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RESEARCH ARTICLE

A Study on Clinical Efficacy of *Lepidium sativum* Seeds in Treatment of Bronchial Asthma

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ABSTRACT

The present investigation was carried out to determine the efficacy and safety of *Lepidium sativum* (*L. sativum*) (Garden Cress, Fam: Cruciferae) in patients of bronchial asthma. *L. sativum* seed powder was given at a dose of 1 gm 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, FEV_1, $FEF_{25-75\%}$ 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*. The results of the present study suggest the usefulness of *L. sativum* seeds in patients with bronchial asthma.

Keywords: *Bronchial asthma, Lepidium sativum, Pulmonary function tests*

Lepidium sativum (*L. sativum*) (Garden Cress, Fam: Cruciferae) is an annual erect herbaceous plant, growing up to 30 cm. It is a well known culinary herb and the leaves are widely used as a garnish and are consumed raw in salads. The plant is known to possess varied medicinal properties. Leaves of this plant are diuretic and gently stimulant. The seeds are aperient, diuretic, tonic, demulcent, aphrodisiac, carminative, galactagogue and emmenagogue [1]. The seeds are rubefacient and are applied as a poultice for hurts and sprains [2]. The plant also shows teratogenic effect [3] and antiovulatory properties [4-7]. The root is used in the treatment of secondary syphilis and tenesmus [2]. A preliminary pharmacological study on seeds of *L. sativum* has suggested the presence of cardioactive substance and is shown to have probable action through adrenergic mechanisms [8]. The aqueous extract of *L. sativum* seeds has been reported to exhibit a potent hypoglycaemic activity in normal and streptozotocin induced diabetic rats [9]. Aqueous extract of *L. sativum* was found to have antihypertensive and diuretic effect when studied both in normotensive and spontaneously hypertensive rats [10]. The effectiveness of this plant in treatment of bronchial asthma, hiccups, cough with expectoration and bleeding piles has been reported [2]. Seeds of *L. sativum* are prescribed by many Ayurvedic practitioners in bronchial asthmatic patients. However, no scientific studies are so far carried out to investigate the efficacy of *L. sativum* in the treatment of bronchial asthma. The present study was undertaken to investigate the anti-asthmatic activity of dried seeds of *L. sativum* in Indian asthmatic patients.

MATERIALS AND METHODS

Dried seeds of *L. sativum* obtained from a commercial supplier were identified and authenticated by Dr.Daniel, Dept. of Botany, M.S.University, Vadodara, Gujarat, India and a voucher specimen was deposited in 'BARO' the herbarium of department of Botany, M.S.University, Vadodara. Dried seeds were powdered and used for the study.

An open label, noncomparative clinical study was carried out on patients of either sex, having mild to moderate bronchial asthma and visiting Out Patient Department of Govt. Ayurvedic Hospital, Vadodara, India. The protocol for carrying out the clinical study was approved by Director, Dept. of Ayurveda and Homeopathic Medicine, Govt. of Gujarat, India and also by the institutional ethics committee for the clinical study. Informed Consent was obtained from all patients enrolled in the study.

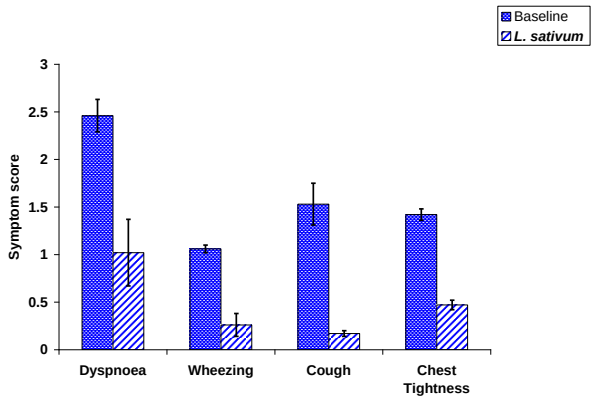

Fig 1. Effect of *L. sativum* on Symptom score of the asthmatic patient-sEach bar represents Mean ± S.E.M. * Significantly different from baseline values. $p < 0.05$ (Student's paired t test)

