e-ISSN: 2349-2678, p-ISSN:2961-6050

available online on www.ijpba.in

International Journal of Pharmaceutical and Biological Science Archive

NLM (National Library of Medicine ID: 101732687)

*Index Copernicus Value 2019: 71.05*

Volume 11 Issue 4; July-August; 2023; Page No. 1-10

Review Article

# A Review of the Phytochemical and Pharmacological Potential of the Watercress Plant *(Nasturtium Officinale*): A Medicinal Plant

**Radha Chaudhary*[1], Sunil Kumar[2], Dr Jitendra Malik[3], Gyan Singh[4], Vinay Kumar Siroliya[5,]**

[1]P.G Research Scholar, Faculty of Pharmacy, P.K University, Shivpuri, Madhya Pradesh, India

[2]Associate Professor, Faculty of Pharmacy, P.K University, Shivpuri, Madhya Pradesh, India

[3]Professor, Faculty of Pharmacy, P.K University, Shivpuri, Madhya Pradesh, India

[4]Associate Professor, Faculty of Pharmacy, P.K University, Shivpuri, Madhya Pradesh, India

[5]Assistant Professor, Faculty of Pharmacy, P.K. University, Shivpuri (M.P.) India

**Received: 20-05-2023 / Revised: 30-06-2023 / Accepted: 13-07-2023**

**Corresponding author: Radha Chaudhary**

**Conflict of interest: Nil**

**Abstract**

The plant *Nasturtium officinale* exhibits considerable potential as a medicinal source for drug development, owing to its wide-ranging chemical composition and pharmacological properties. The potential applications of this research encompass various fields such as drug development, cardiovascular health, anti-inflammatory agents, anticancer potential, antimicrobial agents, and dermatological treatments. The hypolipidemic properties exhibited by the plant have the potential to effectively lower lipid levels in the bloodstream, thereby presenting itself as a viable avenue for the management of cardiovascular diseases. The observed anticancer properties, ability to inhibit tumour growth, and antimicrobial properties of this substance indicate promising prospects for v antibiotic resistance. The dermatological effects exhibited by *Nasturtium officinale* show its potential as a viable component in skincare formulations. The future trend of the pharmaceutical industry hinges upon the continued investigation and exploration of its bioactive compounds, mechanisms of action, and therapeutic efficacy. The establishment of partnerships among traditional healers, scientists, and pharmaceutical companies has the potential to foster the development of novel medicinal products that are both innovative and culturally sensitive. In a current review, the therapeutic benefits of *Nasturtium officinale* come to attention.

**Keywords:** Nasturtium officinale, ingredients, pharmacology, therapeutic effects, alkaloids, flavonoids.

## 1. Introduction

There is an aquatic herb species of water plant that is a member of the Brassicaceae family called *Nasturtium officinale*. This plant is more generally known as watercress. It is indigenous to Europe and Asia, but it has now spread throughout most of the rest of the world thanks to widespread cultivation and naturalization [1,2]. In addition to a long history of use in both culinary and medicinal contexts, watercress is well-known for the bright green colour of its leaves and the exquisite white blossoms that bloom on the plant. The plant known as watercress is a perennial that prefers to establish its root system in soil or consistently damp

water. It forms dense mats with creeping stems that can be up to 1 metre (3 feet) in length at its longest point. Pinnately compound leaves with short, spherical leaflets that have a flavour similar to black pepper can be found on this plant. The tiny, white flowers are arranged in clusters, and the seeds they generate are slightly oval [3].

Since ancient times, people have relied on watercress as a source of sustenance in their culture. Because of the flavour that is both refreshing and slightly spicy, the leaves and stems of this plant are frequently eaten raw in dishes such as salads, sandwiches, and as a garnish. Additionally, soups, stir-fries, and a wide variety of other foods can benefit from the addition of flavorful and nutritious watercress. In addition to its applications in the kitchen, watercress has a long history of use as a therapeutic herb. It is well known for its high nutritional value, and it is a wonderful source of minerals such as calcium, iron, and iodine. Vitamins A, C, and K are also present in significant quantities in it. Scurvy, coughs, and digestive issues are only some of the conditions that have historically responded favorably to treatment with watercress. It is considered to have qualities that are both diuretic and expectorant, as well as anti-inflammatory. Due to the numerous ways in which it may be utilised in culinary preparation, watercress has become increasingly popular in recent decades. As a result of its high nutrient content, it is frequently recommended for use in cleansing diets and eating plans that emphasise overall wellness. The plant known as *Nasturtium officinale*, more commonly known as watercress, has been prized throughout history for both its culinary and medical use due to its exquisite flavour and high nutrient content. Because it is able to flourish in wet situations, it is a one-of-a-kind plant that is highly desirable for use in horticulture and culinary applications all over the world1,4,5].

