



## A Critical Appraisal of Herbs Useful in the Management of Cancer

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### ABSTRACT

Cancer is major health problem in both developed and developing countries. It is considered as an adversary of modernization and advanced pattern of socio-cultural life dominated by Western medicine. Cancer is a leading cause of death worldwide and accounted for 7.9 million deaths (15% of all deaths) in 2007. The number of global cancer deaths is projected to increase 45% from 2007 to 2030 (from 7.9 million to 11.5 million deaths), influenced in part by an increasing and aging global population. New cases of cancer in the same period are estimated to jump from 11.3 million in 2007 to 15.5 million in 2030. Because of high death rate associated with cancer and because of serious side effects of chemotherapy and radiation therapy, many cancer patients seek alternative complementary methods of treatment. Although more than 1500 anticancer drugs are in active development with over 500 drugs under clinical trials, there is need to develop more effective and less toxic drugs through the heritage of Ayurveda. Plants have been used for treating diseases since time immemorial. The recent research findings give valuable information that the herbs such as Nimba (*Azadirachta indica*), Guduchi (*Tinospora cardifolia*), Ashwgandha (*Withania somnifera*), Haridra (*Curcuma longa*), Brahmi (*Bacopa moneri*), Hingu (*Ferula narthex*) are possessing anti-carcinogenic property and are useful at various levels. In the present study, an attempt is made by the authors to review recent research findings and record the data of the herbs useful in the management of cancer for the benefit of the mankind as well as the enthusiastic young scientist who are interested to work on these lines.

**Key Words:** Cancer, Nimba (*Azadirachta indica*), Brahmi (*Bacopa moneri*), Ashwgandha (*Withania somnifera*)

### INTRODUCTION

The incidence of cancer has been rising alarmingly for the last few decades. In India, cancers of oral cavity, oropharynx, esophagus, stomach, rectum, colon and lung are commonly seen in men, whereas cancers of the cervix and the breast commonly affected the Indian women. Cancer can be defined as an abnormal excessive, uncoordinated, autonomous and purposeless clonally proliferation of cells in any tissue or organ of the body. Cancer preys the host and continues to grow indefinitely, competing with the normal tissues for the nutrition. In spite of technical advancements in the diagnosis and management, cancer still remains a major health care burden throughout the globe. Therefore the scientists all over the world are looking for a safe and effective alternative, relying heavily on medicinal plants. Ayurveda is a storehouse of knowledge in the field of immunology and many medicinal plants have been prescribed for this condition. Many such recommendations of Ayurvedic texts have been scientifically validated.

### Aims and Objectives

1. To list out and reveal the anticancerous activity of the herbs
2. To provide information related to the recent research findings of those herbs.

### Materials and Methods

Various *Ayurvedic* compendiums have been consulted for this study as source material. Apart from this relevant modern medical scientific works are also been utilized for this study

### Probable Mode of Action of Medicinal Plants

The therapeutic effect of anti-cancerous medicinal plants is executed by inhibiting cancer- activating enzymes, stimulating DNA repair mechanism, promoting production of protective enzymes, including antioxidant action and by enhancing activity of the immune cells. Some of the medicinal plants protect the body from cancer by enhancing detoxification functions of the body. Certain biological responses modifiers derived from medicinal plants are known to inhibit growth of cancer by modulating the activity of specific hormones and enzymes. Some medicinal plants reduce toxic side effects of chemotherapy and radiotherapy<sup>1</sup>. Thus total herbs can be divided into following categories:

- Anti-tumor or Anti-mutagenic herbs
- Immune modularize herbs
- Radioprotective herbs

#### Anti-mutagenic or Anti-tumor Herbs

- Turmeric (*Curcuma longa*)
- kalmegha (*Andrographis paniculata*)
- Neem (*Azadirachta indica*)
- Pippali (*Piper longum*)
- Bhallataka (*Semecarpus anacardium*)

