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A REVIEW: PLANT OVERVIEW, PHYTOCHEMICAL COMPOSITION AND PHARMACOLOGICAL ACIVITY OF *RAPHANUS SATIVUS*

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ABSTRACT

Raphanus sativus L. (radish), a member of the *Brassicaceae* family, is a commonly consumed vegetable with notable nutritional and medicinal significance. Traditionally employed in Unani, Greco-Arab, and Indian medicine, it has been used to manage digestive, hepatic, and respiratory disorders. The plant is rich in bioactive compounds, including glucosinolates, isothiocyanates, flavonoids, terpenes, and phenolics, which underpin its diverse pharmacological activities. Studies demonstrate its strong antioxidant, anti-inflammatory, anticancer, hepatoprotective, cardioprotective, and antimicrobial effects. Radish leaves, in particular, are more nutrient-dense than roots, containing higher levels of protein, fiber, and phenolic compounds, enhancing their therapeutic potential. Evidence also suggests its efficacy in mitigating oxidative stress, liver injury, cardiovascular dysfunction, infections, and respiratory conditions. Collectively, *Raphanus sativus* emerges as a versatile plant with promising applications in human health, highlighting its role in disease prevention and as a source of natural therapeutics.

KEYWORDS: Raddish, antioxidant, seeds, leaves.

INTRODUCTION

From very ancient times, various herbs are using in treatment, prevention, and cure the numerous infections and diseases. Numerous plants are associated with a plethora of healing properties, encompassing anti-diabetic, analgesic, anti-inflammatory, anti-malarial, hypoglycaemic, anti-microbial, stimulant, immunomodulatory, anticancer, and anti-hypertensive effects.[1] According to the 'World Health Organisation (WHO) report around 80% of the world's population depends on herbal traditional medicine' in certain parts of prime health care.[2] The *Brassicaceae* family, which encompasses a wide range of commonly consumed vegetables, includes leafy, root, and seasoning types, as well as oilseed crops. This diverse family consists of approximately 310 genera and around 3,500 species. The radish (*Raphanus sativus* L.) is a species belonging to the genus *Raphanus* and is classified within the Rapa/Oleacera lineage, as revealed by phylogenetic analyses of the *Brassicaceae* family.[3] In Unani, Greco-Arab, and Indian folk medicine, radish has long been used as a home remedy to treat a variety of conditions, such as jaundice, gallstones, liver disorders, rectal prolapse, indigestion, and other gastrointestinal ailments[4] Secondary metabolites are found in smaller amounts than primary metabolites and are stored in specialized cells. They include phenols, steroids and terpenes, and alkaloids. Phenols, produced via the shikimate pathway, are a major class and help plants survive by acting as antioxidants, antimicrobials, and stress protectors.[5] The main bioactive compounds in radish are glucosinolates, isothiocyanates, and polyphenols. Glucosinolates, unique to cruciferous vegetables 444, are classified as aliphatic, aromatic, or indolic and are being studied for their anticancer and anti-inflammatory potential.

Recent studies show that radish leaves contain higher levels of protein, fiber, ash, and ascorbic acid than roots, making them more nutritious. As interest in waste reduction grows, radish by-products have gained attention for their potential uses. This review outlines the phytochemical composition and pharmacological properties of radish leaves, highlighting key compounds such as carbohydrates, flavonoids, glucosinolates, phenolics, and polysaccharides.[6]

PLANT PROFILE

FIG -1: LEAVES AND SEESD OF *RAPHANUS SATIVUS*.

Synonyms

Wild radish, garden radish.

Biological source

It is obtained from dried seeds and leaves of *Raphanus raphanistrum* (L.) belonging to the family *Brassicaceae.*

Taxonomic Classification

kingdom - *Plantae*

Phylum - *Magnoliophyta*

Class -*Magnoliopsida*

Sub class - *Dilleniidae*

Order - *Capparales*

Fanily- *Brassicaceae*

Genus -*Raphanus*

Subiect - Raphanus Sativus L

Vernacular Name

Tamil - Mullangi

Hindi - Mauli, Mulak Muli

Malayalam – molabham

Kannada - moolangi

Sanskrit- mulaka

Description of Plant

- **Root:** The edible part is a fleshy, elongated taproot that is usually white in color. It varies in size and shape depending on the cultivar. The root has a pungent taste due to the presence of glucosinolates.
- **Stem:** Erect, branched flowering stem that develops during the reproductive stage.
- **Leaves:** Leaves are lyrate-pinnatifid with rough texture. Basal leaves form a rosette pattern**.**
- **Flowers:** Flowers are small, white to pale purple, arranged in racemes. They are bisexual and cross-pollinated.
- **Fruit:** The fruit is a siliqua (pod) containing round, brown seeds.[7]