**Figure 1:** *Nasturtium officinale* **( source : https://plantic.in/products/water-cress-imported)**

## 2. Synonyms:

*Arabis nasturtium, Baeumerta nasturtium, Baeumerta nasturtium-aquaticum, Cardamine aquatica, Cardamine Fontana, Cardamine nasturtium, Cardamine nasturtium-aquaticum, Cardaminum nasturtium, Crucifera fontana, Nasturtium aquaticum, Nasturtium aquaticum, Nasturtium fontanum, Nasturtium nasturtium, Nasturtium nasturtium-aquaticum, Nasturtium officinale subsp. rotundifolium, Nasturtium siifolium, Radicula nasturtium, Radicula nasturtium-aquaticum, Rorippa nasturtium, Rorippa nasturtium-aquaticum, Rorippa nasturtium-aquaticum, Rorippa officinalis, Sisymbrium amarum, Sisymbrium cardaminefolium, Sisymbrium fluviatile, Sisymbrium nasturtium, Sisymbrium nasturtium-aquaticum* [3].

## 3. Taxonomic classification:

**Kingdom**: Plantae,
**Subkingdom**: Viridiplantae,
**Infrakingdom**: Streptophyta,
**Superdivision**: Embryophyta,
**Division**: Tracheophyta,
**Subdivision**: Spermatophytina,
**Class**: Magnoliopsida,
**Superorder**: Rosanae,
**Order**: Brassicales**,**
**Family**: Brassicaceae,

**Genus**: Nasturtium,
**Species**: *Nasturtium officinale*[22].
**Common names:**
**Arabic**: HabbArreshad;
**Chinese**: dou ban cai;
**English**: Watercress, bronkors;
**French**: cressond'eau;
**German**: Brunnenkresse, echte Brunnen-kresse;
**Indonesian**: selada-air;
**Japanese**: mizu-garashi, oranda-garashi;
**Portuguese**: agrião;
**Spanish**: berro[3].

## 4. Distribution:

*Nasturtium officinale* is native to Western Asia, India, Europe, and Africa, However, It is distributed in **Africa** (Algeria, Egypt, Libya, Morocco, Tunisia); **Asia** (Afghanistan, Iran, Iraq, Palestine, Jordan, Lebanon, Syria, Saudi Arabia, Turkey, Armenia, Azerbaijan, Georgia, Russian Federation, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, India, Pakistan, Nepal, Sri Lanka, Indonesia, Malaysia, Philippines, China, Japan); **Europe** (Denmark, Ireland, Sweden, United Kingdom, Austria, Belgium, Czech Republic, Germany, Hungary, Netherlands, Poland, Slovakia, Switzerland, Ukraine, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Romania, Serbia, Slovenia, France, Portugal, Spain); **Australasia** (Australia, New Zealand); **Northern America** (Canada, Mexico, United States) and **Southern America** (Barbados, Cuba, Dominica, Dominican Republic, Guadeloupe, Haiti, Jamaica, Martinique, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, United States, Guatemala, Nicaragua, Venezuela, Brazil, Bolivia, Ecuador, Peru , Argentina, Chile, Uruguay)[2,3].

## 5. Nutritional constituent:

Watercress is an unique reservoir of essential nutrients, boasting a rich abundance of vitamins and minerals. Watercress is considered a nutritious dietary choice due to its rich composition of various phytochemicals and essential nutrients. These components contribute to promoting immune function and overall well-being in the human body. According to Al-Snafi et al. (2020), watercress is recognised as an essential source of vitamins and is considered to possess detoxifying properties. Based on the available data, this report presents the chemical composition and quantitative nutritional analysis of *Nasturtium officinale*, commonly known as watercress[2,3].

