International Journal of Chemical and Biochemical Sciences
(ISSN 2226-9614)

Journal Home page: www.iscientific.org/Journal.html

Health benefits of Arugula: A review

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Abstract

Plants in the Brassicacae family are thought to have various therapeutic and medicinal properties, such as tumorigenesis i nhibition, antiulcer and hepatopharmacy. Annual species of rocket (*Eruca sativa*) is part of the mustard (Brassicaceae) family. *Eruca sativa* is commonly used in folk medications and is well known as a cure for renal illness. It contains glucosides, mineral salts and vitamin C and is in this manner thought to be a magnificent stomachic, stimulant, and hence utilized as a diuretic and antiscorbutic. Furthermore, it also showed antisecretory, cytoprotective anti-cancer, antidiabetic and anti-inflammatory activities.

Key words: Flavonoids, Rutaceae, Brassicaceae, Erucic acid, Antidiabetic

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1. Introduction

Rocket (*Eruca sativa*) is a yearly species have a place with the mustard family (Brassicaceae). Common names include greens rocket, garden rocket, and arugula. Rocket is a general name for plants which frame rosette of splendidly green isolated leaves with a particular flavor. Essentially to different Brassicas, *Eruca sativa* contains glucosides, for example, allyl sulphocyanate [1]. *Eruca sativa* has been known since vestige and has generally been devoured in different Mediterranean nations for the hot sharp kind of the takes off. It is expended as crude green, as a piece of plate of mixed greens blends, as a cooked green, and is presently extremely prevalent as a pizza topping. Rocket is utilized as a part of numerous courses other than sustenance. On the Indian subcontinent, exceptional ecotypes of *E. sativa* are developed for seed creation and consequent oil extraction. Rocket is accepted to have sexual enhancer properties. It contains glucosides, mineral salts and vitamin C and is in this manner thought to be a magnificent stomachic, stimulant, and is likewise utilized as a diuretic and antiscorbutic. Late studies demonstrated that a concentrate from rocket have antisecretory, cytoprotective and hostile to ulcer exercises. Rocket is generally developed in Italy, Portugal, Egypt, and Turkey. It has additionally been effectively examined as another product for Indiana and US Midwest where it can be developed in open field and ensured territories. In the previous year's rocket has increasingly got to be well known additionally in the Central Europe. It was presented available as an alleged "fourth era" vegetable which is advertised in the wake of cleaning, leaf cutting, and bundling into plastic packs to keep it crisp for a more drawn out time-life. These days, rocket is accessible in Czech grocery stores from Dutch generation alone as a green or as a piece of serving of mixed greens blends. Notwithstanding of its high wholesome worth rocket is still thought little of as vegetable in the Central Europe. Our study was completed to test the likelihood of rocket development under the environmental states of the Czech Republic (Central Europe), to describe the product for agrobotanical qualities, and in this manner to offer this dismissed vegetable to a wide open [2].

2. History

Rocket is an antiquated harvest, extremely well known among the Romans as it is today in many pizzerias of Rome. Its ubiquity as a nourishment product is presumably because of the fiery hot taste of its leaves which are utilized as enhancement to flavor servings of mixed greens, snacks and a huge assortment of dinners. The monetary capability of rocket is consistently expanding because of the presentation in the business sector of the supposed fourth Generation vegetables, i.e. those verdant vegetables which are promoted in the wake of cleaning, leaf slicing and bundling which add to a more drawn out time span of usability. Rocket is likewise utilized as a part of numerous courses other than as nourishment. Oil from Eruca plants is broadly utilized as a part of the conventional pharmacopeia for different purposes (depurative, diuretic, emollient, tonic, stimulant, purgative, mitigating) and oil and leaf separates had been observed to be a powerful creepy crawly repellent, consequently recommending a conceivable use in the natural control of harvest irritations. The greater part of the business sector interest for rocket is met today utilizing an exceptionally set number of assortments. This is an after effect of the absence of satisfactory germplasm gathering