#### Immunomodulatory Herbs

- Pippali (*Piper longum*)
- Guduchi (*Tinospora cardifolia*)
- Ashwgandha (*Withania somnifera*)
- kalmegha (*Andrographis paniculata*)

#### Radioprotective Herbs

- Lasuna (*Allium sativum*)
- Kumari (*Aloe vera*)
- Shigru (*Moringa oleifera*)
- Tulasi (*Ocimum sanctum*)

### ANTI-MUTAGENIC OR ANTI-TUMOR HERBS

#### Haridra (*Curcuma longa*), Zingiberaceae<sup>2</sup>



Guna: Laghu, Ruksha, Rasa: Katu, Tikta  
Vipaka: Katu, Virya: Ushna  
Dosha karma: Kaphapittahara

Active ingredient: Curcumin

#### Research Profile:

- Curcumin (Diferuloylmethane) is a polyphenol derived from the plant *Curcuma longa*, commonly called turmeric. Extensive research over the last 50 years has indicated this polyphenol can prevent and treat cancer.
- The anticancer potential of curcumin stems from its ability to suppress proliferation of a wide variety of tumour cells. Evidence has also been presented to suggest that curcumin can suppress tumor initiation, promotion and metastasis.
- Pharmacologically, curcumin has been found to be safe. Human clinical trials indicated no dose limiting toxicity when administered at dose up to 10g/day<sup>3</sup>.
- It enhances anticancer effect of cisplatin and reduces its nephrotoxicity in fibrosarcoma bearing rats<sup>4</sup>.

It is found to be an antiproliferative agent for breast tumour cells and help in breast cancer<sup>5</sup>.

#### Kalmegha (*Andrographis paniculata*)<sup>6</sup>



Guna: Laghu, Ruksha Rasa: Katu, Tikta  
Vipaka: Katu Virya: Ushna  
Dosha karma: Kaphapittahara

Active ingredient: Andrographolide

#### Research profile:

- The anticancer and immunomodulatory activity of the methanolic extract of *A. paniculata* in human cancer and immune cells is evaluated and the Dchloromethane fraction significantly inhibits the proliferation of HT-29(colon cancer) cells and augments the proliferation of Human peripheral blood lymphocytes (HPBLs) at low concentrations.<sup>7</sup>
- On further fraction of the Dicloromethane extract, three Diterpene compounds were isolated, i.e. Andrographolide, 14-deoxyandrogrpholide and 14-deoxy-11, 12- didehydroandrographolide<sup>8</sup>.
- Andrographolide showed anticancer activity on diverse cancer cells representing different types of human cancer and all the three molecules showed enhanced proliferation and interleukin-2 (IL-2) induction in HPBLs<sup>9</sup>.

The extract and isolated Diterpene from this plant are proved to be beneficial against tumourigenesis by their anti-lipoperoxidative action and by enhanced carcinogen detoxification action<sup>10</sup>.

#### Nimba (*Azadirachta indica*), Meliaceae<sup>11</sup>



Guna: Laghu, Rasa: Kashaya, Tikta  
Vipaka: Katu Virya: Sheeta  
Dosha karma: Vatapittahara

Active ingredient: Nimbinin, margosin

#### Research profile:

- Recent researches indicated that an ethanolic extract of *A. indica* has been shown to cause cell death of

prostate cancer cell by inducing apoptosis as evidence by dose dependent increase in DNA fragmentation and decrease in cell viability<sup>12</sup>.

- Different studies indicate its use against buccal carcinogenesis, prostate cancer, breast cancer, gastric carcinogenesis and B12 melanoma.<sup>13</sup>.

*A. indica* has also revealed chemo preventive capability by regressing the hepato-carcinogenesis induced by DEN/AAF carcinogens<sup>14</sup>.