**Table 1:** Vitamins and phytochemicals [2,3]

| Vitamins and phytochemicals | Quantity/80 g edible produce |
|---|---|
| Calories (kcal) | 18 |
| Protein (g) | 2.4 |
| Fat (g) | 0.8 |
| Fibre (g) | 1.2 |
| Beta carotene (mcg) | 2016 |
| Vitamin A equivalent (mcg) | 336 |
| Vitamin B1 (mg) | 0.13 |
| Vitamin B6 (mg) | 0.18 |

| | |
|---|---|
| Vitamin C (mg) | 50 |
| Vitamin E (mg) | 1.17 |
| Folate (mcg) | 36 |
| Vitamin K (mcg) | 200 |

**Table 2: Mineral composition of raw watercress Pandey et al.(2015) [2]**

| **Mineral composition** | **Quantity/80g edible produce** |
|---|---|
| **Calcium (mg)** | 136 |
| **Iodine (mcg)** | 12 |
| **Iron (mg)** | 1.8 |
| **Magnesium (mg)** | 12 |
| **Manganese (mg)** | 0.5 |
| **Phosphorus (mg)** | 42 |
| **Potassium (mg)** | 184 |
| **Zinc (mg)** | 0.6 |
| **Selenium (mcg)** | 1.6 |
| **Sodium (mg/100g)** | 68.8 |
| **Copper (mg/100 g)** | 0.58 |

Please note that the values provided are informational and may vary depending on plant variety, growing conditions, and measurement methods.

## 6. Phytochemical and pharmacological potential of the watercress plant *(Nasturtium Officinale*)

### 6.1. Anticancer

In addition to investigations into individual phytochemicals and essential nutrients, numerous studies have examined the notable effects of *N. officinale* extracts, primarily emphasising their chemo-preventive capabilities. In a survey conducted by Boyd et al. (2006), it was observed that the application of watercress extract exhibited a protective effect on colon cancer HT29 cells against oxidative DNA damage caused by different genotoxins, namely 4-Hydroxy Nonenal, hydrogen peroxide, and faecal water[8]. In a study conducted by Hecht et al. (1995), it was found that the intake of watercress, precisely 56.8 g every three days, had inhibitory effects on the metabolic activities of NNK, a prominent tobacco carcinogen, in particular individuals who smoke. In addition, the regular intake of 85 g of uncooked watercress on a daily basis over eight weeks resulted in a reduction of various indicators of DNA damage in Lymphocytes, a

recognised biomarker for cancer. Furthermore, this consumption led to an elevation in the levels of the antioxidant compounds β-carotene and lutein in the plasma. In a study conducted by Rose et al. (2005), it was shown that watercress extract, particularly the non-volatile 7- the component known as methylsulphinylheptyl isothiocyanate was found to decrease the activity of MMP9 in the MDAMB-231 cell line, a type of human breast cancer[9].

### 6.2. Antidiabetic

Diabetes currently represents a significant health issue of concern in contemporary society. This disease holds considerable importance as it gives rise to severe complications. According to Engelen et al. (2006), watercress has been found to contain a compound called gluconasturtin, which belongs to a group of substances known as glucosinolates. This compound has historically been used for the management of diabetes, a chronic endocrine disorder characterised by disrupted carbohydrate metabolism and increased levels of glucose in the blood stream[10-15]. In their study on the effect of *N. officinale* on blood glucose levels in diabetic rats, Al-Snafi, A. E. (2020). They observed a reduction in blood glucose levels comparable to the effects of glycyclamide, an established anti-diabetic drug. As a result, the researchers concluded that *N. officinale* has the potential to serve as a source of anti-hyperglycemic agents and contains pharmacologically active component(s)[3].

### 6.3.Anti-Tuberculosis, Cardio-Protective, And Hepatoprotective Properties.

In their study, Corona et al. (2008) found that *N. officinale* demonstrated the highest potency (MIC ≤ 100 µg/ml) among the four mono-resistant variants tested against tuberculosis[10]. According to a study conducted by Kokhdan et al. (2021), the administration of an alcoholic extract derived from the *N. officinale* plant at a dosage of 40 mg/kg demonstrated a significant reduction in liver damage caused by acetaminophen in an in-situ rat liver model. *N. officinale* potentially has a role to play[3,11].