and preservation activities done on this yield before. Another wellspring of supply for the business sector is spoken to by the broad harvests did in the wild, which sadly is made with no sympathy toward those normally happening populaces. The systems administration activity is an instrument of collaboration going for protecting the differing qualities of rocket germplasm, while in the meantime giving a more extensive hereditary base to its misuse. The objectives of the Network will be come to through regular activities in the range of germplasm accumulation, protection and documentation. Research examinations will be additionally completed to better portray the yield for its major agrobotanical and biochemical qualities. A typical database for the product is being set up and will contain significant data on rocket promotions accessible in genebank accumulations around the world. This brought together framework will be of extraordinary help to reproducers and clients, encouraging their work of harvest change and boosting the utilization of the yield. A descriptors rundown is a work in progress and will add to upgrading the administration of rocket hereditary differing qualities. A portion of the papers included here present preparatory consequences of activities as of now began by the Network individuals. They give general data to the peruser and highlight activities viewed as a need, which will get more prominent consideration by the Network [3].

3. Demography/locaton

Eruca sativa has been renowned for its remains and has been expended for the fiery sharp type of takeoff usually in separate Mediterranean countries. Rocket is consumed as a flavor and as a vegetable (leaves, seeds, flowerings). It's eaten as raw green as a blended green piece, as cooked green, and is extremely well known nowadays as a topping pizza. Rocket is used as part of a number of other applications. For seed generation and resultant oil extraction, sativa is created. Rocket has the characteristics of love potion. This is an unbelieved stomach, stimulant and also a diuretic and antiharmonic substance, it includes glucosides, mineral salts and vitamin C. Late studies show that antisecretory, cytoprotective, and antiulcer exercises are performed in a rocket concentrate. In Italy, Portugal, Egypt and Turkey, Rocket is usually created. It was also examined efficiently as another harvest for Indiana and the U.S. Midwest, where it can be grown in open and secured areas. Rackets have become more and more recognized in Central Europe in past years [4].

4. Morphology

Annual species of rocket (*Eruca sativa*) is part of the mustard (Brassicaceae) family. Common names include salad rocket, garden rocket, rocket (English); salatrauke (Deutsch); oruga, common oruga, eruca (English) and roquette (Italian). Rocket is a general name for the crops that form a brilliantly green rosette with a particular flavor of split leaves. *Eruca sativa* includes glucosides like sulfocyanate allyls, while its seed oil includes erucid acid, which is similar to other Brassicas [5]. The genus *Eruca* L. includes a single species *Eruca vesicaria* (L.) Cav. with the three infraspecific taxa: subsp. *sativa* (Miller) Thell, subsp. *vesicaria* and subsp. *pinnatifida* (Desf.) Emberger ET Maire. *E.vesicaria* subsp. *sativa* (Miller) Thell. is the only taxon with a rather wide circum-Mediterranean distribution and has been further introduced into other countries and continents. It is still frequently referred under simplified synonym *E. sativa* Mill [6]. This is an after effect of the absence of sufficient germplasm gathering and preservation activities done on this harvest previously. Another wellspring of supply for the business sector is spoken to by the broad harvests did in the wild, which tragically is made with no sympathy toward those normally happening populaces. The systems administration activity is a component of collaboration going for shielding the differing qualities of rocket germplasm, while in the meantime giving a more extensive hereditary base to its misuse. The objectives of the Network will be come to through normal activities in the region of germplasm gathering, preservation and documentation. Research examinations will be likewise done to better portray the product for its major agrobotanical and biochemical attributes [7]. A typical database for the yield is being set up and will contain important data on rocket increases accessible in genebank accumulations around the world. This unified framework will be of extraordinary help to reproducers and clients, encouraging their work of product change and boosting the utilization of the yield. A descriptors rundown is being worked on and will add to improving the administration of rocket hereditary differences. A portion of the papers included here present preparatory aftereffects of activities as of now began by the Network individuals. They give general data to the peruser and highlight activities viewed as a need, which will get more prominent consideration by the Network [6].

