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## Anticancer Potential of Some Medicinal Plants: A Review



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### ABSTRACT

Cancer is one of the fatal diseases. It is a rapid and uncontrolled formation of abnormal cells which proliferate throughout the whole body of an individual and causes death in most of the cases. Many medical researchers throughout the world are practicing advanced researchers for cancer treatment. Radiations, chemotherapy and herbal formulations obtained from different plants are commonly used. Herbal medicines are very effective, less expensive and have no side effect. Various researchers from time to time carried out many studies and reported a lot of anticancer drugs from medicinal plants. The present review is mainly concerned with the compilation of data related to various medicinal plants that are used as anticancer agents. These plants are mainly used in the form of extracts formed in different solvents such as water, methanol, aqueous. Petroleum ether etc. Many bioactive compounds were obtained from these plants that have been used in cancer treatment.



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## INTRODUCTION

Cancer is a fatal disease that is caused when cells in the body grow or divided in an uncontrolled manner and not normal, killing normal cells and often causing death. Cancer is the second dreadful and very serious disease in the world. It causes about 13% of all annual deaths worldwide (Karimi et al., 2014)<sup>1</sup>. In a worldwide population of 6 billion in the year 2000, approximately 10 million victims of cancer disease were diagnosed, 5.3 million in men and 4.7 million in women. Today 24.6 million people are living with cancer and 6.7 million people are dying of cancer every year. A steadily increasing proportion of elderly people in the world will result in approximately a 50% increase in new cancer cases over the next 20 years. More men than women get cancer of the lung, stomach, throat and bladder. Prostate, breast and colon cancers are more common in richer countries than in poor countries (Kanavos et al., 2006)<sup>2</sup>. According to the American cancer society 2005, more than 175,000 cancer deaths were caused by tobacco use by the year 2005. Medical researchers throughout the world work a lot for the treatment of cancer. Among these researchers, herbal medicine is the main focus. Medicinal plants play a very important role in the treatment of cancer. Recently for the synthesis of potential anticancer herbal drugs, a lot of has been applied. So far, pharmaceutical companies have screened more than 25,000 plants for the formation of anticancer drugs. These medicinal plants contain various types of phytochemicals such as flavonoids, amino acids, steroids, tannins, saponins, proteins carbohydrates etc which play the significant role in the preparation of anticancer drugs. Herbal anticancer drugs are cheap, and there is no side effect in practicing of these drugs for treatment. Present review gives a precise and brief view of various medicinal plants, their extracts and bioactive compounds that were used to treat the various types of cancer disease.

### **Medicinal plants as anticancer agents:**

***Abelmoschus esculentus L. (Malvaceae):*** - Anticancer activity of the flowers of *A. esculentus* was reported against liver cancer HePG2 cell line by MTT assay. Results showed that phytochemical compounds of this plant have great potential to act as a source of useful anticancer drug<sup>3</sup>.

**Allium cepa (Alliaceae):** - Aqueous extract of *Allium cepa* was found to act as the cytoprotective agent of normal cells and cytotoxic agent for tumor cells. A significant decrease in melanoma B16F10 cell population by crude extract was observed<sup>4</sup>.

**Anacardium occidentale: - Phytochemical** compounds:  $\beta$ -Sitosterol,  $\beta$ -Sitosterol glucosidase, Gallic acid, 2,4-dihydroxyacetophenone and Tanacetene of stem bark of *A. accidentally* showed moderate anticancer activity against human cancer cell line, lung adenocarcinoma (A549). Results of cytotoxicity activity were expressed as IC<sub>50</sub> ( $\mu$ m) and doxorubicin was used as positive control<sup>5</sup>.

**Mothe et al.:-** reported high inhibitory activity of cashew gum from *A. Occidentale* against implanted sarcoma 180 solid tumors in mice. Resulted indicated that anti-tumor activity of the cashew gum can be used for the prevention of cancer disease in human<sup>6</sup>.

**Annona squamosa:** - Aqueous and organic extracts from defatted seeds of *A. squamosa* was studied on a rat histiocytic tumor cell line, AK-5 and the results showed that these extracts possessed antitumor property in vivo<sup>7</sup>.

**Azadirachta indica:-** A flavonoid compound called quercetin was extracted from the leaves of neem which restricted the proliferation of the HeLa cancer cell line after 24Hrs of treatment<sup>8</sup>. Neem leaves preparation was screened against Ehrlich Ascites carcinoma (EAC) in female Swiss albino mice. Results of this study indicated that extracts of neem showed a marked and progressive suppression of the tumor growth<sup>9</sup>.

**Allium sativum:-** Anticancer compound namely diallyl sulfide is present in garlic. Also, uncooked garlic has more anticancer potential than the supplements of garlic<sup>10</sup>.