It has been observed that there is a protective mechanism in place that helps mitigate the hepatotoxic effects induced by paracetamol. This mechanism operates by preserving the normal functioning of the liver. Based on an extensive literature review, it can be inferred that *N. officinale* holds significant importance as a medicinal resource and an economically valuable herb. Vegetables and salads are commonly and extensively utilised in a widespread manner. Furthermore, experimental evidence from previous years has demonstrated their efficacy in combating specific diseases. The herb exhibits significant anticancer activity, showing its full therapeutic potential[11,17].

Biologically active compounds like gluconasturtine are interesting due to their potential physiological effects. In addition to its anticancer properties, it exhibits anti-diabetic and anti-tuberculosis effects. The properties mentioned include anti-inflammatory, antimicrobial, and cardioprotective effects. Therefore, it can be inferred that *N. officinale* possesses the potential to serve as a viable resource for the production and utilisation of nutraceuticals and nutrient supplements. Particularly significant for chronic illness. The Vitamins and mineral constituents of watercress according to different sources (Pandey et al ., 2018 ) are shown in Table 1 and 2, respectively[2,5].

### 6.4.Antimicrobial effect:

*Nasturtium officinale* was tested for its ability to inhibit the growth of Escherichia coli, Salmonella typhimurium, Staphylococcus aureus, and Listeria monocytogenes using both aqueous and alcoholic extracts. Both the alcoholic and the aqueous extracts of *Nasturtium officinale* had antibacterial activity. However it was more effective against Gram-positive bacteria than it was against Gram-negative bacteria. With a minimum inhibitory concentration of 8 g/ml, S. aureus and L. monocytogenes were the most sensitive bacteria. In tests conducted on S. aureus, the MIC for the plant extract was found to be 6.25 g/ml, and the MBC was found to be 12.5 g/ml. However, E. coli and S. Typhimurium were resistant to the alcoholic and aqueous extracts (2,3).

The essential oil of *Nasturtium officinale* was tested for its ability to inhibit the growth of several vital food-borne germs, including Gram-positive bacteria like Staphylococcus aureus and Bacillus cereus, as well as Gram-negative bacteria like Escherichia coli and Salmonella harmful bacteria: Escherichia coli and S. enteric). S. enteric and E. coli showed the highest resistance to the essential oil, whereas B. cereus isolates displayed the highest level of sensitivity (2,3).

*Nasturtium officinale* had its methanolic extract put through antimicrobial tests against Bacillus cereus, Enterococcus faecalis, Klebsiella pneumonia, and Escherichia coli. The results showed that the section has antibacterial action. The minimum inhibitory concentrations (MICs) of the extract against these bacteria were 0.6, 0.4, 0.8 and 0.6, whereas the minimum inhibitory concentrations (MBCs) ranged from 0.10 to 0.8 mg/ml, respectively (2,3,8).

In this experiment, the antibacterial properties of silver nanoparticles (Ag-NPs) from the aqueous extract of *Nasturtium officinale* leaves were tested against the growth of Gram-positive (S. aureus) bacteria. It was observed that the inhibition occurred in the Ag-NPs against S. aureus. The findings demonstrated that most S. aureus was severely harmed and eliminated due to the addition of Ag-NPs(3,9).

The in vitro synergism between aqueous and methanolic extracts of *Nasturtium officinale* and 2-phenyl ethyl isothiocyanate, discovered in *Nasturtium officinale,* was carried out against conventional antibiotics. The tested organisms included Escherichia coli, Klebsiella pneumoniae, and Escherichia coli. 11 different strains of Escherichia coli with extended-spectrum beta-lactamases. When the antibiotics were mixed with plant extracts and 2-phenyl ethyl isothiocyanate, the results showed an increase in the antibacterial activity of the antibiotics (3,9).

### 6.5. Dermatological effect:

The ability of watercress oil to promote wound healing following thermal and chemical burns in rabbits was investigated in this study. The experimental burns caused by chemical reactions and direct heat were treated with watercress oil.