5. Chemistry

5.1. Chemical composition

Erucic and taramira petroleum oleic acids, which are found to correspond to the literature values, represented 40.8% and 22.3% of the complete fatty acid composition [8]. The taramira oil fatty acid profile was nearer than that of canola oil for mustard seed. GCMS analysis is used for the characterization of essential oils [9-15]. The fact that erucic acid is produces unpalatable flavours, and has connections to the heart problems, is why it is not used as a cooking medium. The ester level of taramira bio diesel was above the 96% minimum global standard which showed that the crude vegetable oil was almost completely converted. But greater conversions can still happen by subjecting the raw oil to a refining, deodorization and bleaching method [16]. Their density was similar to their low ASTM threshold, as were their density for pure mineral diesel. This outcome showed the similar storage, handling and

combustion characteristics of bio-diesel fuels as mineral diesel. Given that taramira bio diesel's viscosity is near the upper limit for the American test material standard, it is probable that it will have less grease effect on the motor than canola bio diesel or mineral diesel fuel. In the contrast to other kinds of petrol shown in Taramira Bio Diesel flash point is smaller than the ASTM threshold which shows that a potential fire hazard may occur if stored. Its flash point however is greater than mineral diesel and therefore safer than its counterpart for fossil fuel. However, elevated flash points may lead in the bio diesel being unable to burn properly compared to mineral diesel fuel in the compression-injecting motor.

5.2. Phytochemistry

Many raw leafy vegetables other than lettuce have been used in salads in latest years, either alone or in a blend of salads. A rocket (*Eruca sativa* mill.) with a increasing customer interest is one of the most common vegetables in the Mediterranean countries. Rocket is famous for its lovely bitter taste but also the elevated level of phytonutrients that promote health [17]. Rocket is generally sold in altered atmosphere packages as leaf bundles or fresh-cut individual leaves. The harvesting is performed by hand, which allows crops to re-grow and generate more leaves, with a knife 2–3 cm above the floor. Leaves of distinct ages are included in each harvest due to the harvesting process. The blade age could have a major impact on rocket shelf life and quality, as the leaf age has significant impact on lettuce structure [18] Jute leaves were noted. No data is, however, accessible on the metabolism, structure and quality of the missile. Leaf age effects are presently not accessible. Four aliphatic compounds, in specific, (glucoraphanin, glucoalyssine, glucoerucin and progoitrin) had been found in the outcomes; the epiprogoitrin, one aromatous GSL (glucosinalbin), two indolederived compounds (4-OH-glucobrassicin and glucobrassicin) and two structurally-related compounds with one intermolecular disulfide linkage. The two structurally linked disulfides are naturally present in new cocket salads. *Eruca sativo* Miller is an annual diploid herbaceous plant up to 80 cm (1.8 in.) *Eruca sativa* Miller (Brassicaceae, Eruca vesicaria Rocket), is frequently known as "Tarmira". The seeds ripen in the flora all year round from May to August and from July to September. Young leaves–raw or cooked are heavily spicy. Although the flavor is too powerful for many tastes, few leaves added to the sauce are acceptable. Blossoms-raw has the same flavour as leaves and on the salad tray, they give a pleasant garnish. The grain yields semi-dry oils, which are edible when stored for 6 months and which contain 32 percent fat, 27 percent protéin. It is called jamba oil. It is a fuel oil. Studies in literature are showed that Rocket was used medicinally at one moment, but now it can only be used as salad herb. The leaves are diuretic, antiscorbutic, stimulant and stomach. The seed is stimulant and rubber-friendly. The seed powder is antibacterial but there are no isolated alkaloids. The seed oil is allegedly aphrodisiac. Erucic acid is contained in the seed oil. Several plant species possess natural substances that have been reported to inhibit the development of many fungi. The separate plant extracts have been used in the current research to inhibit microorganism development. The *Eruca sativa* crude savory was only effective on Escherichia coli and Salmonella typhi and Bazllus subtilis. This is the first study of *Eruca sativa* seed powder antifungal activity. Raw has a flavour comparable to the leaves and on the Bowl salad they are pleasant to create garnish. The seed produces semi-drying oil that, if stored 6 months, is edible. It includes 32% fat, 27% protein. The seeds are roasting and stimulating. It is known as' jamba oil.' The powdered seed has antibacterial activity, but there are no isolated alkaloids. The seed oil has aphrodisiac characteristics. It is reported. Erucic acid is found in the seed oil. There have been reports of a number of plant species with natural substances that prevent the development of many fungi. The various plant extracts are inhibited by the microorganism's development in the current research. Only *Escherichia coli, Salmonella typhi* and *Bacillus subtilis* were activated with the raw juice *Eruca sativa*. This is the first analysis of *Eruca sativa* powder's antifungal activity.

