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Phytochemical and Nutritional Composition of Different Parts of Garden Cress (*Lepidium sativum* L.)

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A B S T R A C T

Traditional medicines of plant origin have become the alternative remedies to treat human as well as animal ailments. People rely on medicinal plants due to their faith in traditional healing process. One of traditional medicinal plant rich in nutrients is garden cress (*Lepidium sativum* L.). Despite ubiquitous occurrence, people know very little about this nature's creation of a treasure trove of nutrients. The present study was undertaken to investigate the proximate, mineral and chemical composition of different parts *viz*. seeds, aerial parts and roots of garden cress (*Lepidium sativum* L.) collected from two different locations i.e. Hisar and Solan. Results revealed that all parts of garden cress were found to have good proximate composition. On the basis of calorific value, all parts of garden cress collected from both locations were found to be very rich sources of energy. Seeds, aerial parts and roots of garden cress contained significant amount of minerals *viz*. Fe, Cu, Zn and Mn. Different parts of garden cress also contained ascorbic acid, starch, tannins, total sugars, reducing sugars and non-reducing sugars in varying amounts. Hence, this treasure trove plant could have the potential in various pharmaceutical formulations.

Introduction

In a society increasingly concerned with health and nutrition, medicinal plants emerge as alternative to synthetic products. They are used not only in traditional medicine but also in a number of food and pharmaceutical products, due to their nutritional properties and bioactivity which may be attributed to the presence of several chemical constituents (Phillipson, 2007).

Lepidium sativum L., commonly known as garden cress, is an important medicinal crop in India. It is a fast growing edible herbaceous plant genetically related to water cress and mustard sharing their peppery, tangy flavour and aroma. It is a member of family Brassicaceae and cultivated all over India, North America and parts of Europe. Garden cress is known as asalio or chandrasur in India. In some regions, garden cress is known as garden pepper cress, pepperwort, pepper grass or poor men's pepper. Seeds, leaves and roots are economically important, however, the crop is mainly cultivated for seeds. Major bioactive constituents of garden cress include alkaloids, flavonoids, tannins, glucosinolates,

sterols, triterpenes, saponins, anthracene glycosides, carbohydrates, proteins and phenolics (Manohar *et al.,* 2012; Ahamad *et al.,* 2015) which are responsible for its various ethno-pharmacological activities.

In India, the herb is generally regarded as a cure for bleeding piles, asthma, menstrual disorders and dysentery (Sharma and Agarwal, 2011). The seeds are considered aphrodisiac, depurative, emmenagogue and galactogogue. They are also used for the treatment of dyspepsia, leucorrhoea, diarrhoea, seminal weakness and scurvy. Seeds possess significant antipyretic, anti-inflammatory and coagulant activities (Al-Yahya *et al.,* 1994). Therefore, the objective of the present study was to analyze the proximate, mineral and chemical composition of different parts viz. seeds, aerial parts and roots of garden cress (*Lepidium sativum* L.) collected from two different regions.

Materials and Methods

Plant material

Seeds, aerial parts and roots of garden cress (*Lepidium sativum* L.) were procured from the experimental area of Medicinal, Aromatic and Potential Crops Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana and from the Medicinal and Aromatic Research Farm, Department of Forest Products, College of Forestry, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, H.P.

Proximate analysis

Estimation of moisture content

Two gram of the powdered samples of seeds, aerial parts and roots of garden cress were taken in three replications and dried initially at 80-90ºC and finally at 100-102ºC. Weights of dried samples were noted until constant weights were obtained. The percentage of moisture content was calculated as follows:-

$$\text{Moisture content (\%)} = \frac{\text{Wt. of powder (before drying)} - \text{Wt. of powder (after drying)}}{\text{Wt. of powder (before drying)}} \times 100$$

Estimation of fat

Two gram of the dried powdered samples of seeds, aerial parts and roots of garden cress were taken in a thimble and placed in a soxhlet extractor. A dried and pre-weighed round-bottomed flask (250 mL) was connected to the soxhlet assembly. Then petroleum ether was added up to one and a half siphons i.e. approximately 150-175 mL. The assembly was heated and extraction was carried out for 8 h. After extraction, petroleum ether was evaporated from the round-bottomed flask and weight of the round bottomed flask along with the extract was determined again. The crude fat (%) contents were calculated using the following formula:

$$\text{Fat content (\%)} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100$$

Estimation of ash

Two gram of the powdered samples of seeds, aerial parts and roots of garden cress were weighed and transferred into previously ignited and weighed crucible and placed in a muffle furnace (preheated at 600ºC) for 2 h.

