through 60 mesh sieve. Roasted flour was developed by initial roasting of seeds in iron vessel followed by similar procedure as for raw flour. Both flours were stored in air tight containers for further research analysis. In nutritional composition moisture, total ash, crude protein, crude fat, crude fibre, total carbohydrate and physiological energy were assessed for both raw and roasted seed flour.

Results: The result of the nutritional composition for raw and roasted seed flour showed that roasted flour has a higher nutritional composition than raw seed flour. It can be concluded that processing not only improves the shelf life and acceptability but also improves the nutritional composition of flour, which can be helpful to maintain and improve health and nutritional status.

KEYWORDS: Garden cress seeds, Nutritional composition, Palatability Roasting.

INTRODUCTION

Garden cress is one of the traditional medicinal plants that packed with nutrients. Garden cress seed (*Lepidium sativum*) is an annual herb that thrives throughout the Middle East, Europe, and the United States (Karazhiyan *et al.*, 2009). *Lepidium sativum* is a perennial food plant that grows quickly and is related to mustard and watercress. Garden cress is a member of the Brassicaceae family and is a species in the Kingdom Plantae, Division Magnoliophyta, Class Magnoliopsida, and Order Brassicales. It is a chilly season plant that is commonly cultivated in hot temperate climates around the world for a variety of culinary and medicinal purposes (Shabbir *et al.*, 2018). It can be grown and harvested throughout the year; however, January, February, and November are the best months to sow in Mediterranean climate (Tuncy *et al.*, 2011). Cress is an erect, smooth, annual herbaceous plant that grows to a height of about 15-45 cm. It features little white flowers in long racemes and pods that are widely or oblong, spherical, elliptic, emarginated, with notches at the apex and are winged. Garden cress seeds have a tiny size, a smooth texture, an oval form, and a reddish brown colour (Verma and Rana 2020). The seeds physically resemble some oil seeds, with the dicotyledonous endosperm accounting for 80–85 percent of the seed content, while the seed coat and embryo account for 12–17 percent and 2–3 percent of the seeds, respectively (Mathews *et al.*, 1993; Gopalan *et al.*, 2000). The seeds contain high amount of calories with protein, fat, dietary fibre, and carbohydrates per 100gm (Gopalan *et al.*, 2010; Chaudhary and Gupta, 2017). Seeds are consumed either raw or processed forms, in India (soaked, boiled and roasted). Shelf life and acceptability of food improve with different processes (Arinola and Adesina, 2014). Garden cress downgraded due to the presence of its odd pervasive scent and aninutritional factors. But different household cooking processes such as boiling, roasting, mirowaving, frying, germination, griddling, dehulling, etc. thoroughly affect the texture and nutritional composition of seeds. So the present study was conducted to assess the effect of roasting process on the nutritional composition of garden cress seed flour.

MATERIALS AND METHODS

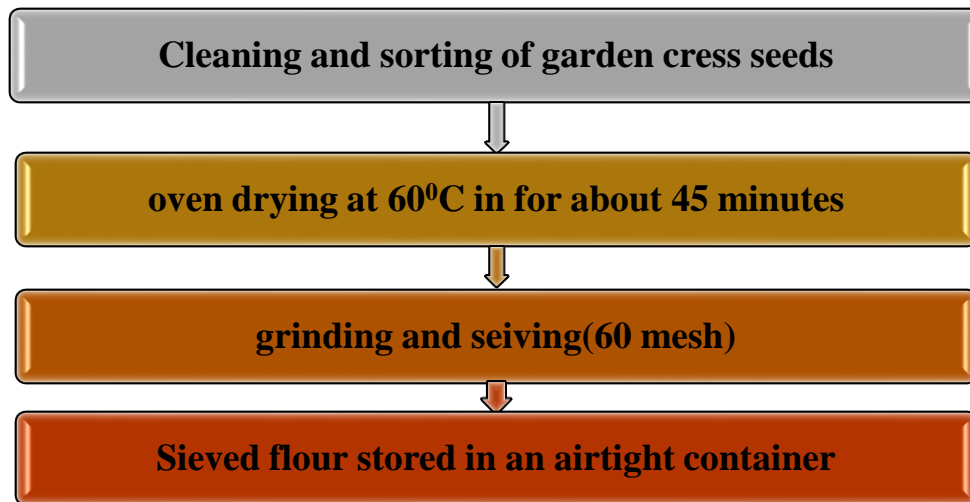
Duration and Locale of the Study

The present study was conducted in the Department of Foods and Nutrition, College of Home Science, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand.