6. Post-harvest Technology

Seeds of two adhesions of *E. sativa* were used as part of a large-scale experiment to test the agricultural capacity of the indigenous Cruciferae. At Bet Dagan Experiment Station, sativa was grown. Four replications were made for every membership. At the moment of soil preparing, basic fertilization was carried out. Herbicide was used in Treflan (2.5 kg / ha). Until seedling was established, irrigation was implemented. There have been observations of percent germination, crop vigor, crop homogeneity, flowering and ripening days and seed production. Seed was evaluated using popular techniques for the oil content and structure of fatty acids. In the Ramat HaNegev Experimental Station, sativa gathered in Israel were grown during the increasing seasons of 1991/92. The one was filled with non-salt water and the other with salt water, two water irrigation lines were used. The two lines had 12 mm of length, parallel to each other

7. Value addition

Shoah (leaves) and spices (leaves, seeds, flowers) are eaten as plants. As a raw green, as part of the salad mixture, as a baked green, it is now widely used as a topping of pizza. Rocket is not used in food in many respects. For seed manufacturing and later petroleum extraction, sativa are grown. Aphrodisiac characteristics are thought to be in Rocket.It includes glucosides, mineral salts and vitamin C a nd therefore is a very good estomach, stimulant, diuretic and a daemon. Recent trials have shown the antisecretory, cytop rotective andanti-ulcer effects of the extract from the rocket.

8. Uses

Although many crops and spices are eaten at small levels, they are rich of antioxidants and certain mineral compounds; they are significant for the health. The quantity of Rocket (*Eruca sativa*) to benefit health is not evident and scientists have no specific guidelines on how accurately to use it. Nonetheless, *Eruca sativa (*Rocket) does not contain any calorie and antioxidants and also has many nutritional fibers and certain minerals. Basil adds a flavor to meat, and Rocket (*Eruca sativa)* oils and teas are accessible in many foodstuff shops, although there is no logical proof that they are good for human health. Regardless of your taste or preferences, the kitchen can be made from basil; its aroma, quality and additional health advantages are added to food / dishes.