**Albizia amara (Roxb.):**- It is a wild medicinal plant belongs to family Mimosideae, commonly known as "munja" and has been reported to have antioxidant, antibacterial, antifungal, anticancer properties. Gopinath et al<sup>11</sup>, in 2013, reported that *Albizia amara* leaf extract showed inhibitory potential against human breast cancer cells (MCF-7) by depletion of proteins-survivin and ORP150. Ethyl acetate leaf extract showed significant inhibitory potential and induced apoptosis

***Beta vulgaris* (Chenopodiaceae):** - It is widely used in traditional western cooking. Hussam Zein *et al.*,<sup>12</sup> reported the cytotoxicity activity of chard and beetroot leaves as anticancer agent towards the breast cancer (MCF7) and liver cancer.

***Brassica rapa*:-** Dharani *et al.*,<sup>13</sup> demonstrated anticancer activity of methanolic extract and nanoparticles of methanolic extract of *B. rapa chinensis* leaves (800, 1mg/kg orally) against Dalton's Lymphoma Ascites (DLA) in mice.

***Calotropis procera* (Arka):** *In vitro* assay for cytotoxic activity of the stem and leaves of *calotropis procera* was carried out against human cancer cell lines at the concentration of 10, 30 and 100g/ml. Results revealed that the extracts of the plant possessed *in vitro* anticancer potential against HCT-15 (colon) cancer cell line at different concentrations. Further, the fractionation of the extracts was carried out and the fractions were tested on the same human cancer cell line. It was found that all the fractions inhibited the growth of HCT-15 at 100g/ml except water soluble fraction but the significant growth inhibition was shown by the chloroform soluble fractions and 50% ethanolic extract<sup>14</sup>.

Root extracts of *calotropis procera* inhibit the proliferation of HeP2 cell via apoptotic and cell cycle disruption based mechanisms<sup>15</sup>.

***Camellia sinensis*:** Copper nanoparticles (CUPs) were synthesized from the leaf extract of *camellia sinensis*. They showed inhibitory activity against HT-29 (human colon cancer cell line), MCF-7 (human breast cancer cell line) and MOLT-4 cancer cell lines through sulphodiamine B assay<sup>16</sup>.

***Carica papaya*:-** Gurudatta *et al.*,<sup>17</sup> reported therapeutic efficacy of *Carica papaya* on BMBA-induced mammary carcinoma in rats. Administration of aqueous leaf extract of *Carica papaya* in a dose of 200mg/kg body weight prevented the progression of cancer growth.

***Datura metel*:-** Methanolic leaf extract of *Datura metel* has significant inhibitory effect on MCF-7 cancer cell line.<sup>18</sup>

***Eletteria cardamomum***:- Silver nanoparticles (AgNPs) using *E.cardamomum* seed extract were synthesized. Cytotoxicity of AgNPs of *E.cardamomum* against Human Larynx carcinoma cancer (HeP-2) and the inhibitory concentration (IC50) was found to be 51µg/ml<sup>19</sup>.

***Ficus Carica***: It is used to cure various human diseases. This medicinally important plant have many properties including antimicrobial, antioxidant and anticancer etc. Cytotoxic effects of different extracts and latex of *Ficus Carica* L. on HeLa cell line was reported. Administration of different concentrations of the extracts or latex after 24 hours incubation reduced the viability of the HeLa cancer cells<sup>20</sup>.

Jasmine *et al.*,<sup>21</sup> also reported the antioxidant and anticancer activity of *Ficus Carica* fruits.

***Ficus bengalensis* Linn. and *Ficus elastica* Roxb.** :- Methanolic extract of leaves and branches of both *F. elastic* and *F. bengalensis* showed cytotoxicity. Methanolic extract of Ficus elastic Roxb. leaves exhibit significant inhibition against liver (HePG-2) and breast (MCF-7) human tumor cell line<sup>22</sup>.

***Foeniculum vulgare***:- Methanolic extracts of fennel seeds revealed anticarcinogenic activity against breast, colon, and liver cancer cells. Cytotoxicity of the plant extracts was confirmed by using sulphodiamine-B assay<sup>23</sup>.

***Helianthus annuus* L.**:- Seed extract of *Helianthus annuus* L. has shown the cytotoxic action against two types of cancer cell lines, rhabdomyosarcoma (RD) and murine L20B cells. The administration of the seed extract of *H. annuus* (1.3, 2.6, 5.2, 10.4, 20.8, 41.6, 83.2, and 166.4 µg/ml) for 24, 48, and 72 hrs resulted in a clear cytotoxic action against two cell lines (RD and L20B). More significant inhibition (P<0.05) was reported at a concentration of 83.2 and the inhibitory effect on cancer cell line was concentration dependent<sup>24</sup>.

***Mentha spicata***:- The aqueous extract of *Mentha spicata* leaves exerted a significant cytotoxic effect on wehi-164 fibrosarcoma and U937 leukemic monocyte tumor cell lines. Inhibition of proliferation of these cancerous cell lines was dose and time- dependent<sup>25</sup>.

***Mentha longifolia***: It belongs to the family Lamiaceae and is commonly used in the pharmaceutical preparations. Khalil *et al.*,<sup>26</sup> have reported that water and methanolic extract of

*Mentha longifolia* leaves showed anti-cancer activity against human liver cancer (HepG2) and vero cell lines.