### Pippali (*Piper longum*), Piperaceae<sup>15</sup>



Guna: Laghu, snigdha, Tikshna, Rasa: Katu, Vipaka: Madhur Virya: Anuushnashita Dosh karma: Kaphapittahara

*Active ingredient:* Piperine

#### Research profile:

- Its active alkaloid piperine used as an ingredient in Ayurvedic anticancer formulation because of its possessing antioxidative potency in vitro and in vivo conditions<sup>16</sup>.
- Studies revealed increases in MMI and phagocytic activities which prove that it enhance the host resistance in accordance with its immune stimulation property<sup>17</sup>.

It has also been screened for inhibitory effect of lung metastasis which is evident for anti cancer activity<sup>18</sup>.

### Bhallataka (*Semecarpus anacardium*), Anacardiaceae<sup>19</sup>



Guna: Laghu, Snigdha, Tikshna, Rasa: Katu, Tikta, Kashya Vipaka: Madhur Virya: Ushna Dosh karma: Kaphapittahara

*Active ingredient:* Semecarpol, bhilawanol

#### Research profile:

- In Ayurveda classics, numerous references are available on the anticancer properties of *Semecarpus anacardium* nuts<sup>20</sup>.

- The chloroform extract of *S. anacardium* nut possess antitumour action with increased life span against leukemia, melanoma and glioma<sup>21, 22</sup>.
- The milk extract of *S. anacardium* produces regression of hepatocarcinoma by stimulating host immune system<sup>23</sup> and normalizing tumour markers including alpha-fetoprotein levels<sup>24, 25</sup>.
- This preparation stabilizes the lysosomes, and normalizes glycoprotein and mineral content in the body during cancer progression<sup>26, 27</sup>. It also corrects hypoglycemia and controls abnormal lipid peroxidation by the maintenance of antioxidant defense status<sup>28</sup>.
- In the microsomes, it acts as a bifunctional inducer of both phase I and II biotransformation enzymes and prevents tumour initiation by preventing carcinogen activation<sup>29</sup>. Histological, on treatment with the *S. anacardium* extract to hepatocarcinoma animals, the liver sections showed almost a normal architecture. The nodules become completely regressed and further cell necrosis was prevented<sup>30</sup>.
- *Anacartin forte*, another preparation from *S. anacardium* has been used for several decades as an anticancer drug since it is giving health improvement with alleviation or disappearance of troublesome symptoms. It provides clinical benefit with an extension of survival time in various cancers including oesophageal, chronic myeloid leukemia, urinary bladder and liver cancer<sup>31</sup>.

Another Ayurvedic drug containing *S. anacardium*, *Amura rohitaka*, *Glycyrrhiza glabra* and copper powder were reported to inhibit breast tumour development in mice by significantly extending the survival period. This drug was also found to be efficient in clinical trials<sup>32</sup>.

### IMMUNOMODULATORY HERBS

#### Guduchi (*Tinospora cardifolia*), Menispermaceae<sup>33</sup>



Guna: Snigdha, Guru Rasa: Kashaya, Tikta Vipaka: Madhur Virya: Ushna Dosh karma: Kaphapittahara

*Active ingredient:* Giloin, berberine

#### Research profile:

- The active principles of *T.cardifolia* enhance host immune system by increasing immunoglobulin and blood leukocytes levels and by the stimulations of stem cell proliferation. It has the ability to reduce solid tumour volume by 58.8%, which is comparable to cyclophosphamide, a known chemotherapeutic agent<sup>34</sup>.

- These immune stimulating properties can be used in the prevention of tumour mediated immunosuppressant and hence could be a drug choice for various cancers. Exposure of Hela cells to 0,5,10, 25, 50, and 100 microg/ml of *Guduchi satva* (methanol, aqueous and methylene chloride) resulted in a dose dependent but significant increase in cell killing, when compared to non-drug treated controls. The effect of Guduchi extracts was comparable or better than doxorubicin treatment<sup>35</sup>.