8.1. Pharmacological uses

8.1.1. Anti-cancer activity

The presence of nines of isolated natural flavonoid compounds, identified with the presence of kaempferol 3-*O*-(2"-*O*malonyl- β-D-glucopy-ranoside)-4'-*O*-β-D-glucopy-ranoside (1), kaempferol 3,4'-*O*-diglucopyranoside (2), rhamnocitrin 3-*O*-(2"-*O*-methylmalonyl-β-D-glucopyranoside)-4'-*O*-β-D-glucopyranoside (3), 3-*O*glucopyranoside (4), 4'-*O*-glucopyranoside (5), rhamnocitrin 3-*O*-glucopyranoside (6), 4'-*O*glucopyranoside (7), kaempferol (8) and rhamnocitrin (9) was possible with phytochemical examinations of the aqueous extreact of *Eruca sativa* fresh leaves. Compounds (1) and (3) appear to be novel. Different spectroscopic methods, in relation to chemical and physical techniques of assessment, determined the elucidation of chemical structures of all isolated compounds. The 70% ethanol (ES-EE) and compounds (2) and (3) of sativa have been shown to be cytotoxic in 4 distinct human tumor cell lines: hepG2 (liver-carcinoma), MCF7 (breast-carcinoma), HCT116 (colon-carcinoma), and Hep2 (carcinoma of the larynx). These findings indicate that as a new preventive cancer agent ES-EE and Compounds (1) and (3) appear to have potential.

8.1.2. Radio protective activity

The research was carried out on the effects in normal as well as in tumor-bearing mice of a macerated extract of *Nigella sativa* seed against gamma-induced cellular tissue harm. This was performed to imitate the clinical environment in which the deleterious impacts of radiation are introduced into the ordinary tissue of cancer patients undergoing radiation treatment. Cellular DNA protection has been investigated by the use of alkaline comet assay and also by an estimation of biological parameters and of blood parameters such as concentrations of antioxidant enzymes superoxide dismutase, thiobarbituric acid reactive substance and protein oxidatase following pret reats with a macerated sample of the *Nigella sativa* plants (1 00 mg / kg).The findings have shown that *Nigella sativa* macerated extract protects the liver, spleen, brain and intestines in both ordinary and tumour-bearing mice. This research concluded that *Nigella sativa* extract has protective impacts against radiated damage and biochemical changes that might be ascribed to the capacity and antioxidant characteristics of free radicals to be scavenged. Therefore, macerated extract of *Nigella sativa* seeds may be used in conjunction with a mitigation of undesirable side effects from radiation in the ordinary tissues, to safeguard from oxidative stress and improved quality of life of cancer patients.

8.1.3. Antimicrobial activity

In the late 19th century, scientific tests were initially recorded on the antimicrobial characteristics of the plant compounds. Plants are rich in a broad range of secondary metabolites, including tannins, terpenoids, alkaloids and flavonoids with antimicrobial characteristics. Many plant extracts now have antimicrobial activity. Various plant extracts for their antimicrobial characteristics have been assessed.

8.1.4. Anti-inflammatory effect

Gastric ulcer is a disease that impacts a large amount of individuals around the world. Stress, smoking, dietary defects, diseases, frequent and indiscriminate consumption of non-steroidal anti-inflammatories (NSAIDs) include etiological factors. These include: Different aggressive and defensive factors, for example mucus secretion, mucous barrier, secretion of acid pepsin, blood flow, cell regeneration, and endogenous protectors, are involved in the pathogenesis of the gastroduodenal ulcer (prostaglandins and the epidermal factor of development). Although proton-pump-inhibitors were introduced with the classical anti-ulcer therapy, peptic ulcers and other gastrointestinal disorders had been revolutionized, there is still no full treatment of this illness. Long-term use of these medicines has been shown to cause numerous side impacts and negative impacts. Disease recurrence, inefficiency of various regimes of drugs and even drug resistance arise. This means that more effective and secure anti-ulcer agents need to be identified urgently. Over the previous few decades, a broad search for fresh anti-ulcer therapies from natural sources has been initiated. Herbs, medicinal plants, spices, vegetables and crude substances are regarded as potential sources of illnesses such as stomach ulcer. Many medicinal plants with a gastric potential anti-ulcer have been recorded in science literature. Rocket "*Eruca sativa* L"(EER), a member of the Brassicacae family, has become more prominent, particularly among the people of the Middle East and Europe, as a plant and spice salad. Plants in the Brassicacae family are thought to have various therapeutic and medicinal properties, such as tumorigenesis inhibition, antiulcer and hepatopharmacy.