Habitat of Plant

White radish (*Raphanus Sativus L.*) thrives in cool and temperate climates, preferring full sunlight and temperatures between 10°C and 25°C. It grows well in loose, well-drained sandy loam soils rich in organic matter and is sensitive to extreme heat and frost. The plant is usually propagated by seeds, which germinate quickly under suitable moisture conditions. Its well-developed taproot allows it to grow efficiently in suitable soil conditions, making it a widely cultivated vegetable crop, especially during the winter season in India.[8]

Phytochemical Composition

White radish contains various bioactive compounds

- Glucosinolates (e.g.,glucoraphanin)
- Isothiocyanates
- Phenolic compounds
- FlavonoidsVitamin C
- Dietary fiber
- Minerals (Potassium, Calcium, Magnesium[9]

TRADITIONAL USE

White radish is low in calories and rich in fiber and vitamin C. It supports digestion, improves immunity, and helps regulate blood sugar levels.[10]

- **Digestive Aid:** Improves digestion and relieves constipation due to high dietary fiber.
- **Antidiabetic Activity:** Helps regulate blood glucose levels and improves insulin sensitivity.
- **Hepatoprotective (Liver Protection):** Supports liver function and detoxification.

- **Antioxidant Activity:** Rich in vitamin C, phenolics, and flavonoids that reduce oxidative stress.
- **Anti-inflammatory Activity:** Bioactive compounds help reduce inflammation.
- **Antimicrobial Activity:** Shows inhibitory effects against certain bacteria**.**
- **Antifungal Activity:** Contains glucosinolates and isothiocyanates that exhibit inhibitory effects against fungal species like Candida and other pathogenic fungi.
- **Diuretic Effect:** Promotes urine output and supports kidney health.[11]
- **Respiratory Relief:** Traditionally used to relieve cough, asthma, and bronchitis.
- **Weight Management:** Low calorie and high fiber content helps in weight control.

PHARMACOLOGICAL ACTIVITY

ANTI CANCER ACTIVITY

Leaves (RSLs) and roots (RSRs) of *Raphanus sativus L*. (white radish) contain bioactive compounds, including phenolics, flavonoids, rutin, and isothiocyanates. Studies on Saudi Arabian samples showed that RSLs have higher phenolic (125.3 mg GAE/g) and flavonoid (44.5 mg QE/g) contents than roots, stronger antioxidant activity (DPPH IC_{50}: 216.8 µg/mL; ABTS IC_{50}: 326.7 µg/mL), and greater cytotoxicity against human cancer cell lines (IC_{50}: 217–453 µg/mL), with rutin detected only in leaves.[11,12] Isothiocyanates in RS, particularly in flowers and pods, exhibit anticancer effects through inhibition of proliferation, angiogenesis, and induction of apoptosis, with sulforaphane and sulforaphene contributing to colon cancer–preventive potential.[12]

HEPATO PROTECTIVE ACTIVITY

Alcohol and drug overdoses, including acetaminophen (APAP), are major causes of liver injury. Extracts from radish (*Raphanus sativus,* RJ) and turnip (RG), rich in glucosinolates and isothiocyanates, demonstrated hepatoprotective effects in APAP-induced liver injury in mice by improving liver histology, reducing ALT, AST, and MDA levels, enhancing antioxidant enzymes (GSH, SOD, CAT), and upregulating Nrf-2 and HO-1.[14] Radish enzyme extract (REE) also showed low cytotoxicity in HepG2 cells and protected against tacrine- and CCl4-induced liver damage in vitro and in vivo, reducing serum liver enzymes and improving histology, comparable to silymarin.[13].