The crucibles with the samples were transferred directly from the furnace into a desiccator, allowed to cool and weight was taken. The ash contents (%) were calculated using the following formula:

$$\text{Ash content (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Estimation of protein

Nitrogen and crude protein content in the powdered samples of garden cress were estimated by following conventional micro-Kjeldahl's method. 100 mg powdered samples of seeds, aerial parts and roots of garden cress were weighed and transferred to 100 mL micro-Kjeldahl's digestion flasks. About 1 g of K_2SO_4: $CuSO_4$ (9:1) was added to it followed by 10 mL conc. H_2SO_4. The flasks were then kept in an inclined position on the hot plate in the digestion chamber and heated gently till the solution became transparent giving a bluish green colour. After cooling, the contents of the flask were mixed with distilled water, cooled, transferred to 100 mL volumetric flask and volume was made up to the mark with distilled water. 10 mL of N/100 H_2SO_4 was taken in a conical flask which acts as a receiving flask. This flask was placed in such a way that outlet of the condenser of micro-Kjeldahl's distillation apparatus dips into the acid solution. Then, 10 mL of acid digested sample was transferred to the steam chamber of micro-Kjeldahl's apparatus followed by 10 mL of 40% NaOH. Immediately, the stopcock was closed, steam was passed through the steam chamber and ammonia was distilled till 30-40 mL of distillate was collected in the receiving flask. Receiving flask was removed and the contents were titrated against N/100 NaOH and volume of NaOH used was noted. The end-point was reached when colour changed from pink to yellow. A blank was also run simultaneously which has been digested and distilled in similar manner. Protein content was calculated as follows:

Amount of nitrogen (%) = (A – B) x 1.4

Where,

A = Volume of N/100 NaOH used for blank (mL)

B = Volume of N/100 NaOH used for sample (mL)

Protein content (%) in sample = Nitrogen content in sample x 6.25

Estimation of crude fibre

Crude fibre was estimated by the modified method of Maynard (1970). One gram of moisture and fat free powdered samples of seeds, aerial parts and roots of garden cress were weighed and transferred to the spoutless one litre beaker and added 200 mL of 1.25% (w/v) sulphuric acid. The beaker was then placed on hot plate and allowed to reflux for 30 min timed from onset of boiling and the contents were shaked after every 5 min. After boiling for 30 min beaker was removed from hot plate and filtered through a muslin cloth using suction. The residue was washed with hot water till it became free from acid, then the material was transferred to the same beaker and added 200 mL of 1.25% NaOH solution and the contents were again refluxed for 30 min. It was filtered again through muslin cloth with the help of vacuum or suction pump and the residue was washed with hot water till it became free from alkali. The residue was then transferred to a crucible and placed in hot air oven, allowed to dry to constant weight at 80-110°C and recorded its weight. The residue was ignited in muffle furnace at 550-660°C for 2-3 h, then cooled and weighed again. The loss of weight due to ignition is weight of crude fibre. The crude fibre contents (%) were calculated using the following formula:

$$\text{Crude fibre content (\%)} = \frac{\text{Weight of crude fibre}}{\text{Original weight of sample}} \times 100$$

Estimation of total carbohydrates

Total carbohydrates content was calculated by difference as follows:

Total carbohydrates content (%) = 100 – [Moisture (%) + Fat (%) + Ash (%) + Protein (%) + Crude fibre (%)]

Estimation of calorific value

The calorific value in kilocalories (kcal) was calculated according to the Atwater system as follows:

Calorific value (kcal) = (4 x Protein content) + (9 x Fat content) + (4 x Total carbohydrates content)

Estimation of minerals

0.5 g of powdered samples of seeds, aerial parts and roots of garden cress were weighed and transferred to 100 mL conical flask. To this, 10 mL of diacid mixture of HNO_3 and $HClO_4$ in a ratio of 4:1 was added and the samples were allowed to stand overnight. The samples were heated on a hot plate gently at first and then vigorously until a clear colourless solution results or till white fumes ceased to come out. Samples were not heated to dryness. Heating was discontinued when the volume reduced to 2 - 3 mL. The samples were cooled, transferred to 50 mL volumetric flask, made up to the mark by adding distilled water, filtered through Whatman no. 1 filter paper and used for the estimation of Fe, Cu, Zn and Mn using Varian AA240FS Fast Sequential Atomic Absorption Spectrophotometer (Agilent Technologies).

