

## A Review on Physical and Functional Properties of *Lepidium sativum* L.

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### Abstract

Garden cress is an annual, herbaceous, edible plant. It belongs to the Brassicaceae family and the Kingdom Plantae. According to scientific evidence, it is thought to have originated in Ethiopia. Garden cress can thrive in any climate and soil type. In India, garden cress is cultivated as a culinary vegetable. The seeds, leaves, and roots of garden cress are nutritious and have medicinal properties. This review is mainly focusing on the physical and functional properties of garden cress seeds as seed used in many food products as gelling agent, a water retention agent, a thickening agent, an emulsifying agent, and a binding agent.

**Keywords:** *Lepidium sativum* L, Garden Cress, Emulsifying Agent, Seeds

## Introduction

*Lepidium Sativum* L. commonly known as Garden cress (GC) is an annual herb that grows in the Middle East, Europe, and the United States. It belongs to the Brassicaceae family and the Kingdom Plantae. Garden cress is an annual, herbaceous edible plant, thought to have originated in Ethiopia, according to scientific evidence. Garden cress can thrive in any climate and soil type. It is cultivated in India, as culinary vegetable. The seeds, leaves and roots of garden cress have economic value but its crop is mainly cultivated for its seeds. Garden cress has been considered as an important nutritional and medicinal plant in India since the Vedic era (between 500-1700 B.C.) as it contains several medicinal properties like antioxidant properties, anti-anaemic properties, anti-diabetic properties, anti-inflammatory properties, hepato-protective properties, antimicrobial properties and chemo-protective properties. The seeds resemble some oil seeds in appearance, with dicotyledonous endosperm accounting for 80–85 percent of the seed content and the seed coat and embryo accounting for 12–17 percent and 2–3 percent, respectively [1,2]. Instead of having a good nutritional profile, seeds are also used in a variety of foods for its good physical and functional properties. Garden cress seeds pose as a good gelling agent, a water retention agent, a thickening agent, an emulsifying agent, and a binding agent. Food physical and functional properties are important in explaining cooking and processing characteristics because they explain how foods perform in a system as a chemical intermediate or as a significant participant of product attributes. Information on the physical and functional characteristics of garden cress seeds provides the data needed to evaluate and maintain the quality of developed products, as well as an indication of how they would behave in the food system. As a result, the purpose of this review is to compile the physical and functional properties of garden cress seeds.

The present article is mainly divided into two sections

1. Physical Characteristics of Garden Cress Seeds
2. Functional Characteristics of Garden Cress Seeds Flour

### Physical Characteristics of Garden Cress Seeds

Garden cress seeds are small oval-shaped, pointed and triangular at one end, smooth, about 2-3 mm long, 1-1.5 mm wide, slightly broader at base and notched at apex, dorsiventrally bulging, with a furrow present on both surfaces extending up to two thirds

downward, and a slight wing-like extension present on both edges of seed. By absorbing water, the seeds swell and become slippery when combined with water, and after boiling, they form a gel-like material with strong adhesive properties [3,4]. According to Paranjape and Mehta [5], garden cress seeds are morphologically similar to oilseeds, with the dicotyledonous endosperm accounting for 80-85 per cent of the seed matter, the seed coat 12-17 per cent, and the embryo 2-3 per cent.

Gokavi *et al.* (2004) conducted study on physical composition of garden cress seeds and found that the seeds were brownish red in colour and oval in shape. The seed length and width were  $298 \pm 3.2 \mu\text{m}$  and  $100 \pm 1.9 \mu\text{m}$  respectively. The weight, volume and bulk density of one thousand kernels was  $2.5 \pm 0.13 \text{ g}$ ,  $3.3 \pm 0.15 \text{ ml}$  and  $0.75 \pm 0.01 \text{ g/ml}$ , respectively [6].