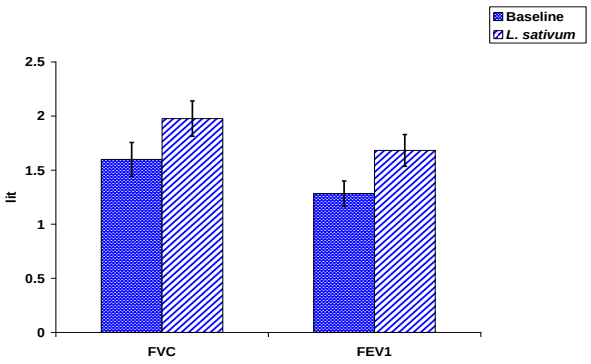

Fig 2. Effect of *L. sativum* on lung volumes of the asthmatic patients. Each bar represents Mean ± S.E.M. * Significantly different from baseline values. $p < 0.05$, ** Significantly different from baseline values. $p < 0.01$, *** Significantly different from baseline values. $p < 0.001$ (Student's paired t test)

All patients in the age range of 15-80 years having mild to moderate bronchial asthma as diagnosed by their clinical history; commonly observed symptoms of bronchial asthma (dyspnoea, wheezing, tightness in chest, cough etc.) and physical examination were enrolled in the study. Patients having breathlessness due to cardiovascular disorders were excluded. Patients having very severe bronchial asthma (Peak Expiratory flow rate (PEFR) < 20% and Forced Expiratory volume in 1 second (FEV_1) < 20% of predicted value) were not enrolled. Patients below age of 15 years and pregnant women were excluded. Patients with disorders such as pulmonary tuberculosis and cardiovascular disorders etc. were also not enrolled in the study.

In the patients satisfying the inclusion and exclusion criteria, baseline characteristics were measured and clinical and family history was recorded. Details of duration of bronchial asthma, other diseases present and concomitant medication taken were recorded. Patients were given finely powdered dried seeds at a dose of 1g thrice a day for 4 weeks and were advised to take it orally with water.

For patients taking concurrent medication for bronchial asthma, details of the drugs used and their dosages were collected before starting the treatment with *L. sativum* and at the end of the study. General physical examinations which include temperature, heart rate, blood pressure and respiratory rate were measured before start of the treatment and at every week after start of the treatment. hematological examinations which include Haemoglobin estimation, total leukocyte count, differential leukocyte count and erythrocyte sedimentation rate were carried out before start of the treatment and at the end of 4 weeks of treatment. Patients were given medication supply of 1 week and were asked to report every week. At every weekly visit, patients were asked for occurrence of untoward effect if any and improvement in the symptoms observed. Symptom score was measured for all commonly observed symptoms of bronchial asthma i.e. dyspnoea, wheezing, cough and chest tightness before starting the treatment and at the end of 4 weeks of treatment. Score was graded as 3, 2, 1 and 0 for presence of severe, moderate, mild and absence of any symptom respectively [11]. Grades were given by interviewing the patient and by physical examination.

Evaluation of lung functions was done with the help of computer aided spirometer. Spirometry was performed before starting the treatment with *L. sativum* and at the end of 4 weeks of treatment. The values were expressed as mean ± Standard error of Means (S.E.M.) Statistical significance of the differences in parameters before and after treatment was calculated using Student's paired t-test. $p < 0.05$ was considered to be significant.

RESULTS

Demographic Profile

Thirty four patients satisfying inclusion and exclusion criteria were enrolled in the study. However, 4 patients discontinued the study in between due to unknown reasons. 30 patients completed the total 4 weeks of study. Demographic profile of the patients enrolled is shown in Table 1.

