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Review

Lepidium sativum (Garden cress): a review of contemporary literature and medicinal properties

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SUMMARY

The utility of *Lepidium sativum* Linn (Garden cress) as a medicinal plant has increased many fold over a period of time. A survey of literature relating to the medicinal uses of *L.sativum* reveals it to be one of the widely used medicinal plants. It finds place in folklore medicine, Ayurveda, Unani and other indigenous systems of medicine. Following a large number of claims on the wide range of traditional medicinal properties of the plant, considerable efforts have been made to verify its efficacy as a curative agent through pharmacological investigations and clinical trials. In this article, a comprehensive account of the traditional uses, phytochemical investigation and therapeutic potential of *Lepidium sativum* is presented.

Key words: *Lepidium sativum*; Pharmacological activities; Phytochemical investigation; Traditional uses

INTRODUCTION

Lepidium sativum Linn. (commonly known as Garden cress) belonging to the family Cruciferae is an erect, glabrous annual, 15 - 45 cm in height, cultivated as a salad plant through out India, Europe and United States. The cauline leaves are sessile and usually entire. It has small white flowers in long recemes. The pods are obovate or broadly, elliptic rotundate, emarginated, notched at apex and winged. The plant thrives on any good light soil, but does best on moist loam. It can be grown at all elevations, all the year round, but the best crop is obtained in the winter season (Wealth of India, 1962).

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The herb is an important medicinal plant since the Vedic era. The various Sanskrit names of *L. sativum* as mentioned in the old literature include Ashalika, Bhadra, Chandrashura, Chandrika, Dhrighabija, Kalmesha, Nandini, Raktbija and Vasupreshpa. Among these Chandrashura is the most common name which is still popular among the Ayurvedic physicians (Ayurvedic Pharmacopoeia, 1990).

The leaves of the plant are consumed raw in salads, also cooked with vegetable curries and used as garnish. The plant is used as fodder for horses and camels. It is also medicinal and used in the treatment of asthma, cough and bleeding piles. Leaves are mildly stimulant, diuretic, and useful in scorbutic diseases and liver complaints. The root is used in secondary syphilis and tenesmus. The seeds of the plant are rubefacient, galactogogue, emmengogue, laxative, tonic, aphrodisiac and diuretic.

They are used in poultices for hurts and sprains (Kirtikar and Basu, 1933; Nadkarni, 1954). Following a large number of claims on the wide range of folk curative properties of *L.sativum*, considerable efforts have been made to justify its efficacy as a curative agent through pharmacological investigations and clinical trials. The present review highlights the traditional uses, phytochemical and pharmacological research work carried out on the plant, which may explain the multifaceted role of this natural product.

Traditional uses

Folk medicine: The plant is used in Indian folk medicine by the tribals and rural population for a wide spectrum of diseases. In Sikkim and West Bengal the plant is used by the aborgines in the treatment of asthma, bronchitis, dysentery, pain, pneumonia and stomachache (Jain, 1970). In Purulia district of West Bengal, the leaves of the plant are used as edible vegetable (Jain, 1966).

Unani: In Unani system of medicine seeds and leaves of the *L.sativum* are claimed to possess diuretic, aperient and aphrodisiac activity and recommended in inflammation, chest complaints, bronchitis, rheumatism and muscular pains. It is reported to improve brain power and brightening of the intellect (Kirtikar and Basu, 1933).

Ayurveda: Ayurvedic literature describes the plant as hot, bitter, galactogogue and aphrodisiac. It is claimed to destroy Vata and Kapha. The fresh fruits of *L.sativum* are listed as the useful drug for injuries, skin and eye diseases. Kasturyadi gutica- a drug useful in Kapha contains the seeds of the plant as one of the ingredient (Kirtikar and Basu; 1933, Ayurvedic Pharmacopoeia, 1990).