Chemical analysis

Estimation of ascorbic acid

Ascorbic acid was estimated by titrimetric method by following the method of Sadasivam and Manickam (1996). 5 mL of the working standard solution was pipetted out into a 100 mL conical flask, added 10 mL of 4% oxalic acid and titrated against the dye (V_1 mL). End point was the appearance of pink colour which persisted for a few minutes. One gram of the powdered samples of seeds, aerial parts and roots of Garden cress were extracted in 4% oxalic acid by using centrifuge and made up to a known volume i.e. 100 mL. 5 mL of the plant extracts was pipetted out into a 100 mL conical flask, added 10 mL of 4% oxalic acid and titrated against the dye (V_2 mL). Ascorbic acid content was calculated as follows:

$$\text{Amount of ascorbic acid mg/100g sample} = \frac{0.5 \text{ mg} \times V_2 \text{ mL} \times 100 \text{ mL}}{V_1 \text{ mL} \times 5 \text{ mL} \times \text{Wt. of the sample}} \times 100$$

Estimation of starch

Starch was estimated by following the method of Sadasivam and Manickam (1996). 0.2 g of finely powdered samples of seeds, aerial parts and roots of garden cress were weighed and placed in 60 mL centrifuge tubes and added 20 mL of hot 80% alcohol to remove sugars. The tubes were then shaked for 5-10 min, centrifuged at 3000 rpm for 10 min and supernatant was decanted. The residue was again extracted repeatedly with hot 80% alcohol until the supernatant was free of sugars as judged by negative test with anthrone reagent. The residue was cooled in ice water and added 5.0 mL of water and 6.5 mL of 52% perchloric acid while stirring the contents with a glass rod. It was allowed to stand for 15 min with occassional stirring, centrifuged and supernatant fractions were collected. The extraction step using perchloric acid was repeated 2-3 times. All the supernatants were collected; pooled and final volume was made up to 100 mL with water. Then 0.2 mL aliquot of the extract was taken and made up to 1 mL with water. After that, 4 mL freshly prepared anthrone reagent was added, mixed properly and the tubes were transferred to boiling water bath and heated for 8 min. Then, the tubes were cooled rapidly under running tap water and the intensity of green to dark green colour was read at 630 nm using UV-Vis Double beam

spectrophotometer Model 2203 (Systronics Co.) against a blank prepared similarly but containing respective solvent instead of extracts. A standard curve was prepared using 0 to 100 µg glucose as per the procedure described above. Amount of glucose was calculated in the sample aliquots from the standard curve and multiplied by a factor 0.9 to arrive at the starch content.

Estimation of tannins

Tannins content was estimated as catechin equivalent by vanillin-hydrochloric acid method of Burns (1971). Five hundred mg of powdered samples of seeds, aerial parts and roots of garden cress was taken in a 50 mL test tube and 10 mL of methanol was added to it. The tubes were closed with pith corks. The contents of the tubes were shaken occasionally and allowed to stand overnight at 25 to 32ºC. One mL of clear supernatant was then pipetted in a test tube and 5 mL of vanillin-HCl reagent was added to it. The absorbance of brownish red colour so produced was measured at 525 nm after 25 min on a Spectronic 20 colorimeter. A blank containing methanol was also run simultaneously. A standard curve of catechin was prepared simultaneously in order to calculate amount of tannin.

Estimation of total sugars

Total sugars were estimated by the modified phenol sulphuric acid method of Dubois *et al.*, (1956). For estimation of total sugars in aqueous extracts of seeds, aerial parts and roots of garden cress, 1.0 mL of each extract was diluted with respective solvent to adjust the absorbance within calibration limits. Then, 2.0 mL of phenol solution (2%, w/v) was added followed by 5.0 mL concentrated sulphuric acid. Acid was added in such a way that it directly pours on the solution. The test tubes were allowed to cool for 30 min and absorbance of the solution was measured at 490 nm using UV-Vis Double beam spectrophotometer Model 2203 (Systronics Co.) against a blank prepared similarly but containing respective solvent instead of extracts. The amount of total sugars present in the extracts was calculated from the standard curve of glucose and the results are expressed as milligrams per gram.