Table 1. Demographic profile of asthmatic patients enrolled in the study

Variables	Mean ± SEM	Range
Age (years)	50.83 ± 3.32	15-76
Male/Female	17/13	-
Height (cm)	156.69 ± 1.54	142-168
Weight (kg)	48.26 ± 1.63	40-62
Duration of Asthma (years)	3.82 ± 0.91	4 months-20 years

Table 2. Types of asthmatic patients enrolled

Types of asthmatic patients	No. of patients
Patients with extrinsic asthma	05
Patients having intrinsic asthma	25

Effect of L. Sativum on Physical Parameters and Hematological Profile of the Asthmatic Patients

General physical parameters like temperature, heart rate, respiratory rate, and blood pressure were recorded

Table 3. Effect of *L. sativum* on general physical parameters of the asthmatic patients

Parameters	Before Treatment (Mean ± SEM)	After Treatment (Mean ± SEM)
Heart Rate (Beats/Min)	71.35 ± 1.12	70.74 ± 0.9
Systolic B.P (Mm Hg)	129.61 ± 3.56	126.70 ± 2.49
Diastolic B.P (Mm Hg)	81.65 ± 2.18	79.39 ± 1.12
Resp. Rate (/Min.)	21.70 ± 0.63	19.26 ± 0.35

Table 4. Effect of *L. sativum* on hematological profile of the asthmatic patients

Parameters	Before treatment (Mean ± SEM)	After treatment (Mean ± SEM)
Hb. (gm %)	11.70 ± 0.25	11.59 ± 0.27
TC (/cmm)	9495.65 ± 455.34	8991.30 ± 287.00
Neu. (%)	63.48 ± 1.41	65.52 ± 1.41
Lymp. (%)	28.78 ± 1.13	29.65 ± 0.94
Mono. (%)	0.43 ± 0.14	0.14 ± 0.07
Eosi. (%)	6.79 ± 0.75	5.48 ± 0.35
ESR(mm/hr)	26.74 ± 3.10	17.04 ± 2.32 *

before, every week and at the end of 4 weeks of treatment with *L. sativum*. No significant change was observed in any of these parameters by treatment with *L. sativum* (Table 3). Also hematological parameters were not changed markedly with *L. sativum* except Erythrocyte sedimentation rate (ESR). ESR was significantly reduced by treatment with *L. sativum* (Table 4).

Effect of L. Sativum on Commonly Observed Symptoms of Bronchial Asthma

In the present study, *L. sativum* was found to significantly improve the commonly observed symptoms of bronchial asthma. Symptom score of all symptoms was significantly reduced by *L. sativum* (Fig 1).

Effect of L. Sativum on Lung Function Parameters of the Asthmatic Patients

In the present study, *L. sativum* caused highly significant increase in Forced Vital Capacity (FVC) ($p<0.001$) and Forced Expiratory volume in 1 sec (FEV_1) ($p<0.01$) of the patients (Fig 2). Mean % increase found in FVC was 32.92 ± 10.07 % and in FEV_1 was 35.81 ± 8.32 % (Table 5). However, no significant change was observed in ratio of FVC and FEV_1 (FVC/FEV_1%) by *L. sativum* (Fig 3).

In the present study, *L. sativum* also significantly increased Peak Expiratory Flow Rate (PEFR) ($p < 0.01$) of the patients (Fig 4). Mean % increase found in PEFR was 43.58 ± 13.56 % (Table 6). Forced Expiratory Flow between 25 and 75 % ($FEF_{25-75\%}$), $FEF_{25\%}$, and $FEF_{50\%}$ were also significantly increased by *L. sativum*. However $FEF_{75\%}$ was not significantly increased with *L. sativum* (Fig 5). Mean % increases found in these parameters were 42 ± 13.48 %, 43.87 ± 13.37 %, and 43.21 ± 13.28 % and 38.49 ± 14.80 % respectively (Table 6). Maximum voluntary ventilation (MVV) was also significantly increased by *L. sativum* (Fig 6). Mean % increase found in MVV was 18.23 ± 6.59 % (Table 6).

