IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 3, 2022

CENTELLA ASIATICA: A POTENT HERBAL AGENT IN CANCER THERAPY A DEEP ANALYSIS

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ABSTRACT:
Cancer is a group of diseases characterized by abnormal cell growth with the potential to invade or spread to other parts of the body. Women with genetic mutations in either BRCA1 or BRCA2 have an increased risk of developing breast and ovarian cancer. The lifetime risk of breast cancer for women with these mutations is estimated to be 82%, while the lifetime risk for ovarian cancer is 54%. Herbal medicine often exerts broad complementary or synergistic effects on physiological systems. Although scientific evidence for the effectiveness of herbal medicine is limited, many people find these remedies helpful, and their use is typically based on traditional practices rather than rigorous research. *Centella asiatica* is a medicinal herb widely used in folk medicine to treat various ailments. Its main constituents, asiatic acid and asiaticoside, have demonstrated anticancer activity against breast and ovarian cancers. Studies indicate that the growth suppression of cancer cells occurs in a concentration-dependent manner, with cytotoxic effects on SKOV-3 and OVCAR-3 ovarian cancer cells. *Centella asiatica* also inhibits cell proliferation in MCF-7 breast cancer cells. According to research, there have been no reports of negative interactions between Centella asiatica and medications, highlighting its potential as an anticancer agent.

Keywords: Herbal remedy, *Centella asiatica*, breast cancer, ovarian cancer, asiatic acid, asiaticoside, apoptosis, cytotoxic.

INTRODUCTION:

As specialty chemicals, bioactive natural compounds hold significant economic value. They are utilized in various applications, including pharmaceuticals, nutraceuticals, biological or pharmacological components, and as raw materials for pharmaceutical manufacturing. Indian Pennywort, known scientifically as Centella asiatica (Linn.), belongs to the Apiaceae family (formerly Umbelliferae). The medicinal uses of Centella asiatica have a long history, thoroughly reviewed by Brinkhaus et al. (2000). This history traces back to the Indian physician Sushruta (circa 1200 BC), includes traditional herbal medicine systems in Asian and African countries, and covers the plant's introduction to and scientific study in Europe during the 19th and 20th centuries [1]. Today, the plant or its derivatives are used in

commercial topical and oral products worldwide (Brinkhaus et al. 2000). Due to its numerous health benefits, such as antioxidant, anti-inflammatory, wound healing, and memory-enhancing properties, the use of Centella asiatica in food and beverages has increased over time [2].

Fig 1: *Centella asiatica* plant.

The plant, *Centella asiatica*, is known by various vernacular names such as Thankuni in Bengali, Mandookaparni in Hindi, Pegaga in Malay, Kodagam in Malayalam, Gotukola in Sinhalese, Vallarai in Tamil, and Bekaparanamu in Telugu . Centella asiatica can be found up to 600 meters above sea level throughout India's tropical and subtropical regions. It is also native to parts of China, the Western South Sea Islands, Madagascar, South Africa, Southeast USA, Mexico, Venezuela, Colombia, and Eastern South America. Additionally, it is found in Southeast Asia, India, and Sri Lanka [3].

Centella asiatica (L.) is a prostrate, mildly scented, stoloniferous, perennial creeping herb that grows up to 15 cm (6 inches) in height. The stem is glabrous, striated, and rooted at the nodes. The plant forms a lush green carpet in shaded, marshy, damp, and wet areas such as paddy fields and riverbanks. The most fertile soil for the regeneration of Centella asiatica is a sandy loam with 60% sand content, in contrast to clayey soil. The leaves, which emerge 1-3 from each node of the stem on long petioles, are 1.5–5 cm wide and 2–6 cm long. They are glabrous on both sides, orbicular-reniform in shape, with a crenate margin and a sheathing leaf base. The plant produces umbels of flowers in fascicles, with three to four white, purple, or pink flowers in each umbel. The flowering season is from April to June. The fruits are borne throughout the growing season, approximately 2 inches long, oblong, globular in shape, with a strongly thickened pericarp. The seeds have a pendulous embryo that is laterally compressed [4].

Chemical Constituents

Scientific literature corroborates the claims of the Indian medical system that Centella asiatica contains a diverse array of biochemical components, known as secondary metabolites, which are of significant importance in modern medicine. The plant is reported to contain the following types of chemical compounds:

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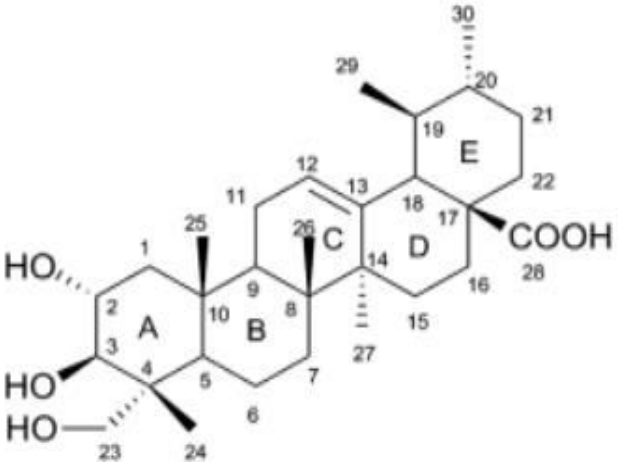

Fig2: Asiatic acid structure

Fig 3: Mechanism of action

Effects of Asiatic Acid on Cell Cycle

Asiatic acid increases the fraction of cells in the G0/G1 phase in a concentration-dependent manner.