When treated with watercress oil, the typical architecture was restored more quickly, considerably reducing the time needed to close the burn(3,5).In normal human dermal fibroblasts, the protective properties of indole 3-acetonitrile-4- methoxy -2- S--d-glucopyranoside (IAMG) from *Nasturtium officinale* were investigated against ultraviolet B-induced photodamage. According to the findings, IAMG caused an increase in the migration of human dermal fibroblast cells. IAMG therapy was able to reduce the UVB-induced elevations in MMP-1 as well as the decrease in type I procollagen. The findings provided compelling evidence that IAMG derived from *Nasturtium officinale* mitigated the photodamage caused by UVB (3,10-13]).

### 6.7. Effects Beneficial to urinary tract health

Rats were given ethylene glycol in this experiment to promote kidney stone formation. Then the preventive effects of a hydrophilic extract of *Nasturtium officinale* (750 mg/kg and 1.5 g/kg of extract) were examined. The percentage of calcium oxalate crystals was 75% in the hostile control groups, 28.6% in the preventive groups treated with a low dosage, and 57.1% in the preventive groups treated with a high dose. We see that in contrast to the healthy control group (12.5%). The oxalate concentration in the urine was higher in the preventive and opposing control groups than in the healthy control group (P 0.05) (3,8).

**6.8. Antigenotoxic impact**: The effect of aqueous extract (two concentrations: 13.2 and 26.4 mg/ml) on cell viability and its possible antigenotoxic qualities against induced oxidative damage were evaluated utilising a comet assay and in vitro microsome analysis. In vitro model using cells taken from the peripheral blood. At no point was there a detectable difference in the levels of cell viability between the control group and the treatment group. Significant antigenotoxic effects were seen at both concentrations ($p = 0.005$ at 30 min; P 0.001 at 60 and 90 min), with the percentage reductions in damage being comparable

between the concentrations that were employed (67.1% and 75.2%, respectively(3,12).

### 6.9.Thyroid disease

Based on present studies, there needs to be more scientific evidence that establishes a causal relationship between watercress consumption and thyroid function. Nevertheless, it is crucial to acknowledge that watercress belongs to the Brassicaceae family, encompassing various vegetables such as broccoli, cabbage, and kale. These vegetables are recognised for their elevated levels of glucosinolates, which can potentially disrupt thyroid function when consumed excessively, especially among individuals with insufficient iodine levels. The catabolism of glucosinolates in the body gives rise to compounds that have the potential to impede the uptake of iodine within the thyroid gland. Due to its crucial role in synthesizing thyroid hormones, an insufficiency of iodine can result in hypothyroidism, characterized by diminished thyroid gland activity. This condition can induce various symptoms, including fatigue, weight gain, and depression [15-19].

## 7. Adverse reactions and harmful effects:

Mice were used for the research on in vivo acute toxicity. The mouse subjects were subjected to a stressful experience at varying levels due to the plant extract's acute oral toxicity, particularly at 80 mg/kg and 100 mg/kg. Within eight hours of receiving the gavage, some clinical symptoms were observed, including intense agitation, followed by immobility. Several fatalities were found after 72 hours, with LD50 values ranging from 50 to 500 mg/kg body weight (45). The acute and sub-acute effects of oral administration of a standardised extract of *Nasturtium officinale* containing 5.0 mg/ml of phenyl ethyl glucosinolate were investigated in rats as part of a safety study. The LD50 was somewhere between 2 and 5 grammes per kilogramme. According to the findings, *Nasturtium officinale* extract at doses up to 5 g/kg in acute studies was safe. In comparison, sub-acute administrations of the extract up to 1 g/kg were found to have no deleterious effects (51, 85). However, the acute toxicity of an ethanolic extract of *Nasturtium officinale* was investigated in mice at doses ranging from 0.5 to 5,000 milligrammes per kilogramme of body weight (mg/kg bw). The maximum quantity did not result in any deaths, and the animals remained in their usual conditions. There were no statistically significant variations in the relative weights of the mice's liver, heart, or kidneys across any of the doses. According to the findings of histopathological research, the most incredible doses induced necrosis and hydropic degeneration of the liver and kidneys, as well as an inflammatory manifestation of the heart with a myofibril irregular heart(3,6).