DISCUSSION

Bronchial asthma is one of the commonest respiratory illnesses characterized by increased responsiveness of the tracheobronchial tree to a multiplicity of stimuli. It manifests physiologically by a widespread narrowing of airways and clinically by paroxysms of dyspnoea, cough and wheezing [12]. Significant decrease in all commonly observed symptoms of bronchial asthma by *L. sativum* in the present study suggests the effectiveness of this drug in improving the symptoms associated with asthma. Apart from the symptoms, decrease in ESR observed by *L. sativum* in the present study also indicates the beneficial effect in asthmatic patients since ESR is found to be higher in many patients of bronchial asthma. Eosinophils are considered to be the major inflammatory cells in asthma as they damage the epithelial cells lining in bronchial tree [13, 14]. In present study, eosinophil count was not found to be significantly decreased by *L. sativum* as most of the patients were found to have normal eosinophil count during admission in the trial. However, in patients with eosinophil count higher than normal, treatment with *L. sativum* was found to reduce the eosinophil count to normal values.

Table 5. Effect of *L. sativum* on lung flow rates of the asthmatic patients

Parameters	Before treatment (Mean ± SEM)	After treatment (Mean ± SEM)	% increase (Mean ± SEM)
PEFR (lit/s)	2.58 ± 0.30	3.31 ± 0.29 **	43.58 ± 13.56
$FEF_{25-75\%}$ (lit/s)	1.60 ± 0.23	2.03 ± 0.21 *	42.00 ± 13.48
$FEF_{25\%}$ (lit/s)	2.21 ± 0.29	2.81 ± 0.27 **	43.87 ± 13.37
$FEF_{50\%}$ (lit/s)	1.74 ± 0.26	2.18 ± 0.21 *	43.21 ± 13.28
$FEF_{75\%}$ (lit/s)	1.07 ± 0.15	1.31 ± 0.14	38.49 ± 14.80
MVV (lit/min.)	50.29 ± 4.39	57.02 ± 4.72 **	18.23 ± 6.59

Table 6. Effect of *L. sativum* on lung volumes of the asthmatic patients

Parameters	Before treatment (Mean ± SEM)	After treatment (Mean ± SEM)	% increase (Mean ± SEM)
FVC (lit)	1.60 ± 0.16	1.98 ± 0.16 ***	32.92 ± 10.07
FEV_1 (lit)	1.28 ± 0.12	1.68 ± 0.15 **	35.81 ± 8.32
FEV_1/FVC (%)	81.76 ± 2.28	85.50 ± 2.39	6.19 ± 3.93

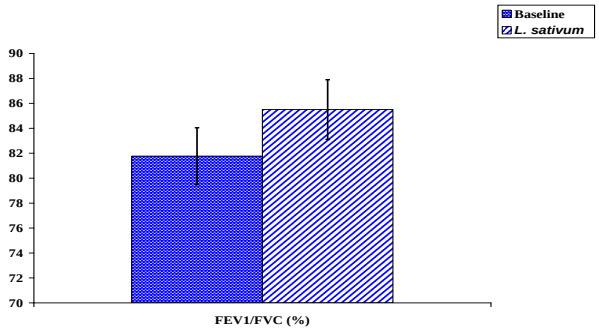

Fig 3. Effect of L .sativum on FEV1 /FVC% of the asthmatic patients.Each bar represents Mean ± S.E.M.

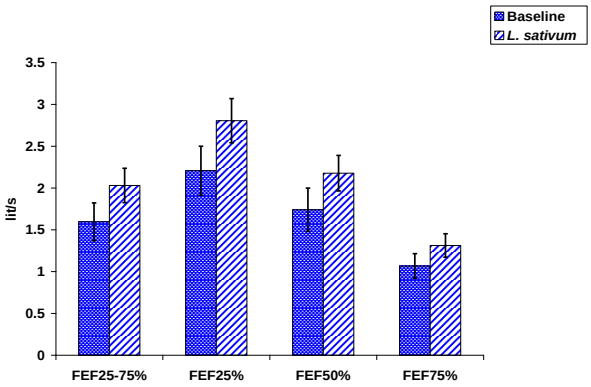

Fig 5. Effect of L.sativum on Forced expiratory flow rates of the asthmatic patients Each bar represents Mean ± S.E.M. * Significantly different from baseline values. $p < 0.05$, ** Significantly different from baseline values. $p < 0.01$ (Student's paired