Estimation of reducing sugars

Reducing sugars were estimated by the method of Nelson (1944) as modified by Somogyi (1952). For estimation of reducing sugars in aqueous extracts of seeds, aerial parts and roots of garden cress, 1.0 mL of each extract was diluted with respective solvent to adjust the absorbance within calibration limits. Then, 1.0 mL distilled water was added, followed by addition of 1.0 mL alkaline copper reagent, solution was mixed, covered with aluminium foil and heated in boiling water bath for 20 min. The tubes were cooled to room temperature and 1.0 mL of arsenomolybdate reagent was added.

The contents were mixed thoroughly and volume was made up to 10.0 mL with distilled water. The absorbance of the solution was measured at 520 nm using UV-Vis Double beam Spectrophotometer Model 2203 (Systronics Co.) against a blank prepared similarly but containing respective solvents instead of extracts. The amount of reducing sugars present in the extracts was calculated from the standard curve and the results are expressed as milligrams per gram.

Estimation of non-reducing sugars

The non-reducing sugars were calculated from the difference between the content of total sugars and that of reducing sugars.

Non-reducing sugars = Total sugars – Reducing sugars

Results and Discussion

Proximate composition

The data of proximate composition of seeds, aerial parts and roots of garden cress of Hisar and Solan regions is given in Tables 1 and 2, respectively. Amongst different plant parts of garden cress (Hisar region and Solan region), moisture content ranged from 8.00 - 9.25% and 7.91 - 10.43%, respectively; fat content ranged from 4.23 - 22.16% and 4.99 to 23.16%, respectively; ash content ranged from 4.81 - 5.75% and 3.02 - 5.60%, respectively; protein content ranged from 6.33 - 25.51% and 4.19 - 21.82%, respectively; crude fibre content ranged from 10.83 - 32.90% and 10.70 - 31.83%, respectively; total carbohydrates content ranged from 28.45 - 43.65% and 30.81- 45.54%, respectively; calorific value ranged from 234.55 - 415.31 kcal and 243.85 - 418.93 kcal, respectively. Present findings are in agreement with Al-Jasass and Al-Jasser (2012) who reported that crude fat content, ash content, crude protein content and crude fibre content in *L. sativum* seeds grown in Saudi Arabia was 23.19%, 7.1%, 24.19% and 11.9%, respectively. Zia-Ul-Haq *et al.,* (2012) reported that proximate analysis of *L. sativum* seeds indicated the presence of appreciable amounts of protein (24.18%), fibre (6.75%), lipids (28.03%), ash (3.92%), moisture (3.92%) and carbohydrates (32.87%).

Mineral composition

The data of mineral (Fe, Cu, Zn and Mn) composition of seeds, aerial parts and roots of garden cress of Hisar and Solan regions is given in Tables 3 and 4, respectively.

Iron (Fe) content

Fe content in seeds, aerial parts and roots of garden cress (Hisar region) was 92.37, 129.73 and 133.01 ppm, respectively (Table 3). The corresponding values of Fe content in garden cress (Solan region) were 98.60, 142.73 and 142.60 ppm, respectively (Table 4).

Copper (Cu) content

Cu content in seeds, aerial parts and roots of garden cress (Hisar region) was 6.90, 3.40 and 5.70 ppm, respectively (Table 3).

The corresponding values of Cu content in garden cress (Solan region) were 6.03, 4.07 and 5.07 ppm, respectively (Table 4).

Zinc (Zn) content

Zn content in seeds, aerial parts and roots of garden cress (Hisar region) was 46.49, 34.70 and 25.28 ppm, respectively (Table 3). The corresponding values of Zn content in garden cress (Solan region) were 58.02, 29.05 and 25.37 ppm, respectively (Table 4).

Manganese (Mn) content

Mn content in seeds, aerial parts and roots of garden cress (Hisar region) was 33.30, 11.13 and 12.73 ppm, respectively (Table 3).

The corresponding values of Mn content in garden cress (Solan region) were 20.17, 12.27 and 12.45 ppm, respectively (Table 4).

Similar findings have also been reported by other research workers. Sat *et al.,* (2013) reported that Fe, Cu, Zn and Mn content in leaves of two garden cress cultivars *viz*. Dadas and Izmir cultivated in Turkey ranged from 47.21 to 45.94 mg/kg, from 26.16 to 28.33 mg/kg, 92.30 to 118.80 mg/kg and from 74.20 to 62.01 mg/kg, respectively.