This increase is accompanied by a significant decrease in the proportion of cells in the S and G2/M phases, indicating that G0/G1 phase arrest contributes to the growth-suppressive action of Asiatic acid.

Treatment with Asiatic acid significantly reduces the protein levels of CDK2, CDK4, CDK6, cyclin D, and cyclin E in a concentration-dependent manner.

Additionally, Asiatic acid treatment leads to a significant increase in the CDK inhibitors p21 and p27.

Consequently, cell proliferation can be halted by arresting the cell cycle at the G0/G1 phase .
Anticancer Activity of Centella Asiatica Extract

Asiatic acid, derived from Centella asiatica, exhibits cytotoxic effects on fibroblast cells and induces apoptosis in various cancer types.

In MCF-7 breast cancer cells, Centella asiatica extract significantly inhibits cell growth in a dose-dependent manner. Treatment with different concentrations of the extract results in a concentration-dependent decrease in cell viability, as evidenced by the MTT assay [5].

Asiatic acid induces apoptosis in ovarian cancer cells. Flow cytometry studies show that SKOV3 and OVCAR-3 cells undergo concentration-dependent apoptosis when treated with varying doses of asiatic acid. Cells treated with 40 µg/ml asiatic acid exhibit a 7–10 times higher percentage of apoptotic cells compared to those treated with a vehicle [6].

No concentration-dependent decline in cell viability was observed in other cell lines such as HeLa, HepG2, or SW 480. The increased cell death caused by asiatic acid may be due to the production of reactive oxygen species (ROS).

Additionally, the methanolic extract of Centella asiatica is known for its antioxidant properties.

Herb-Drug Interaction

- **Safety and Sedation**: No harmful interactions between Centella asiatica (CA) and medications have been reported to date. However, high doses of CA can cause sedation. Therefore, it should not be combined with drugs that promote sleep or reduce anxiety.
- **Blood Glucose and Cholesterol**: There is a theoretical concern that CA could affect blood glucose levels, potentially interfering with hypoglycemic and cholesterol-lowering treatments.

CONCLUSION

The study demonstrates that asiatic acid has a cytotoxic effect on ovarian cancer cells. At a concentration of 40 µg/ml, asiatic acid reduced the viability of both SKOV3 and OVCAR3 cells by approximately 50%, while showing no significant impact on the viability of normal ovarian surface epithelial (OSE) cells. Additionally, the extract did not exhibit cytotoxicity toward the lung carcinoma cell line A and the normal kidney cell line BHK-21. These results suggest that Centella asiatica may selectively target specific cancer cell lines, particularly those related to ovarian and testicular cancers.

The observed selectivity could be due to differences in the morphology and physiology of the tested cell lines, although this has yet to be confirmed. This selectivity is promising because most chemotherapeutic drugs currently affect both tumor and normal cells, posing risks to healthy tissues. Moreover, asiatic acid, unlike the methanolic extract of the same plant, is known to possess antioxidant properties.

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REFERENCES:

[1]. Kim, W. J., Kim, J., Veriansyah, B., Kim, J. D., Lee, Y. W., Oh, S. G., &Tjandrawinata, R. R. (2009). Extraction of bioactive components from Centella siatica using subcritical water. The Journal of Supercritical Fluids, 48(3), 211-216.

[2]. Gray, N. E., Alcazar Magana, A., Lak, P., right, K. M., Quinn, J., Stevens, J. F., ... & Soumyanath, A. (2018). Centella siatica: phytochemistry and mechanisms of neuroprotection and cognitive enhancement. Phytochemistry Reviews, 7, 161-194

[3]. Seevaratnam, V., Banumathi, P., Premalatha, M. R., Sundaram, S. P., & Arumugam, T. (2012). Functional properties of Centella asiatica (L.): A review. Int J Pharm Pharm Sci, 4(5), 8-14.

[4]. Verma, R., & Gurmaita, A. (2019). A review on anticarcinogenic activity of ―Centella asiatica‖. endangered species, 6, .

[5]. Singh, S., Gautam, A., Sharma, A., & atra, A. (2010). CENTELLA ASIATICA (L.): A PLANT W ITH IM M ENSE M EDICINAL POTENTIAL BUT THREATENED. endangered species, 3, 4.

[6]. Veerendra Kumar, M. H., & Gupta, Y. K. (2003). Effect of Centella asiatica on cognition and oxidative stress in an intracerebroventricular streptozotocin model of Alzheimer's disease in rats.