A study of Vaishnavi *et al.* (2020) revealed that garden cress seeds were oval shaped and reddish-brown in colour. Dimensional properties viz. length, width and thickness measured using vernier calliper were found as 2.6mm, 1.2mm and 0.94mm, respectively. Sphericity was 54.59 per cent and the average weight of 1000 garden cress seeds was 1.86g. True density and bulk density of garden cress seeds were measured using a graduated cylinder and were calculated as  $1230 \text{ kg/m}^3$  and  $729.74 \text{ kg/m}^3$  respectively. Porosity of garden cress seeds was 40.67% and angle of repose for garden cress seeds was calculated as  $20.59^\circ$  [7].

Patel *et al.* [8] studied the physicochemical properties of *Lepidium sativum* mucilage powder in which they found that particle size ( $\mu\text{m}$ ), swelling ratio, viscosity, bulk density (g/ml) and tapped density (gm/ml) were 189.57, 3.7, 8.05, 0.37 and 0.62 respectively. Najia *et al.* [9] analyzed the influence of thermal treatments on textural characteristics of cress seed gum gel. In this study, the cress seeds were treated with different thermal treatments viz.  $60^\circ\text{C}$  for 30min,  $80^\circ\text{C}$  for 23min,  $100^\circ\text{C}$  for 18min and  $121^\circ\text{C}$  for 15min. Textural stability were studied by using penetration and Instrumental Texture Profile Analysis (TPA) tests. The obtained results revealed that cress seed gel was heat stable in almost all of the textural attributes and gel at 7 per cent concentration had a cohesiveness value of 0.43, hardness 11 g, consistency 77 g, adhesiveness 9.2 g, elasticity 11.23 g/s, springiness 3.8 mm, gumminess 44 g, chewiness 170 g mm.

Wadhwa *et al.* [10] found that garden cress seeds were ovoid and flattened, measuring 2–3 mm in length and varied in colour from pale brown to brownish red to black. The seedling germinated epigeally; the cotyledons were tri-foliolate, the leaflets were spatulate, and the lateral leaflets were smaller than the central one.

Deshmukh *et al.* [11] observed true density and bulk density of garden cress seeds as 0.76 and 1.25 g/ml, respectively. The porosity of seed was 39.2 per cent and angle of repose was 19°. The bulk and tapped densities of dried garden cress seeds mucilage powder before and after roasting process was examined by Hassan and Abdel-Rahman [12]. The bulk density of mucilage extracted from raw and roasted sample was recorded as 0.1396 and 0.17013 g/ml, respectively. The tapped density was 0.2178 and 0.3162 g/ml, respectively for raw and roasted samples. They found that increase in bulk and tapped density was directly proportional to roasting time.

Sonawane *et al.* [13] studied the physicochemical characteristics of extracted cress seed mucilage and reported the swelling index, bulk density, tapped density, compressibility index, pH, extractive values, particle length and breadth as 11ml, 0.2857 g/cc, 0.3389 g/cc, 15.69 per cent, 5.6, 13.36 per cent, 1.3674 mm and 0.875 mm, respectively. Gaikwad *et al.* (2021) [14] reported 1000 kernel weight, true density, bulk density, porosity and angle of repose of garden cress seeds as 1.96 g, 1182 kg/ m<sup>3</sup>, 0.76 g/ml, 36 per cent and 25.17° respectively. Different dimensional properties like length was 2.6, width was 1.2 and thickness was measured 0.94 (mm).

Physical Characteristics	Gokavi <i>et al.</i> (2004)	Vaishnavi <i>et al.</i> (2020)	Deshmukh <i>et al.</i> (2017)	Gaikwad <i>et al.</i> (2021)
Length	298±3.2 µm	2.6 mm	-	2.6 mm
Weight (1000seeds)	2.5±0.13 g	1.86 g	-	1.96 g
Bulk Density	0.75±0.01 g/ml	729.74 kg/m <sup>3</sup>	1.25 g/ml	0.76 g/ml
True density	-	1230 kg/m <sup>3</sup>	0.76 g/ml	1182 kh/m <sup>2</sup>

**Table 1:** Physical properties of Garden Cress Seeds

## Functional Properties of Garden Cress Seeds Flour

Functional properties comes under the essential physicochemical properties of foods that explain the interactions between structures, molecular conformation, compositions, and physicochemical properties of food components with the nature of the environment and the conditions under which these are examined. Functional properties are needed to effectively determine and precisely evaluate how different proteins, fats, carbohydrates (starch and sugars), and fibres may function in specific food systems [15,16].