Solomon *et al.,* (2016) reported 11.30 mg/100g Fe content and 1.85 mg/100g Mn content in *L. sativum* seeds collected from Eastern Ethiopia.

Table.1 Proximate composition of seeds, aerial parts and roots of Garden cress (Hisar region)

Plant and Location	Parameter	Seeds	Aerial Parts	Roots
Garden cress (Hisar)	**Moisture (%)**	8.09 ± 0.02	9.25 ± 0.08	8.00 ± 0.10
	Fat (%)	22.16 ± 0.07	6.69 ± 0.06	4.23 ± 0.09
	Ash (%)	4.96 ± 0.05	4.81 ± 0.04	5.75 ± 0.24
	Protein (%)	25.51 ± 0.52	8.77 ± 0.25	6.33 ± 0.13
	Crude fibre (%)	10.83 ± 0.52	26.83 ± 1.35	32.90 ± 0.55
	Total carbohydrates (%)	28.45 ± 0.89	43.65 ± 1.64	42.79 ± 0.82
	Calorific value (kcal)	415.31 ± 1.73	269.89 ± 6.11	234.55 ± 2.38

Table.2 Proximate composition of seeds, aerial parts and roots of Garden cress (Solan region)

Plant and Location	Parameter	Seeds	Aerial Parts	Roots
Garden cress (Solan)	**Moisture (%)**	7.91 ± 0.08	9.13 ± 0.02	10.43 ± 0.04
	Fat (%)	23.16 ± 0.13	8.98 ± 0.22	4.99 ± 0.06
	Ash (%)	5.60 ± 0.05	3.44 ± 0.03	3.02 ± 0.07
	Protein (%)	21.82 ± 0.06	7.21 ± 0.13	4.19 ± 0.38
	Crude fibre (%)	10.70 ± 0.68	25.83 ± 0.23	31.83 ± 0.43
	Total carbohydrates (%)	30.81 ± 0.58	45.41 ± 0.45	45.54 ± 0.55
	Calorific value (kcal)	418.93 ± 3.53	291.27 ± 1.51	243.85 ± 1.43

Table.3 Minerals content (ppm) in seeds, aerial parts and roots of Garden cress (Hisar region)

Plant and Location	Minerals ↓ Plant Part →	Mineral content (ppm)		
		Seeds	Aerial Parts	Roots
Garden cress (Hisar)	**Fe**	92.37 ± 4.09	129.73 ± 2.79	133.01 ± 4.37
	Cu	6.90 ± 0.06	3.40 ± 0.06	5.70 ± 0.12
	Zn	46.49 ± 6.30	34.70 ± 1.00	25.28 ± 1.61
	Mn	33.30 ± 1.08	11.13 ± 0.19	12.73 ± 0.72

Table.4 Minerals content (ppm) in seeds, aerial parts and roots of Garden cress (Solan region)

Plant and Location	Minerals ↓ Plant Part →	Mineral content (ppm)		
		Seeds	Aerial Parts	Roots
Garden cress (Solan)	**Fe**	98.60 ± 1.47	142.73 ± 1.01	142.60 ± 6.54
	Cu	6.03 ± 0.09	4.07 ± 0.24	5.07 ± 0.28
	Zn	58.02 ± 2.47	29.05 ± 0.83	25.37 ± 0.58
	Mn	20.17 ± 0.12	12.27 ± 0.15	12.45 ± 0.16

Table.5 Chemical composition of seeds, aerial parts and roots of Garden cress (Hisar region)

Plant and Location	Parameter	Seeds	Aerial Parts	Roots
Garden cress (Hisar)	Ascorbic acid (mg/100g)	49.75 ± 0.74	84.28 ± 0.50	19.08 ± 0.53
	Starch (mg/g)	13.77 ± 0.42	23.03 ± 0.73	11.90 ± 0.31
	Tannins (mg/g)	3.94 ± 0.04	3.16 ± 0.06	1.28 ± 0.04
	Total sugars (mg/g)	15.86 ± 0.07	33.04 ± 0.07	14.35 ± 0.08
	Reducing sugars (mg/g)	2.58 ± 0.09	3.27 ± 0.07	1.78 ± 0.09
	Non-reducing sugars (mg/g)	13.28 ± 0.02	29.77 ± 0.04	12.57 ± 0.12