## 8. Use of *Nasturtium officinale* in traditional and value-added foods [17-24]

*Nasturtium officinale,* sometimes known as watercress, is a plant extensively utilised in traditional and value-added culinary products. Here is some information on its applications:

Watercress has a long history of culinary use in traditional meals, particularly in European and Asian cuisines. It is well-known for its peppery and slightly bitter flavour, which gives foods a distinct flavour. Here are a few examples of how watercress is utilised in traditional cuisine:

**Salads:** Watercress is a popular fresh element in salads. Its soft leaves and stems are frequently combined with other greens, vegetables, and dressings to make light, healthy salads.

**Soups and stews:** Watercress adds flavour and nutrition to soups and stews. Add it near the end of the cooking process to keep its crispness and brilliant green colour.

Watercress can fill or garnish in sandwiches, wraps, or rolls, adding a crunchy texture and a distinct flavour.

**Stir-fries:** Watercress is stir-fried with vegetables, meats, or shellfish in some Asian cuisines to make a quick and tasty dish.

Watercress is used in value-added food items, processed or blended with other ingredients to produce new gourmet experiences in addition to its conventional applications. Here are a couple of such examples:

**Pesto:** In pesto, watercress can be used in place of or in addition to regular basil. The watercress pesto has a bright green colour and a distinct flavour profile. Watercress can be mixed with other fruits and vegetables to make nutrient-dense smoothies and drinks. It offers a pleasant flavour while also providing essential vitamins and minerals.

**Sauces and Dressings:** Watercress can increase the flavour and nutritional value of sauces, dressings, and dips. It can be blended with other ingredients such as yoghurt, lemon, garlic, or herbs to make a variety of condiments. Watercress can be used with butter to make flavoured butter spreads. This adds a delightful twist to toast and as a topping for cooked veggies or grilled meats.

**Watercress Infused Oils and Vinegars:** Watercress can be infused into oils or vinegar to add flavour and colour. These scented products can be used as salad dressings or garnish in various cuisines. Overall, watercress, or *Nasturtium officinale*, is a versatile plant that may be used in traditional and value-added foods. It is a favourite choice among chefs and food followers due to its peppery flavour, brilliant colour, and nutritional benefits.

## 9. Side effects and toxicity:

The in vivo acute toxicity was studied in mice. The data presented appears to be derived from a scientific investigation or investigations examining the acute toxicity of Nasturtium extracts in mice and rats. Based on the information provided, the section can induce toxicity when administered in high quantities[3,21-24].In the context of acute oral toxicity tests conducted on mice, it was observed that the extract elicited notable stress-inducing effects, mainly when administered at doses of 80mg/kg and 100mg/kg. Mice exhibited a noteworthy state of heightened agitation followed by a subsequent period of immobility within eight hours after administration. Mortalities were recorded after a 72-hour period, wherein the LD50 (the dosage necessary to induce mortality in 50% of the experimental cohort) exhibited a range spanning from 50 to 500 mg/kg of body mass. The extract was investigated in rats using both acute and sub-acute oral dosages. The LD50 value fell within 2-5 grammes per kilogramme. In the critical study, administering a dosage of up to 5g/kg was deemed safe, as no detrimental effects were observed. No adverse effects were observed during the sub-acute administration of up to 1g/kg. A separate investigation assessed the immediate toxicity of an ethanolic extract derived from *Nasturtium officinale* in mice, utilising a range of doses (0.5, 5, 50, 500, 1000, 2000, and 4000 mg/kg body weight). The administration of the highest dosage did not result in mortality, and the animals' observed behaviour and physical characteristics remained within the expected range[3]. Nevertheless, histopathological investigations revealed that administering the highest doses resulted in liver and kidney necrosis and hydropic degeneration. An inflammatory response in the heart was also observed, characterised by irregular myofibrils. Based on the provided data, it can be inferred that administering *Nasturtium officinale* extract in excessive quantities may exhibit toxicity, impacting the liver, kidneys, and heart. Nevertheless, it is crucial to acknowledge that the studies mentioned above were carried out on murine and rodent models, and it is only sometimes valid to extrapolate the same outcomes to the human population. Additional investigation is required to ascertain the safety profile and potential adverse reactions associated with administering *Nasturtium officinale* extract in human subjects[3,23-27].