#### Ashwagandha (*Withania somnifera*), Solanaceae<sup>36</sup>



Guna: Laghu, snigdha Rasa: Katu, Tikta, kashaya  
Vipaka: Madhur Virya: Ushna  
Dosha karma: Kaphavatahara

*Active ingredient:* Cuesohygrine, anahygrine

#### *Research profile:*

- Effect of *Withania somnifera* on the cellular immune response (CMI) was studied in normal as well as tumour bearing animals. Administration of *Withania* extract was found to enhance the proliferation of lymphocytes, bone marrow cells and thymocytes in responses to mitogens<sup>37</sup>.

The chemo preventive effect of *Withania somnifera* hydroalcoholic root extract on 7,12-dimethylbenzanthracene (DMBA) induced skin cancer was investigated in Swiss albino mice and results suggest its potential chemo preventive activity in this experimental model of cancer. The chemo preventive activity may be linked to the antioxidant/ free radical scavenging constituents of the extract<sup>38</sup>.

#### HERBS ON CHEMOTHERAPY/ RADIATION

#### Rasona (*Allium sativum*), Liliaceae<sup>39</sup>



Guna: Snigdha, Tikshna, Picchila Rasa: Madhur,  
Lavana, Katu,  
Tikta, Kashaya  
Vipaka: Katu Virya: Ushna  
Dosha karma: Kaphapittahara

*Active ingredient:* Allyl-propyl sulphide, diallyl disulphide

#### *Research profile:*

Water soluble derivative of garlic, S-allylmercaptocysteine (SAMC), inhibit proliferation and cell cycle progression in two human colon cancer cell lines, SW-480 and HT-29, similar to the effects of sulindac sulfide (SS), a well known colon cancer chemo preventive agent. Co-administration of SS with SAMC enhanced the growth inhibitory and apoptotic effects of SS, suggesting the usefulness of SAMC alone or in combination with SS or other chemo preventive agents<sup>40</sup>.

#### Kumari (*Aloe vera*), Liliaceae<sup>41</sup>



Guna: Guru, Snigdha, Picchila Rasa: Katu,  
Vipaka: Katu Virya: Sheeta  
Dosha karma: Vatapittahara

*Active ingredient:* Aloin

#### *Research profile:*

- In a randomized double blind clinical trial, comparing mild soap and Aloe vera gel against incidence of radiation therapy induced skin reactions; the median time of five weeks was taken to show any skin changes in the aloe/soap treatment versus three weeks in the soap only treatment. The protective effect of adding aloe to the soap regimen increases during long time radiation exposure<sup>42</sup>.

In another clinical trial involving patients with advanced solid tumours, for whom no other standard effective therapy was available, combination of pineal indole melatonin (MLT) plus Aloe vera extracts produced some therapeutic benefits, at least in terms of stabilization of diseases and survival when compared to MLT alone treatment.<sup>43</sup>

**Shigru (*Moringa oleifera*), Moringaceae<sup>44</sup>**



Guna: Laghu, Ruksha Rasa: Katu, Tikta  
Vipaka: Katu Virya: Ushna  
Dosha karma: Kaphapittahara

*Active ingredient:* Moringine

*Research profile:*

Pre treatment with the leaf extract of *M. oleifera* exhibits significant radiation protection to the bone marrow chromosomes in mice and this could be use full to overcome side effects of radiation therapy<sup>45</sup>.

**Tulasi (*Ocimum sanctum*) Labiatae<sup>46</sup>**



Guna: Laghu, Ruksha Rasa: Katu, Tikta  
Vipaka: Katu Virya: Ushna  
Dosha karma: Kaphapittahara

*Active ingredient:* Orantin, Vicenin

*Research profile:*

Orientin and Vicenin, two water soluble flavonoids isolated from the leaves of *Ocimum sanctum* have shown significant protection to the human lymphocytes against the clastogenic effect of radiation, radiation lethality and chromosomal aberrations in vivo. This radioprotection associated with their antioxidant activity may have clinical potential in cancer therapy<sup>47</sup>.