CARDIO PROTECTIVE ACTIVITY

Cardio-pharmacological studies on *Raphanus sativus* demonstrate multiple cardiovascular benefits. In Cyclosporin-treated rabbits, fruit powder (0.5–1.5 g/kg) and its aqueous extract

(1.5 g/kg) reduced serum uric acid and cardiac enzymes (GOT, LDH) and showed dose-dependent antioxidant activity, whereas ethanolic extract had no effect.[16] In ISO-induced myocardial injury in rats, RS leaf extract (RSLE, 500 mg/kg) elevated cardiac markers and caused histopathological changes, indicating potential cardiotoxicity via histaminergic activity.[17] In ApoE-/- mice fed a high-cholesterol diet, white and purple radish extracts reduced aortic plaque, improved lipid profiles (triglycerides, LDL, HDL), suppressed inflammatory cytokines (TNF-α, IL-1β, IL-6), regulated NO synthesis, and decreased VCAM-1 and ICAM-1 expression, demonstrating anti-atherosclerotic effects comparable to atorvastatin.[14]

ANTI MICROBIAL ACTIVITY

Raphanus sativus extracts exhibit significant antimicrobial and antioxidant activities. Dry extracts showed strong inhibition against Bacillus subtilis (18.67 mm), while the ethyl acetate fraction had the lowest MIC (0.1 mg/mL) against Micrococcus luteus, correlating with phenolic and flavonoid content.[19,20] Ten new phenylpropionate compounds from Raphani Semen demonstrated antibacterial effects, with compound 4 enhancing ampicillin activity; core targets included EGFR, GAPDH, and MMP9.[21] Hydrogels containing radish seed extract showed concentration-dependent antimicrobial activity, promoting cutaneous wound healing.[15]

RESPIRATORY ACTIVITY

Radish (*Raphanus sativus*) roots contain bioactive compounds with anti-inflammatory and antitumor properties. Methanol and ethyl acetate extracts reduced PMA-induced MUC5AC overexpression in NCI-H292 cells, with ethyl acetate extracts from dried and aged radish showing the strongest inhibition. Among four newly isolated compounds, 4-[formyl-5-(methoxymethyl)-1H-pyrrol-1-yl]butanoic acid exhibited the most potent regulatory effect, indicating potential against mucus-related disorders.[23] A nutraceutical combining R. sativus with other plant extracts demonstrated antioxidant, hepatoprotective, and anti-inflammatory effects, reducing GST, NO, IL-1β, IL-6, and TNF-α levels in vitro and in asthmatic rat models, suggesting potential for managing airway inflammation.[16]

LIPIDEMIC ACTIVITY

The aqueous leaf extract of *Raphanus sativus* var. *longipinnatus* showed significant hypolipidemic effects in rats, increasing HDL and reducing total cholesterol, triglycerides, LDL, and VLDL. It also lowered oxidative stress and liver enzymes, indicating liver-

protective and lipid-lowering activity.[32] Green radish polysaccharide (GRP) lowered body weight, liver index, and serum lipid levels in hyperlipidemic mice, while reducing liver damage, oxidative stress, and inflammation. It also improved fat metabolism and modulated gut microbiota, likely through glycolysis and propionate metabolism pathways.[17]

DETOXIFICATION PROPERTY

Cadmium (Cd) causes oxidative stress in plants, hindering growth. This study found that combining strigolactone (25 µM) with acidified biochar (0.75% w/w) significantly improved radish growth, biomass, and chlorophyll levels while reducing antioxidant activity under Cd stress. The combined treatment effectively alleviated Cd toxicity.[18]

SKIN PROTECTION ACTIVITY

Topical application of a mixture of *Raphanus sativus* seed powder and honey showed effectiveness in managing melasma, with improvements in the Melasma Area and Severity Index (mMASI) comparable to standard hydroquinone (4 %) cream. The treatment was well tolerated, with no adverse effects reported, and both interventions led to similar enhancements in skin-related quality of life.[19]

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DIGESTIVE IN HEALTH

Radish green extract (RGE) improved intestinal health in mice fed a Western diet by promoting beneficial gut bacteria, enhancing MUC2 expression, strengthening barrier integrity, reducing inflammation, and increasing microbial diversity.[29] Crude extracts of *Raphanus sativus* leaves (Rl.Cr) induced dose-dependent contractions in guinea-pig ileum and colon via histaminergic (H1) receptors, with high doses causing relaxation; aqueous fractions were most potent, indicating the presence of histaminergic constituents alongside mild relaxant components.[21]

CONCLUSION

Raphanus sativus L. (radish) is a nutrient-rich plant with potent bioactive compounds, including glucosinolates, isothiocyanates, flavonoids, and phenolics. These compounds confer antioxidant, anti-inflammatory, anticancer, hepatoprotective, cardioprotective, antimicrobial, and respiratory benefits. Radish leaves are particularly rich in nutrients and bioactives, showing greater therapeutic potential than roots. Overall, radish represents a valuable functional food with promising.

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