

## ANTI-CANCEROUS EFFECTS OF VARIOUS AYURVEDIC HERBS: A REVIEW

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### ABSTRACT

Non-Communicable Diseases (NCDs) are responsible for majority of deaths worldwide. Out of all the NCDs, cancer is the leading cause of death before the age of 70 years. Worldwide incidence and mortality of Cancer is rapidly increasing. The contemporary cancer therapy (chemotherapy) is known to have drug-induced toxic side effects. Hence, there is an urgent need to explore safer possibilities in Ayurveda. Ayurvedic herbs work on different organ systems simultaneously, thereby healing the body as a whole, as well as supporting the body's defence system. Symptoms of diseases like *arbuda*, *granthi* etc. described in Ayurvedic texts, have much

resemblance with clinical features of carcinoma. Further, in Ayurveda, many plants are told to have *granthihara*, *gandmalahara*, *arbudahara* properties. Various studies have also been conducted to prove the anti-cancerous activities of herbal drugs like curcumin, *Triphala*, *Guduchi Haritaki* (*Terminalia chebula*), *Vacha* (*Acorus calamus*), *Kanchanara* (*Bauhinia variegata* (L.) Benth.), *Bhumyاملaki* (*Phyllanthus amarus*), *Yahtimadhu* (*Glycyrrhiza glabra*) etc. Therefore, need of the hour is to develop adjuvant chemotherapeutic agents for various carcinomas. Keeping this in view, the present work is designed to review and summarize the research works carried out in recent past, regarding anti-cancerous activities of various herbs. For this purpose, a thorough study of various research articles, as well as the Ayurveda classics have been carried out to bring out a valuable compendium.

**KEYWORDS:** Anti-cancerous Herbs, *Curcumin*, *Guduchi*, *Triphala*.

## INTRODUCTION

Cancer is a major public health problem in both developed and developing countries. It is defined as the uncontrolled growth of abnormal cells in the body and is one of the major causes of death worldwide. It is estimated that worldwide new incidence of Cancer is about 6 million cases per year.<sup>[1]</sup> It is the second major cause of death after cardiovascular diseases.<sup>[2]</sup>

There is a constant demand for new therapies to prevent and treat this life-threatening disease. In *Sushruta Samhita*, there is a mention of *arbuda* and *granthi*, the signs and symptoms of which are similar to cancerous growth. Therefore, the medicines which are used for the treatment of *arbuda* and *granthi* must possess anti-cancerous activities. Various other herbs having anti-cancerous properties are mentioned in Ayurveda classics. In this article, an attempt has been made to summarize the important work done in recent past regarding the anticancer properties of various herbs.

The contemporary cancer therapy (chemotherapy) is known to have drug-induced toxic side effects. Ayurvedic formulations, however, work on different organ systems simultaneously, acting on multiple biochemical pathways and healing the body as a whole. Ayurvedic medicines support the body's defence system as well. Therefore, an integrated approach in anti-cancer treatment will be very helpful for the mankind as a whole to reduce and eliminate suffering in the world.

According to the World Health Organization (WHO), about three quarters of the world's population currently uses herbs and other forms of traditional medicines to treat diseases.<sup>[3]</sup> There are atleast 2,50,000 species of plants, out of which more than one thousand plants are found to possess significant anticancer properties.<sup>[4]</sup> These drugs have been used in Ayurvedic medicines since ages. The plant kingdom produces naturally occurring secondary metabolites which, in recent times, are being investigated for their anticancer activities, leading to the development of new clinical drugs. Also, worldwide efforts are going on, to identify new anticancer compounds from plants. In the recent years, owing to the fear of side effects, people prefer more and more use of natural plant products for the treatment of cancer or to overcome the side effects of conventional drug therapies. Owing to these reasons, World Health Organization (WHO) supports the use of traditional medicines which are efficacious and non-toxic.<sup>[5]</sup>

## MATERIALS AND METHODS

An exhaustive literature survey of published work in research journals available in PubMed, Ayu, DHARA and Research Gate as well as Ayurveda classics have been carried out.

## DISCUSSION

Cancer is the abnormal malignant growth of body tissues or cells. A cancerous growth is called a malignant tumour or malignancy. A non-cancerous growth is called a benign tumour. The process of cancer metastasis consists of a series of sequential interrelated steps, each of which is rate limiting.<sup>[6]</sup>

In a study carried out by Gaidhani S.N. et al, titled “In-Vitro Anticancer Activity of Standard Extracts Used In Ayurveda”, which was published in 2009 in PhacoMag, the hydro-alcoholic extracts of five Ayurvedic medicinal plants viz. pericarp of *Terminalia chebula*, rhizome of *Acorus calamus*, stem bark of *Bauhinia variegata*, whole plant of *Phyllanthus amarus*, and root of *Glycyrrhiza glabra* were evaluated for their anti-proliferative activity on fourteen cancer cell lines. These plant extracts were tested by sulforhodamine-B (SRB) assay for its anti-proliferative activity and it was found that four extracts except *Glycyrrhiza glabra* were active against prostate cancer cell line (DU145). In addition to this, *Terminalia chebula* exhibited activity against leukaemia cancer cell line (K562). These five plant extracts were selected for studying anticancer activity based on the available literature. This study proves that the promising active principle in *Terminalia chebula* inhibits both prostate cancer and leukaemia.<sup>[7]</sup>