Toliba and Mohamed [17], studied the functional properties i.e. water holding capacity, oil holding capacity, emulsifying activity and stability of garden cress seeds powder and reported these as 4.51±0.83 ml/g, 2.79±0.32 ml/g, 44.54±1.35 per cent and 40.65±1.02 per cent, respectively. Hanan *et al.* [18] reported the water absorption capacity and oil absorption capacity of garden cress seeds flour as 11.21 g/g and 0.726 g/g, respectively.

Kilor and Bramhe (2014) reported the water retention capacity of garden cress seeds as 10.5ml/g found with precipitation of soaked and blended seed in acetone and 16.3ml/g in alcohol [19].

Emulsifying and foaming properties of cress seeds gum (1% w/w) were measured by Najia *et al.* [9]. The observed results revealed that garden cress seeds gum solution has high emulsifying (92 per cent) and foaming (25.4 per cent) capacity at 25°C. Functional properties of protein isolated from garden cress seeds were studied by Ali [20]. The water absorption, fat absorption, emulsification capacity and forming capacity of garden cress seeds were 229±2.89, 350±0.99, 65±3.02 and 39.50±1.57 per cent, respectively.

Ghada *et al.* [21] studied the functional properties and antihyperlipidemic activities of garden cress seed oil. They reported the refractive index of oil as 1.475, peroxide value (meq. peroxide/kg oil) as 2.06, saponification value (KOH/g oil) as 179.5, iodine value (g of I<sub>2</sub> absorbed/ 100g oil) as 120.6 and oxidative stability (hrs) as 30.

Zia-Ul-Haq *et al.* [22] reported the refractive index, specific gravity, unsaponifiable matter, acid value and saponification values of garden cress seeds as 1.47, 0.82, 0.57 µg/g, 1.04 mg KOH/g and 179.03 mg KOH/g, respectively.

Functional Characteristics	Ali (2013)	Rajshri and Haripriya (2018)	Toliba and Mohamed (2019)	Hanan <i>et al.</i> (2019)
Water holding capacity	229±2.89 %	9.56±0.40 ml/g	4.51±0.83 ml/g	11.21g/g
Oil holding capacity	350±0.99 %	7±0.72 ml/g	2.79±0.32 ml/g	0.726g/g
Emulsifying activity	65±3.02 %	-	44.54±1.35%	-
Forming capacity	39.50±1.57 %	-	-	-

**Table 2:** Functional Characteristics of Garden Cress Seed

Rajshri and Haripriya (2018) evaluated the effect of roasting on functional properties of garden cress seeds. They found out that water absorption and oil absorption of untreated garden cress seeds powder was 9.56±0.40ml/g and 7±0.72ml/g respectively, while it was 8.93±0.30ml/g and 7.4±1.07ml/g respectively for roasted garden cress seeds. There was a significant decrease in water absorption (6.58 per cent) and oil absorption (5.71per cent) on dry roasting. The untreated and roasted seed's powder swelling capacity was found as 11.2±0.68 and 12.1±0.69 per cent, respectively. On dry roasting a significant increase (8.0 per cent) in swelling capacity was observed. The Bulk density of untreated and roasted seed powder was reported as 1±0.5g/ml and 0.63±0.01g/ml respectively. 37 per cent decrease in bulk density on dry roasting was recorded.

## Conclusion

Garden cress seeds are full of nutrients. Seeds contain all the nutrients in a good amount that make the seeds useful for treating many diseases. Besides that, the seed's physical and functional properties are also very good. Food's physical and functional properties are important in explaining cooking and processing characteristics. Information on the physical and functional characteristics of garden cress seeds provides the data needed to evaluate and maintain the quality of developed products, as well as an indication of how they would behave in the food system. The result of all of the reviews shows that seeds have good physical and functional properties. These properties of garden cress seeds make them an important and healthy.

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