Phytochemical investigation

Phytochemical studies on *L.sativum* have revealed the presence of alkaloids, glycosides, sterols, carotene, volatile oil and fixed oil. Seven imidazole alkaloids, Lepidine B, C, D, E, and F (dimeric) and two new monomeric alkaloids semilepidinoside A and B were found in seeds of *L. sativum* (Maier *et al.,* 1998). From the methanolic extract of defatted seeds sinapic acid and sinapin (Schultz and Gmelin, 1952) were isolated. Presence of carotene (Butkevich and Voronkova, 1962) in the leaves of *L. sativum* was reported. On steam distillation the plant yielded 0.115 % of colourless volatile oil containing variable proportions of benzyl isothiocyanate and benzyl cyanide. The seeds on extraction with petroleum ether yielded 25.5 % of yellowish brown fixed oil. The percentage of saturated and unsaturated fatty acids was found as, palmitic (1.27), stearic (6.01), arachidic (1.54), behenic (1.73), lignoceric (0.2), oleic (61.25) and linolenic (28.0). The unsaponifiable matter reported to contain β-sitosterol and α-tocopherol (Lofty, 1957; Vasudev, 1956). A new steryl ester isolated from aerial parts of *L. sativum* was identified as stigmast-5-en-3, β 27-diol 27-benzoate (Mughal *et al.,* 1999).

Pharmacological studies

Cardiovascular and respiratory system

Preliminary pharmacological studies on seeds of *L. sativum* have suggested the presence of cardioactive substance and are shown to have probable action through adrenergic mechanisms. Ethanolic extract of the seeds of *L. sativum* (10 - 20 mg/kg, i.v.) caused marked rise in B.P. (40 - 80 mmHg, 5 - 15 min) of anaesthetized cats and dogs. The hypertensive effect was associated with slight respiratory stimulation but this effect was of transient duration (0.5 - 1 min). The extract was not found to potentiate or depress the pressor responses of adrenaline (2 μg/kg, i.v.) and carotid occlusion (45 s). The extract (10 - 20 mg/kg, i.v.) caused marked increase in the rate and force of auricular and ventricular movements of open chest cat heart preparation in situ. The cardiostimulant action was also observed on isolated rabbit auricles (Vohora and Khan, 1977). The antihypertensive and diuretic effects of the aqueous extract of *L.sativum* were studied both in

normotensive (WKY) and spontaneously hypertensive rats (SHR). Daily oral administration of the aqueous extract (20 mg/kg for 3 weeks) exhibited a significant decrease in blood pressure in SHR rats while in WKY rats; no significant change/was noted, during the period of treatment. The systolic blood pressure was decreased significantly from 7th day to the end of treatment in SHR rats. The aqueous extract of *L. sativum* enhanced significantly the water excretion in WKY rats but no statistically significant change was observed in SHR rats (Maghrani *et al.,* 2005).

Smooth and skeletal muscles

Ethanolic extract of the seeds of *L.sativum* (1 - 5 mg/ml) elicited no action on smooth muscles (rat ileum and rat uterus). The response to Ach (0.5 - 2 μg/ml) of these tissues was also not affected by the extract. The extract was also found to show contractile action on frog rectus abdominus muscle (Vohora and Khan, 1977).

Fracture healing property

The effect of *L. sativum* used for fracture healing in Saudi folk medicine was tested on collagen deposition and tensile strength in experimental models. *L. sativum* significantly increased collagen deposition at fracture position. The tensile strength of the broken tibiae also increased in the *L. sativum* treated group (Atasan *et al.,* 1989).

Protective effect against chemical induced genotoxicity and preneoplastic lesions

The chemoprotective effect of garden cress (GC) *L. sativum* and its constituents, glucotropaeolin (GT) and benzylisothiocyanate (BITC), a breakdown product of GT, towards 2-amino-3-methyl-imidazo [4,5-f] quinoline (IQ)-induced genotoxic effects and colonic preneoplastic lesions was investigated in single cell gel electrophoresis (SCGE) assays and in aberrant crypt foci (ACF) experiments, respectively. Pretreatment of F344 rats with either fresh GC juice (0.8 ml), GT (150 mg/kg) or BITC (70 mg/kg) for three consecutive days caused a significant (P < 0.05) reduction in IQ (90 mg/kg, 0.2 ml corn oil/ animal)-induced DNA damage in colon and liver cells in the range of 75 - 92%. Chemical analysis of GC juice showed that BITC does not account for the effects of the juice as its concentration in the juice was found to be 1,000-fold lower than the dose required to cause a chemoprotective effect. Parallel to the chemoprotection experiments, the modulation of the activities of Cytochrome P4501A2, glutathione-S-transferase (GST) and UDP glucuronosyltransferase (UDPGT) by GC juice, GT and BITC was studied. Whereas GT and BITC did not affect the activity of any of the enzymes significantly, GC juice caused a significant (P<0.05) increase in the activity of hepatic UDPGT-2. In the ACF assay, IQ was administered by gavage on 10 alternating days in corn oil (dose 100 mg/kg). Five days before and during IQ treatment, subgroups received drinking water which contained 5% cress juice. The total number of IQ-induced aberrant crypts and ACF as well as ACF with crypt multiplicity of > or = 4 were reduced significantly (P < 0.05) in the group that received IQ plus GC juice compared with the group that was fed with IQ only (Kassie *et al.,* 2002).