***Morus alba*:** Eleven flavonoids obtained from *Morus alba* showed cytotoxic activity against breast cancer (MCF-7), HeLa cells and liver cancer (HeP3B) cells. Among these 11 flavonoids obtained from mulberry, sanggenol L, M, murysyna, and furans have shown significant cytotoxic effect<sup>27</sup>. Boyoon chang *et al.*,<sup>28</sup> in 2015, also reported the anticancer activity of fruit extract of *Morus alba* against CT26 cancer cell through immune response mediated by toll- like receptor (TLR) 4 signaling. The result showed that mulberry fruit extract activated the macrophages and increased the level of immunoglobulin G (IgG) antibody production for inhibition of growth of cancer cells.

***Mimosa pudica*:** Kamanashis Das *et al.*,<sup>29</sup>; in 2014 conducted a research to investigate antioxidant and cytotoxic activities of methanolic extract of the leaves of *Mimosa pudica*. Results of this study showed moderate antioxidant activity-5.038mg/g AAE. Cytotoxicity activity was evaluated using brine shrimp lethality bioassay and indicated that *Mimosa pudica* leaves contain significant source of anticancer compounds. Chowdhury, *et al.*,<sup>30</sup> in 2012 also reported the in-vitro cytotoxicity activity of methanolic extracts of *Mimosa pudica*.

***Nelumbo nucifera Gaertn. cv. Rosa-plena* :-** Chi- Ming Liu *et al.*<sup>31</sup>., have isolated fifteen compounds from the leaves of *Nelumbo nucifera Gaertn. Cv. Rosa-plena*. These researchers have shown that the isolated compounds were characterized by the cytotoxic activity against human melanoma, prostate and gastric cancer cells. The strongest activity showed by 7-hydroxydehydronuciferine. These fifteen compounds include aporphine alkaloids: liriodenine, lysicamine, (-)-anonaine, (-)-asimilobine, (-)-caaverine, (-)-*N*-methylasimilobine, (-)-nuciferine, (-)-nornuciferine, (-)-roemerine, 7-hydroxydehydronuciferine and cepharadione B; two steroids:  $\beta$ -sitostenone and stigmasta-4,22-dien-3-one; and two chlorophylls: pheophytin-a and aristophyll-C and they also showed antioxidant activity.

***Phaseolus vulgaris cv.*:** It is commonly known as gold bean and is also used as the anticancer agent. Recently a trypsin inhibitor compound with the molecular mass of 17.5- kDa has been isolated and purified from this plant. This compound has been examined for antiproliferation activity against leukemia L1210 and lymphoma MBL2 cancer cells. Results of this study showed

that trypsin inhibitor significantly inhibited the proliferation of cancer cell lines with  $Ic_{50}$  value of about  $2\mu m^{32}$ .

***Piper nigrum***:- Pellitorine isolated from the roots of *Piper nigrum* showed cytotoxicity activity against HL60 and MCT cancer cell lines<sup>33</sup>.

**Reshmi, et al.**:-<sup>34</sup> an alkaloidal constituent namely piperidine have been isolated from the extract of *P. nigrum*. This compound was examined for invitro antitumor activity against HEP2 (Human epithiloma cells of laryax). Results showed that piperidine inhibited the proliferation of HEP2 cancer cells.

***Piper Genus***:- Methanolic and dichloromethane extracts of *P. retrofractum*, *P. betel* and *P. nigrum* displayed the cytotoxic effects against MC-7 cancer cell lines with  $IC_{50}$  values of  $8.33\pm 1.27$  and  $7.48\pm 0.57\mu g/ml$  by MTT assay<sup>35</sup>.

***Prunus armeniaca***:- Ethanolic extract of bitter almonds exhibited anticancer activity against HePG2, A549 and FL838 cancer cell lines. Also, the extract promoted apoptotic characteristics like cell shrinkage and cytotoxic effects in these cancer cells.<sup>36</sup>

***Solanum nigrum***:- Sanjay, et al;<sup>37</sup> in 2009 reported the in-vitro cytotoxicity activity of *S. nigrum* extracts against HeLa and Vero cancer cells.

***Tamarindus indica***: - Bioactive fraction of the bark extract of *T. indica* has been shown to promote apoptosis in HeLa and PA-1 cancer cell lines<sup>38</sup>.

**Lycopene**: - Lycopene and vitamin E combination were administered in breast cancer MCF-cell line and HEP-2 cells at the concentration of  $100\mu l/ml$  and  $150\mu l/ml$ . Results indicated that lycopene and vitamin E combination showed inhibitory effect on cell proliferation and differentiation of these cancer cells<sup>39</sup>.

## CONCLUSION

Medicinal plants play an important role in cancer treatment. Besides providing various resources for the survival of human beings, their role in medical fields also well known. From ancient times, medicinal plants are practiced in folk flore and traditional medicine system. Presently

many bioactive compounds obtained from these plants are used in pharmaceutical formulations for the treatment of cancer and many other fatal diseases. Further research is required in this field so that a large number of anticancer agents can be obtained for the sake of mankind.

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