8.1.5. Antidiabetic activity

In the modulation of the oxidative stress of diabetes mellitus (DM), clinical research verified the efficacy of several plant extracts. *Eruca sativa* oil (ESS) has been

experimentally inducing alloxane injection for the prevention and therapy of DM. A single dose of alloxan (100 mg/kg) resulted in lower levels of insulin, hyperglycemia, increased complete lipids, triglycerides, high density of lipoprotein and hepatic glycogen and increased activity in hepatic glucose6-phosphatase. At the same time, malondialdehyde and 4-hydroxynonenal concentrations in the liver were increased. This stress has been associated with a reduced level of glutathione (GSH) and dismutase of superoxides in the liver of rats with alloxane diabetic. Oil from ESS (0.06 ml / kg) per capita has considerably improved liver GSH. ESS oil has been administered orally daily two weeks before and after inducing diabetes, enhanced lipid profile and ameliorated hyperglycemia have bluntly increased malondialdehyde and4-hydroxynonenal and has stimulated GSH in the liver of rats treated with alloxan. In the event of DM, we proposed that ESS oil be used for the purpose of antidiabetics. Their antioxidant characteristics and increased hepatic GSH can be linked to that.

8.1.6. Anti oxidant activity

Mercuric chloride ($HgCl_2$) is a well-known nephrotoxic substance. The function of oxidative stress in $HgCl_2$ induced nephrotoxicity is evident in increasing numbers of evidence. *Eruca sativa* is commonly used in folk medications and is well known as a cure for renal illness. The antioxidant potential of ethanol extract *E. sativa* is presented in the current research. Sativa seeds were identified and their protective impact on renal toxicity caused by $HgCl_2$ was examined. The extract had a strong antioxidant impact, high polyphenol content and a strong reduction capacity. The HPLC assessment disclosed that the main antioxidants in the extract were glucoerucine and flavonoids. Several reactive oxygen (ROS) and reactive nitrogen (RNS) species were considerably scavenging *E. sativa* extract. Extract feeding to rats provided substantial protection of renal toxicity caused by $HgCl_2$. 4 mg / kg subcutaneous body weight $HgCl_2$ caused renal injury which was apparent as a significant rise in serum creatinine and urea and in histopathological modifications such as necrosis and edema. A important increase in lipid peroxidation and attenuation content and action of antioxidant enzymes (e.g., catalase (CAT), glutathione peroxidase (GPX), superoxide dismuutase (SOD) and glutatathione reducctase (GR) were apparent from the oxidative modulation of the renal tissue following exposition to $HgCl_2$. Oral management of *E. sativa* Dose rat extract: 50-200 mg / kg body weight considerably and dose dependently protected against modifications in all these diagnostic parameters for 7 days before $HgCl_2$ therapy. Data from this research indicate *E. Sativa* seeds have a strong antioxidant and renal protective activity and prevent oxidative kidney harm.

8.1.7. Cardiovascular

Species of rockets also contain high levels of polyglycosylated flavonol compounds that are known to deduce various benefits to human and other livestock's health. Its impacts on the gastrointestinal tract and cardiac health are particularly noteworthy. A number of rocket researches found and quantified polyglycosylated flavonols belonging to 3 key aglycones: isorhamnetin, kaempferol and queercetin.

9. Summary

Plants in the Brassicacae family are thought to have various therapeutic and medicinal properties, such as tumori genesis inhibition, antiulcer and hepatopharmacy. Annual species of rocket (*Eruca sativa*) is part of the mustard (Brassicaceae) family. *Eruca sativa* is commonly used in folk medications and is well known as a cure for renal illness. It contains glucosides, mineral salts and vitamin C and is in this manner thought to be a magnificent stomachic, stimulant, and hence utilized as a diuretic and antiscorbutic. Furthermore, it also showed antisecretory, cytoprotective anti-cancer, antidiabetic and anti-inflammatory activities.

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