Table.6 Chemical composition of seeds, aerial parts and roots of Garden cress (Solan region)

Plant and Location	Parameter	Seeds	Aerial Parts	Roots
Garden cress (Solan)	Ascorbic acid (mg/100g)	43.80 ± 0.33	77.59 ± 0.84	14.58 ± 0.54
	Starch (mg/g)	10.37 ± 0.20	19.51 ± 0.54	6.86 ± 0.35
	Tannins (mg/g)	3.67 ± 0.06	2.93 ± 0.04	1.10 ± 0.04
	Total sugars (mg/g)	13.52 ± 0.06	30.87 ± 0.13	12.40 ± 0.08
	Reducing sugars (mg/g)	1.52 ± 0.09	3.00 ± 0.06	1.02 ± 0.03
	Non-reducing sugars (mg/g)	12.00 ± 0.10	27.87 ± 0.07	11.38 ± 0.11

Chemical composition

The data of chemical composition of seeds, aerial parts and roots of garden cress of Hisar and Solan regions is given in Tables 5 and 6, respectively.

Ascorbic acid content

Amongst different plant parts of garden cress (Hisar region), ascorbic acid content (mg/100g) was highest in aerial parts (84.28) followed by in seeds (49.75) and roots (19.08) (Table 5). Similarly, in garden cress of Solan region, ascorbic acid content (mg/100g) was highest in aerial parts (77.59) followed by in seeds (43.80) and roots (14.58) (Table 6). The findings of present studies are in accordance with Sat *et al.*, (2013) who reported that ascorbic acid content in leaves of two garden cress cultivars *viz*. Dadas and Izmir cultivated in Turkey was 54 and 74 mg/100g.

Starch content

In garden cress (Hisar region), amongst different parts starch content (mg/g) was highest in aerial parts (23.03) followed by in seeds (13.77) and roots (11.90) (Table 5). Similarly, in garden cress of Solan region, starch content (mg/g) was highest in aerial parts (19.51) followed by in seeds (10.37) and roots (6.86) (Table 6). However, no literature is available on starch content in Garden cress.

Tannins content

Amongst different parts of garden cress (Hisar region), tannins content (mg/g) was

highest in seeds (3.94) followed by in aerial parts (3.16) and roots (1.28) (Table 5). Similarly, in garden cress of Solan region, tannins content (mg/g) was highest in seeds (3.67) followed by in aerial parts (2.93) and roots (1.10) (Table 6). Other research workers have also reported tannins content in similar range. Hussain *et al.,* (2011) reported 0.61% tannins content in *L. sativum*. Tannins content in whole garden cress seed flour was 51.0 mg/100g (Agarwal and Sharma, 2013).

Total sugars content

In garden cress (Hisar region), amongst different plant parts total sugars content (mg/g) was highest in aerial parts (33.04) followed by in seeds (15.86) and roots (14.35) (Table 5). Similarly, in garden cress of Solan region, total sugars content (mg/g) was highest in aerial parts (30.87) followed by in seeds (13.52) and roots (12.40) (Table 6).

Reducing sugars content

In garden cress (Hisar region), reducing sugars content (mg/g) was highest in aerial parts (3.27) followed by in seeds (2.58) and roots (1.78) (Table 5). Similarly, in garden cress of Solan region, reducing sugars content (mg/g) was highest in aerial parts (3.00) followed by in seeds (1.52) and roots (1.02) (Table 6).

Non-reducing sugars content

Amongst different parts of garden cress (Hisar region), non-reducing sugars content (mg/g) was highest in aerial parts (29.77) followed by in seeds (13.28) and roots (12.57) (Table 5). Similarly, in garden cress of Solan region, non-reducing sugars content (mg/g) was highest in aerial parts (27.87) followed by in seeds (12.00) and roots (11.38) (Table 6).

All parts viz. seeds, aerial parts and roots of garden cress collected from two different locations i.e. Hisar and Solan possessed good proximate and mineral composition. On the basis of calorific values, all parts were found to be very rich source of energy. Seeds, aerial parts and roots of garden cress (Hisar and Solan regions) were also found to be good source of ascorbic acid, starch, tannins, total sugars, reducing sugars and non-reducing sugars. Hence, due to good proximate, mineral and chemical composition, garden cress plant as a whole including seeds, aerial parts and roots or its different parts would be of significant importance in pharmaceutical formulations.

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