Procurement of raw materials

Garden cress seeds for the present study were procured online.

Processing of Garden Cress Seeds



Garden cress seeds were analysed for following nutritional parameters by using standard methods of AOAC (2010).

Proximate composition estimation

Moisture

The sample was dried carefully and weight loss of flour was taken as a measure of the moisture content of sample.

Procedure

Moisture content was analysed by using (AOAC, 2010) method. The oven temperature was maintained at 130±3°C and aluminium dishes were transferred in it for 30 minutes. Then, dishes were placed in dessicator for cooling. In cooled and pre-weighed aluminium dishes, 2g of sample was shifted and dried for an hour in oven at 130±3°C temperature. Then, aluminium dishes are transferred to dessicator and weighed after they have attained room temperature. The loss in weight of dishes is considered as the moisture content of the flour.

$$\text{Moisture (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

W₁ = Weight of empty aluminium dishes

W₂ = Weight of empty aluminium dish (g) + sample before drying (g)

W₃ = Weight of empty aluminium dish (g) + sample after drying (g)

Crude fat

Crude fat estimation is based on the principle that weighed and dried sample is placed in a cellulose thimble and continuously extracted with petroleum ether for about 90 minutes in a soxhlet assembly. The ether is evaporated from the flask at the end of the extraction period, leaving an oil residue. The fat content is calculated by weighing the flask before and after extraction and comparing the difference to the weight of the original dry sample.

Procedure

For this, 2g of moisture free sample was transferred to an extraction thimble. The beaker was washed thoroughly and put in hot air oven at 60°C for drying and weighed after cooling. The sample in extraction thimble was plugged with fat free absorbent cotton. Then, 100 ml of petroleum ether was put into the beaker. The beakers were packed into the system and temperature was set to 90°C in the system. The extraction was carried out for one hour at 90°C. The temperature was raised to 110°C after the completion of extraction period and the stopper was closed in the solvent compartment to collect the solvent. The beaker was removed along



with the fat and transferred in hot air oven at 60°C temperature till a constant weight was obtained. After this the beakers were shifted to desiccators and weighed after cooling. Crude fat percentage was calculated as:

$$\text{Crude fat (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where,

W	=	Weight of sample (g)
W ₁	=	Weight of empty beaker (g)
W ₂	=	Weight of beaker with fat (g)

Crude protein

Crude protein estimation is based on the principle that sample is digested with boiling sulphuric acid. The nitrogen of sample converted to ammonium sulphate is made to react with strong alkali. The released ammonia is collected into boric acid solution, titrated with standard sulphuric acid and used to calculate the nitrogen content of sample.

Procedure

Crude protein was determined by using the principle of micro Kjeldahl method AOAC (2010) using automatic Kel-Plus Classic-dx apparatus. In this, finely ground and moisture free 0.5 gram sample was taken in pre dried digestion tubes in triplicate followed by addition of 10 ml of conc. sulphuric acid and 3 gram of digestion mixture. Tubes were transferred into the digestion unit and heated at 420°C for about 90 minutes or till the colourless or light bluish contents of tubes obtained. After completion of digestion, samples were cooled to room temperature and distilled in distillation unit. During distillation, released ammonia was collected in a 4 per cent boric acid solution containing mixed indicator. Boric acid containing ammonia was then titrated against 0.1N HCl till the end point of light pink colour change was attained. A blank sample was also prepared, and titrated with 0.1N HCl. A factor of 6.25 was used to assess the quantity of crude protein from the amount of nitrogen measured.

The quantity of crude protein was calculated using this formula:

$$\text{Crude protein (\%)} = \frac{\text{Normality} \times 100 \times 14 \times \text{Titrate volume (S-B)} \times F}{\text{Sample weight} \times 1000}$$

Where,

S	=	Volume (ml) of HCl (N/10) used in titration of sample
B	=	Volume (ml) of HCl (N/10) used in titration of blank
F	=	Factor for converting nitrogen to protein i.e. 6.25

Crude fibre

Crude fibre was determined as the organic residue, which remains after the defatted material that boiled successively with diluted sulphuric acid and dilutes sodium hydroxide solution.