Hemagglutinating activity

A lectin has been isolated from extracts of *L. sativum* by affinity chromatography on human immunoglobulin-Sepharose. The lectin reacts with human erythrocytes without specificity for the A, B and O blood groups. Erythrocytes of animal origin are also agglutinated by the lectin. The hemagglutinating activity is abolished by heating the lectin solution at 70°C or by dialysis against strong acid buffers. The hemagglutination reaction is not inhibited by monosaccharides (Ziska *et al.*, 1982).

Clinical studies

Hypoglycemic activity: The effect of *L. sativum* seeds was studied on in *vitro* rate of starch hydrolysis for testing their potential to slow down the

hydrolysis of starch to glucose in diabetic patients. Seeds of *L. sativum* were found to reduce starch hydrolysis by 41%. When tested on 11 NIDDM and 14 normal subjects, *L. sativum* seeds were found to significantly lower glucose response to meal in both normal and diabetics. Further diabetics showed higher reductions than healthy subjects. In the long term treatment of diabetics with 15 g/day of *L. sativum*, 9 out of 11 subjects showed reduction in levels of blood glucose from 10.2 mM/l to 8.3 mM/l at the end of the study (Patole *et al.*, 1998).The hypoglycaemic effect (Eddouks *et al.*, 2005) of an aqueous extract of *L. sativum* seed was investigated in normal and streptozotocin-induced diabetic rats. The results exhibited a potent hypoglycaemic activity of aqueous extract in rats without affecting basal plasma insulin concentrations.

Antiasthmatic activity

The clinical efficacy of *L.sativum* has been reported in patients of bronchial asthma. *L. sativum* seed powder was given at a dose of 1 g thrice a day orally to 30 patients of either sex in the range of 15 - 80 years with mild to moderate bronchial asthma without any concurrent medication. The respiratory functions (FVC, FEV1, FEF 25 - 75% and MVV) were assessed using a spirometer prior to and after 4 weeks of treatment. Efficacy of the drug in improving clinical symptoms and severity of asthmatic attacks was evaluated by interviewing the patient and by physical and hematological examination at the end of the treatment. 4 weeks treatment with the drug showed statistically significant improvement in various parameters of pulmonary functions in asthmatic subjects. Also significant improvement was observed in clinical symptoms and severity of asthmatic attacks. None of the patient showed any adverse effect with *L. sativum* (Paranjape and Mehta, 2006).

Toxicity study

A toxicity study was done on seeds of *L. sativum*. The seeds fed to Wistar albino rats at 2% (w/w) were found non-toxic, 10% (w/w) were toxic but not fatal and 50% (w/w) of the diet for 6 weeks were found lethal and caused depression in growth rate and entero-hepato-nephrotoxicity. Organ lesions accompanied by anemia and leukopenia were correlated with alterations in serum AST and ALT activities and concentrations of total protein, cholesterol, urea, and other serum constituents (Adam, 1999).

Conclusion: Evidenced-based studies on the efficacy and safety of traditional Indian systems of medicine are limited. A critical analysis of the literature screened for this review reveals the fact that although the number of diseases for which *L. sativum* finds use as a medicine is fairly large, yet its curative efficacy has been assessed only in few cases. Further it is also interesting to note that very little efforts have been made to isolate and identify the active principles present in the plant. In view of the wide range of medicinal uses of *L.sativum* as mentioned in Ayurveda, Homeopathy, Unani system and otherwise, it is imperative that more clinical and pharmacological trials should be conducted to investigate unexploited potential of *L.sativum* as a drug. At the same time serious efforts for high quality studies are necessary to evaluate and compare the value of traditional Indian drugs to modern medicine along with identification of the active constituents of the plant.

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