## 10. Conclusion

*Nasturtium officinale*, also known as watercress, is a botanical species with a distinctive pungent taste and significant nutritional composition. It is a rich source of essential nutrients, including vitamins A, C, and K, and minerals like calcium, manganese, and potassium. Watercress has been used for its therapeutic properties, including enhancing respiratory well-being and acting as a diuretic. Extensive investigations have explored its potential medicinal advantages, including its potential role in cancer prevention and treatment. Watercress contains isothiocyanates, which have been extensively investigated for

their potential anti-cancer properties. Additionally, its antioxidant properties are attributed to its high concentration of vitamins C and E. These antioxidants can help prevent chronic illnesses like cardiovascular disease and cancer. Despite the nutritional advantages of watercress, much of the evidence regarding its medicinal properties is still in its early stages. Further research and scientific publications are essential to validate and understand its effects. Monitoring ongoing research and publications is crucial to stay updated on emerging advancements in health benefits and pharmaceutical applications of *Nasturtium officinale.* Healthcare practitioners should also be consulted for guidance on using medicinal plants for therapeutic purposes.

## References


1. Sathasivam, R., Bong, S. J., Park, C. H., Kim, J. H., Kim, J. K., & Park, S. U. (2021). Identification, characterisation, and expression analysis of carotenoid biosynthesis genes and carotenoid accumulation in watercress (Nasturtium officinale R. Br.). *ACS omega*, *7*(1), 430-442.
2. Pandey, Y., Bhatt, S. S., & Debbarma, N. (2018). Watercress (Nasturtium officinale): a potential source of nutraceuticals. Int. J. Curr. Microbiol. App. Sci, 7(2), 2685-2691.
3. Al-Snafi, A. E. (2020). A review on Nasturtium officinale: A potential medicinal plant. IOSR Journal of Pharmacy, 10(9), 33-43.
4. Jeon, J., Bong, S. J., Park, J. S., Park, Y. K., Arasu, M. V., Al-Dhabi, N. A., & Park, S. U. (2017). De novo transcriptome analysis and glucosinolate profiling in watercress (Nasturtium officinale R. Br.). BMC Genomics, 18(1), 1-14.
5. Irhayyim, T., Fehér, M., Lelesz, J., Bercsényi, M., & Bársony, P. (2020). Nutrient removal efficiency and growth of watercress (nasturtium officinale) under different harvesting regimes in integrated recirculating aquaponic systems for rearing common carp (cyprinus carpio L.). Water, 12(5), 1419.
6. Clemente, M., Miguel, M., Gribner, C., Moura, P. F., Rigoni, A. A. R., Fernandes, L. C., & Miguel, O. G. (2019). Watercress, as a functional food, with protective effects on human health against oxidative stress: A review study. Int. J. Med. Plants Nat. Prod, 5, 12-16.
7. Lata, M. (2020). Nutritional, medicinal and indigenous use of Nasturtium officinale in Tehsil Thunag of District Mandi, Himachal Pradesh, North Western Himalayas, India. International Journal of Chemical Studies, 8(5), 1648-1653.
8. Boyd, L. A., McCann, M. J., Hashim, Y., Bennett, R. N., Gill, C. I., & Rowland, I. R. (2006). Assessment of the anti-genotoxic, anti-proliferative, and anti-metastatic potential of crude watercress extract in human colon cancer cells. Nutrition and cancer, 55(2), 232-241.
9. Hecht, S. S., Chung, F. L., Richie Jr, J. P., Akerkar, S. A., Borukhova, A., Skowronski, L., & Carmella, S. G. (1995). Effects of watercress consumption on metabolism of a tobacco-specific lung carcinogen in smokers. Cancer epidemiology, biomarkers & prevention: a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology, 4(8), 877-884.
10. Camacho-Corona, M. D. R., Ramírez-Cabrera, M. A., Santiago, O. G., Garza-González, E., Palacios, I. D. P., & Luna-Herrera, J. (2008). Activity against drug resistant-tuberculosis strains of plants used in Mexican traditional medicine to treat tuberculosis and other respiratory diseases. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 22(1), 82-85.
11. Panahi Kokhdan, E., Khodabandehloo, H., Ghahremani, H., & Doustimotlagh, A. H. (2021). A narrative review on therapeutic potentials of watercress in human disorders. Evidence-Based Complementary and Alternative Medicine, 2021, 1-13.
12. Kazemi Tanha, M., Nayebifar, S., Ghasemi, E., & Nosrat Zehi, S. (2023). Investigating