Procedure

In a 600 ml beaker, 2 g weighed defatted sample and 200 ml of 1.25 percent boiling sulphuric acid were added. Beaker was covered with condenser flask and boiled for 30 minutes. The loss in volume was made up with water. The mixture was filtered with whatman no. 54 filter paper using buchners funnel and flask with gentle suction. With 100ml hot distilled water residue was washed back in beaker followed by addition of 1.25% sodium hydroxide solution and boiling for 30 minutes. Meanwhile, whatman no. 54 filter paper was cut as per size of funnel and placed in weighing bottle and dried for an hour at 105°C. Through weighed filter paper, solution was filtered and any residue from the sides of beaker was washed, using hot distilled water into filter paper. Then, allowed to drain, transferred to oven and dried at 105 °C for 3 hours and weighed.

$$\text{Crude fibre (\%)} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

W₁ = Weight of filter paper

W₂ = Weight of filter paper + collected fibre



Total ash

The ash content is determined by charring a known weight of sample at 550°C until all carbon is burnt. The remaining residue is ash, which signifies the sample's inorganic contents.

Procedure

Moisture free sample was taken to analyze ash. Five gram sample was taken in dried, weighed crucibles and charred over low bunsen flame. Crucibles were kept in muffle furnace at 550 °C until a white ash was obtained. Thereafter, the crucibles were removed from muffle furnace and cooled in a desiccator and reweighed. Ash content was calculated using given formula:

$$\text{Total ash (\%)} = \frac{W_2 - W_1}{\text{Weight of sample}}$$

W_1 – Weight of crucibles

W_2 – Weight of crucibles with ash

Total carbohydrate

By applying difference method, the total carbohydrate was calculated.

$$\text{Total carbohydrate (\%)} = 100 - \{\text{moisture (\%)} + \text{crude protein (\%)} + \text{crude fat (\%)} + \text{total ash (\%)} + \text{crude fibre (\%)}\}$$

Physiological energy

Physiological energy was calculated as:

$$(\text{Total Carbohydrate} \times 4) + (\text{crude protein} \times 4) + (\text{crude fat} \times 9)$$

RESULT AND DISCUSSION

The present study was performed to assess proximate composition of raw and roasted garden cress seeds flour. In proximate composition moisture, total ash, crude fat, crude protein, crude fiber, total carbohydrate and physiological energy of flours were assessed. Results of proximate composition showed increase in contents of crude protein, total ash and total carbohydrates whereas the decrease in content of moisture and fat were observed on roasting.

Proximate composition

The data in respect of proximate of raw and roasted garden cress seed flour have been presented in **Table 1**.

Moisture content

The moisture content of raw and roasted garden cress seeds was 6.25 and 4.89 per cent, respectively. The result of moisture was confirmed by the results obtained previously by Toliba and Mohmed (2019), Zia-Ul-Haq *et al.* (2012), Patil *et al.* (2015) and Doke *et al.* (2017). As the roasting influences the evaporation of moisture it might be the reason for decreased in moisture content. The low moisture content is an index of stability, quality and increased shelf life of flour.

Ash content

The data obtained revealed that the ash content of raw garden cress seed flour was 4.89 percent that was 5.12 percent in roasted seed flour. The result of ash of raw garden cress seed flour was confirmed by the results obtained previously by Toliba and Mohmed (2019) and Hassan and Rahman (2019). Ash content of flour directly related to the amount of minerals. The higher ash content in raw and roasted GCS flour indicated that the garden cress seeds flour is a good source of minerals.

Protein content

In case of protein, observed data showed that the raw garden cress seed flour had 23.90 percent protein which was 24.62 percent in roasted flour. The results of protein content of raw garden cress seed flour was almost in agreement with that documented by Gaafar *et al.* (2013), Jain *et al.* (2016) and Longvah *et al.* (2017) who reported 24.29, 22.81 and 23.36 percent of protein value in seeds. Roasting technique increases the protein content of garden cress seeds, which may be due to the release of protein from the protein-iron-phytate complex during roasting.

Fat content

The value obtained for fat content of raw and roasted garden cress seed flour revealed that seeds contained 12.68 and 12.12 percent fat, respectively. The fat values of raw flour were similar as Patil *et al.* (2015), Doke *et al.* (2017) and Toliba and Mohmed (2019).

By roasting, fat content decreased may be due to loss of volatile oils on open dry heat treatment and there can be break down of fat to give a larger amount of free fatty acids, light esters, acrolein, and formic acid. With a obvious change in the chemical nature of the fat, the fat may come to the surface, through breaking of the fat cells, (Mathur and Chaudhary 2009).