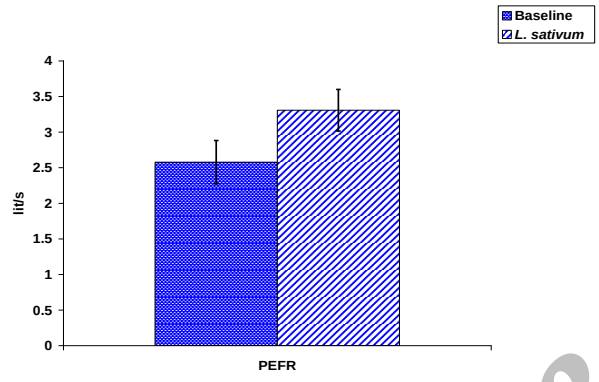

Fig 4. Effect of L.sativum on PEFR of the asthmatic patients each bar represents Mean ± S.E.M. * Significantly different from baseline values. $p < 0.05$, ** Significantly different from baseline values. $p < 0.01$ (Student's paired t test).

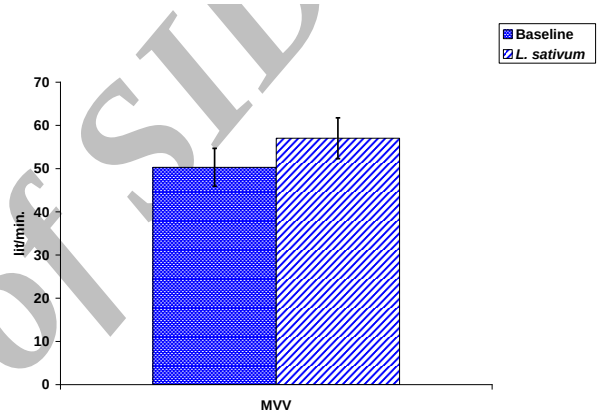

Fig 6. Effect of *L. sativum* on MVV of the asthmatic patients Each bar represents Mean ± S.E.M. * Significantly different from baseline values. $p < 0.05$, ** Significantly different from baseline values. $p < 0.01$(Student's paired t test).

Along with the symptoms, measurement of lung function by spirometer provides direct assessment of the asthma severity and the effect of drug in treatment of this disease. FVC (Forced Vital Capacity) is clinically useful as an index of lung functions. FEV_1 (forced expired volume in one second) is a useful measure of how quickly full lungs can be emptied and is a best single measure of lung function for assessing airflow limitation or asthma severity [15]. In the present study, *L. sativum* was found to significantly increase FVC and FEV_1 indicating its usefulness in reducing asthma severity. The FEV_1/FVC ratio is expressed as a percentage, and a normal young individual is able to forcibly expire at least 80% of his/her vital capacity in one second. A ratio under 70% suggests underlying obstructive physiology. However, in present study no significant change was observed in ratio of FVC and FEV_1 (FVC/FEV_1%). This may be because of increase in both FVC and FEV_1 by *L. sativum*. $FEF_{25-75\%}$ is the average expired flow over the middle half of the FVC manoveure and is regarded as a more sensitive measure of small airways narrowing than FEV_1. $FEF_{25-75\%}$ was found to be increased significantly by *L. sativum*. *L. sativum* also significantly increased Peak Expiratory Flow Rate (PEFR) which is reduced by more than 40 % in asthmatic patients, where the resistance of the airways is increased owing to bronchial constriction. Response to asthma treatment is usually accompanied by an increase in PEFR and a decrease in its variability [15]. Statistically significant increase in lung function parameters by *L. sativum* suggests the effectiveness of this drug in the treatment of bronchial asthma.

Thus, in the present clinical study on *L. sativum*, all patients were found to show the trend towards decrease in severity of symptoms of asthma and improvement in lung function parameters. Thus considering the efficacy and convenience of oral administration and easy availability, this drug appears to have good future in treatment of asthma. Moreover none of the patients showed any adverse effect in dose used and no change was observed in general physical parameters and hematological profile of the patients suggesting good tolerability of this drug. However, detailed experimental studies are required to investigate its mechanism of action.

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