

THE IMPORTANCE OF THE MEDICINAL PLANT NASTURTIIUM OFFICINALE L. IN THE ANTICANCER ACTIVITY RESEARCH

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ABSTRACT

Cancer is known as one of the main cause of death worldwide. It is difficult to discover novel agents that selectively kill tumor cells or inhibit their proliferation without toxicity. Searching for more active and selective compounds with less toxicity is the main target of cancer researches. *Nasturtium officinale* L. has been used for a long time as a food and medicinal plant. Main therapeutic effects of this plant are due to rich essential nutrients as well as health-promoting plant secondary metabolites such as phenolics and glucosinolates. The plant was reported to have antiviral, antiinflammatory, diuretic, expectorant, antidiabetic, hepatoprotective, antihyperlipidemic and anticancer properties. The aim of this study is to make review about the previous reports on secondary metabolites of *Nasturtium officinale* L. in terms of or their effects against various cancer cell lines.

Keywords: Antiviral, anti-inflammatory, anticancer, *Nasturtium officinale*

1. INTRODUCTION

Cancer, as a complex disease is still one of the most important causes of deaths today in the modern world. Over a century, the extensive research about the etiopathogenesis of cancer and the studies on developing new drugs, led the scientists to search for new candidates of new anticancer compounds. Unfortunately, because of severe side effects and targeting of single pathways instead of addressing the many factors that enable cancer to develop, the classical chemotherapeutics could not reach to aimed success rates. Therefore, recent studies are focused

on plant secondary metabolites and their semi-synthetic analogues which have multi-targeted effects on cellular signal pathways [1].

2. MATERIAL AND METHODS

In the present review, information about medicinal properties and biochemical properties of *Nasturtium officinale* L., was gathered by searching scientific databases such as Elsevier, Google Scholar, PubMed, Springer, related book chapters and original research articles.

3. AIM OF THE PRESENT REVIEW

In the present review, pharmacological properties of *Nasturtium officinale* L. were discussed and evaluated for future cancer treatments.

4. MEDICINAL PROPERTIES

4.1 Ethnomedicinal Properties

Nasturtium officinale L., a perennial plant from Brassicaceae family, is traditionally used as raw and cooked form for culinary and for medicinal purposes such as respiratory system diseases, diabetes, oxidative stress, asthma, and immune deficiency [2-12].

4.2 Therapeutical Properties

The major active compounds of *Nasturtium officinale* are found to be phenolic compounds and glucosinolates. Main phenolic compounds were reported to be chlorogenic acid and isorhamnetin. Gluconasturtiin, a precursor of 2-phenylethyl isothiocyanate is reported as a glucosinolate compound with anticarcinogenic and antimicrobial activity. In addition to these secondary metabolites, having high amounts of minerals and with high antioxidant activity, it is worth for searching *Nasturtium officinale* for cancer protective effects [13-15].

N. officinale L. with high content of polyphenolic substances and glucosinolates, may help for anti-inflammatory response and increase antioxidant capacity in cancer patients or patients at high risk group [10,16-22]. Main flavonoids of *N. officinale* L. are found to be quercetin, kaempferol, isorhamnetin, chlorogenic acid, quercetin-3-O-rutinoside, cafeoyltartaric acid and caftaric acid [10,23-24].

Phenylethyl isothiocyanate was found to have an activity to inhibit the migration and invasion of human colorectal carcinoma cells and stop the proliferation of cancer cells. In the cell lines of human breast cancer, phenylethyl isothiocyanate was shown to decrease matrix-metalloprotease-9 and ALDH1 marker and also inhibit tumor invasion [25-27].

N. officinale has an angiogenesis inhibitory activity by decreasing the translation regulator 4E protein 1 (4E-BP1) phosphorylation, by decreasing the effect of hypoxia induction factor (HIF) one of the angiogenesis regulators, and by nuclear factor kB (NF-kB), activator protein (AP1) and tubulin. [28]. It was proven to be cancer protective by decreasing DNA damage and regulation of micro RNA's [23, 29-30].

7-methylsulfinylheptyl, 8-methylsulfinyloctyl and sitosterol 3-O-glucopyranoside isolated from *N. officinale*, specifically inhibit p-450 enzymes and activates phase 2 enzymatic reactions [31]. After consumption of *Nasturtium officinale*, the tobacco smoke specific lung cancer markers 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL) and [4-methylnitrosamino)-1-(3-pyridyl) but-1-yl]-beta-omega-D-glucosiduronic acid (NNAL- Gluc) was found to be increased in urine samples at 24 hours and therefore this effect was attributed for anticancer potential of the plant on tobacco-related and other types of lung cancer [32,33].

Some synergistic activities were also shown between *Juglans regia*, broccoli and *Nasturtium officinale* L. extracts [34].

5. CONCLUSION

Nasturtium officinale L. can easily be considered as safe because of its traditional culinary use and wide therapeutic range for cancer cell-specific effects that inhibit the cancer cell proliferation.

As a traditional culinary plant with vitamins, minerals and phytonutrients such as isothiosionates and gluconasturtiin, *Nasturtium officinale* L. may be considered as potential source for anticancer compounds of natural origin. Further *in vitro* and *in vivo* studies and clinical researches are needed to be conducted on *Nasturtium officinale* L.

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