Crude fibre

Crude fibre is insoluble residue of an acid hydrolysis followed by an alkaline one. The crude fibre obtained through chemical analysis of vegetable substances, is primarily composed of cellulose material. It was observed that crude fibre content of raw garden cress seeds was 8.09. The values obtained for crude fiber was as obtained previously by Zia-Ul-Haq *et al.* (2012), Gaafar *et al.* (2013), Jain *et al.* (2016) and Hassan and Rahman (2019). The crude fibre content of roasted flour was 8.13 percent that was significantly higher than raw flour.

Total carbohydrate

The total carbohydrates in raw garden cress seeds flour that was calculated by difference method in which total amount of moisture, ash, fat, fiber and protein was subtracted from 100. The total carbohydrate content of raw and roasted garden cress seeds flour was 44.19 and 45.12 percent. Obtained result of total carbohydrate was similar with Jain *et al.* (2016) and Rajshri and Haripriya (2018). The decrease in the carbohydrate content after roasting might be due the relative increase in other nutrients.

Physiological energy

The physiological energy is used for the synthesis of substances needed by the body and for all activities. The physiological energy of raw garden cress seeds flour was 386.28 and it was 384.04 Kcal/100g in roasted flour. Zia-Ul-Haq *et al.* (2012) and Doke and Guha (2014) reported higher values of physiological energy of garden cress seeds flour as 454 and 474 kcal/100g, respectively. The differences in the results could be because of the different variety of the seeds used and procedure to obtain the results.

Proximate composition of garden cress seeds (% , on dry weight basis)

Nutrients	Raw GCS	Roasted GCS	CD Values
Moisture	6.25±0.35	4.89±0.26	0.706**
Ash	4.89±0.25	5.12±0.17	0.194**
Crude protein	23.90±0.19	24.62±0.21	0.507*
Crude fat	12.68±0.33	12.12±0.14	0.096**
Crude fibre	8.09±0.57	8.13±0.28	NS
Total Carbohydrate	44.19±1.19	45.12±1.13	0.398**
Physiological energy	386.48±1.12	384.04±1.2	0.119**

GCS: Garden cress seed; Values are mean ± SD of three independent replications

NS-Non significant, **- significant at 1 percent, *- significant at 5 percent

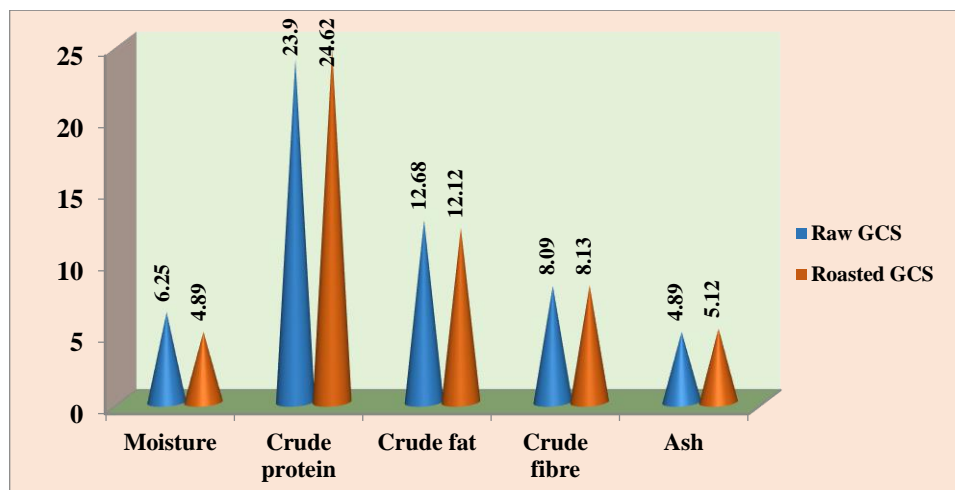


Fig. 1: Difference in proximate composition of raw and roasted garden cress seeds flour



CONCLUSION

The tanginess and peppery aftertaste of flour were successfully removed by roasting garden cress seeds. The proximate composition of raw and roasted garden cress seed flour was found to be very high, especially because it contained a very good amount of crude proteins and fiber. So, consumption of garden cress seeds may improve the protein status of a malnourished population, as protein energy malnutrition (PEM) is the major nutritional problem. Seeds with such high amounts of fibre and protein and low carbohydrates may be a perfect choice for those suffering from hypertension, diabetes, and obesity to improve their nutritional status.

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