**POTENTIAL BENEFITS OF AYURVEDIC HERBS DURING CANCER CACHEXIA**

Cancer cachexia is a common clinical problem that substantially impacts upon the quality of life and survival of cancer patients. The pathophysiology of this syndrome implicates tumour induced metabolic changes and immune responses. Clinical manifestations include anorexia, chronic nausea and change in body image. Among several potential

benefits of Ayurvedic medicine, relief from cancer cachexia is especially valuable. Ayurvedic herbs used in cancer therapy results not only in total healing, but also reduce the side effects and cancer associated complications. It also avoids the need for supplementation therapy to manage cancer cachexia. Each herbal product contains multiple active principles that may operate synergistically, producing therapeutic benefits and lowering the risks on adverse effects.

**Anorexia or Weight Loss**

It is effectively managed by *Withania somnifera*, *Sida cordifolia*, *Asparagus racemosa*, *Vitis vinifera*, *Plumbago zeylanica*, *Tinospora cordifolia*, *Zingiber officinale*, etc. These herbs have been shown to improve appetite, food intake, malnutrition, fatigue and sensation of wellbeing which could elicit bodyweight gain. These herbs might stimulate the flow of digestive juices, thereby improving digestion and increasing the appetite.

**Diarrhoea :**

*Aegle marmelos*, *Holarrhena antidysenterica*, *Punica granatum*, *Cyperus rotundus*, *Embllica officinalis*, and *Plumbago zeylanica* can be used as antidiarrhoeals when diarrhoea becomes one of the complications of cancer cachexia.

**Chronic Constipation:**

*Terminalia chebula* could be useful against chronic constipation and digestive disorders which are common in cancer patients resulting in loss of appetite.

**Nausea and Vomiting:**

*Eclipta prostrata*, *Embllica officinalis*, *Withania somnifera*, *Piper longum* can be directed to correct nausea and vomiting. Among the above-mentioned herbs, *Withania somnifera* and *Tinospora cordifolia* are also proven to be powerful immunostimulants, which could increase body resistance power during cancer associated immunosuppression.

**Anxiety, Stress:**

*Bacopa monniera* strengthens mental faculties and helps to manage insomnia or sleeplessness due to stress<sup>48</sup>. An herbal combination of *Withania somnifera*, *Asparagus racemosa*, *Hydrocotyle asiatica*, *Nardostachys jatamansi*, *Elettaria cardamomum*, *Tribulus terrestris*, *Zingiber officinalis* and *Eclipta alba* could also be useful in the treatment of anxiety, tension and insomnia. *Ocimum sanctum* is beneficial against stress and depression during cancer.

**Cough**

*Curcuma longa*, *Zingiber officinale*, *Glycyrrhiza glabra*, *Terminalia chebula*, *Ocimum sanctum* and *Adhatoda vasica* are used to control cough and shortness of breath especially for lung cancer patients<sup>49</sup>.

Thus, Ayurvedic therapeutic regimen rejuvenates the body tissues, tones up the systems and act as a tonic to the body against cancer cachexia. This kind of orientation toward total healing and health promotion makes Ayurvedic treatment approach to cancer therapy promising.

**CONCLUSION**

In view of the exciting scenario, Ayurveda has a vital role to play in the prevention and management of cancer. Ayurvedic anticancer therapy includes recommendations for lifestyle and use of specific foods and herbs which are very helpful not only in preventing the progression of the disease but also makes the patients feel better and comfortable overcoming the symptoms. With advanced knowledge of molecular science, anti cancerous activity of various medicinal plants has been explored. In the light of some preliminary evidences, efforts to develop some alternatives preventive and curative medicines could be done through extensive studies. By understanding the complex synergistic interaction of various constituents of anticancer medicinal plants, effective compound formulations can be developed to act directly on the cancerous cells without harming normal cells of the body and improving the quality of life by boosting the immune system.

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