the synergistic effect of Nasturtium officinale extract and High-intensity interval training on fatty acid-binding protein 4 (FABP4) and high-sensitivity C-reactive protein (hs-CRP) in overweight subclinical hypothyroid patients: a rand. Sport Physiology, 14(56), 177-200.

13. Klimek-Szczykutowicz, M., Szopa, A., & Ekiert, H. (2018). Chemical composition, traditional and professional use in medicine, application in environmental protection, position in food and cosmetics industries, and biotechnological studies of Nasturtium officinale (watercress)–a review. Fitoterapia, 129, 283-292.
14. Al-Snafi, A. E. (2020). A review on Nasturtium officinale: A potential medicinal plant. IOSR Journal of Pharmacy, 10(9), 33-43.
15. Panahi Kokhdan, E., Khodabandehloo, H., Ghahremani, H., & Doustimotlagh, A. H. (2021). A narrative review on therapeutic potentials of watercress in human disorders. Evidence-Based Complementary and Alternative Medicine, 2021, 1-13.
16. Chaudhary, S. A. C. H. I. N., Hisham, H. A. Z. A. R., & Mohamed, D. O. H. A. (2018). A review on phytochemical and pharmacological potential of watercress plant. Asian J Pharm Clin Res, 11(12), 102-107.
17. Lata, M. (2020). Nutritional, medicinal and indigenous use of Nasturtium officinale in Tehsil Thunag of District Mandi, Himachal Pradesh, North Western Himalayas, India. International Journal of Chemical Studies, 8(5), 1648-1653.
18. Chandra, K., Nautiyal, B. P., & Nautiyal, M. C. (2013). Ethno-botanical resources as supplementary foods and less known wild edible fruits in district Rudraprayag, Uttarakhand, India. Journal of Human Ecology, 42(3), 259-271.
28.
19. Bhardwaj, D., & Bharadvaja, N. (2021). Phycoremediation of effluents containing dyes and its prospects for value-added products: A review of opportunities. Journal of Water Process Engineering, 41, 102080.
20. Devi S, Gupta E, Maurya NK. Development of value-added Amla product. International Archive of Applied Sciences and Technology, 2020; 11 (2), 90-93.
21. Allen, G. (2012). Herbs: a global history. Reaktion Books.
22. Nelly, A., Annick, D. D., & Frederic, D. (2008). Plants used as remedies antirheumatic and antineuralgic in the traditional medicine of Lebanon. Journal of ethnopharmacology, 120(3), 315-334.
23. Goel, B. and Maurya, N.K. Memory booster herb (natural cognitive enhancers): An overview. *International Journal* of Physiology, *Nutrition* and *Physical Education 2019, 4(1): 975-979.*
24. Khan, F. A., Bhat, S. A., & Narayan, S. (2017). Wild edible plants as a food Resource: Traditional Knowledge. University of Agricultural Science and Technology, Research Gate, March.
25. Namdjoyan, S., & Kermanian, H. (2013). Exogenous nitric oxide (as sodium nitroprusside) ameliorates arsenic-induced oxidative stress in watercress (Nasturtium officinale R. Br.) plants. Scientia Horticulturae, 161, 350-356.
26. NK Maurya. Nephrotoxic Effect of Herbal Medicine and Supplements: A Review. Research & Reviews: A Journal of Toxicology. 2019; 9(2) :28-35
27. Ozturk, F., Duman, F., Leblebici, Z., & Temizgul, R. (2010). Arsenic accumulation and biological responses of watercress (Nasturtium officinale R. Br.) exposed to arsenite. Environmental and Experi*mental Botany*, *69*(2), 167-174.