Further, the anticancer properties of curcumin have been highlighted in another study which was carried out by Wilkon et al and published in 2011 in Molecular cancer.<sup>[8]</sup> Curcumin (diferuloylmethane) is a polyphenol derived from *Curcuma longa* plant, commonly known as turmeric. It is nontoxic and has a variety of therapeutic properties including anti-oxidant, analgesic, anti-inflammatory and antiseptic activity. More recently curcumin has been found to possess anti-cancer activities based on its effect on a variety of biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and metastasis. Curcumin has shown anti-proliferative effect in multiple cancers. Head and neck squamous cell carcinoma (HNSCC) is the sixth most common cancer worldwide and treatment protocols include disfiguring surgery, platinum-based chemotherapy and radiation, all of which may result in tremendous patient morbidity. This study has proved that Curcumin is a potential candidate in head and neck cancer. Curcumin

(diferuloylmethane) is the chief component of the spice turmeric and is derived from the rhizome of the *Curcuma longa*. Curcumin has been consumed as a dietary supplement in India for centuries and is considered pharmacologically safe. Epidemiological studies attribute the low incidence of colon cancer in India to the chemo preventive and antioxidant properties of diet rich in curcumin.<sup>[9]</sup> Curcumin's inhibitory effect on carcinogenesis has been demonstrated in several animal models of various tumour types including oral cancer, mammary carcinoma and intestinal tumours.<sup>[10]</sup> Studies of curcumin in various head and neck cancer cell lines have demonstrated decreased cell growth and survival, concomitant with the compound's effects on molecular pathways involved in cellular proliferation. In another study conducted by Chakravarti et al<sup>[11]</sup>, it is seen that curcumin suppressed the growth of immortalized oral mucosal epithelial cells and squamous cell carcinoma cells (UMSCC22B and SCC4) while having minimal effect on normal oral epithelial cells. Therefore, this compound may also be used as an adjuvant agent in combination with standard platinum-based chemotherapy for the treatment of head and neck tumours. Further, Curcumin's lack of systemic toxicity and mechanism of action may make it best suited as an adjuvant therapy for head and neck cancers that are resistant to most of the other therapies.<sup>[12]</sup>

As far as oral cancer is concerned, it is the fifth most common cancer seen in the human body. It has been reported that over 12 million people use some form of tobacco, which is one of the high risk factors and has hence become an alarming world-wide problem. Oral cancer is major problem in India and accounts for 50-70% of all cancers diagnosed when compared to 2-3% in UK and USA.<sup>[13]</sup> Further, it is seen that the use of different forms of tobacco and betel nut have convincing relationship in development of oral pre-cancerous lesions. In such cases, *Triphala* was found to have great potential for reversal of these lesions. In a study conducted by Deshpandey et al which was published in Ayu in 2014, the screening for teenagers belonging to low socio-economic status was carried out.<sup>[14]</sup> In this study, suspected subjects were evaluated for the reversal of such lesions by use of Ayurvedic preparation containing *Triphala* as a mouthwash. For this study, working-child population of North India, between the age of 13 to 19 years was selected. Screening was performed and the positive subjects were further investigated by pap smear and biopsy was done as a confirmatory histopathological report. In second phase, the subjects showing positive lesions were advised indigenous anti-cancer mouth rinse and its effect was evaluated after 6 month and 9 month of treatment i.e. mouth rinsing with *Triphala kvatha*. Histological findings after

9 month use of *Triphala* mouth rinse revealed no changes in cells in 23 (85.2%), hyperkeratinisation in 2 (7.4%), hyperkeratinisation and spongiosis was evident in 1 (3.7%), mild pleomorphism in 1 (3.7%) patient. Thus, proving that *Triphala* is having a great potential for reversal of these lesions.<sup>[15]</sup>

Again, it has been proved in a study conducted by Bansal P. et al published in the Gulf Journal of Oncology in 2017, that, Guduchi, *Tinospora cordifolia* extracts (TCE) induced inhibition of proliferation of KB cells, which was associated with arrest of G0/G1-phase of cell cycle. The effectiveness of TCE in checking the growth of KB cells without altering the growth of normal peripheral blood mononuclear cells (PBMC) indicates that *Tinospora cordifolia* has differential effect on normal and malignant cells hence, it may have therapeutic potential in Human Oral Squamous Cell carcinoma.<sup>[16]</sup>

Further, the different Ayurvedic herbs/ plant species having anticancer properties are listed in the table.<sup>[17]</sup> given below, alongwith their details i.e. active constituents, common names, part used, special character etc.

Sl. No.	Plant name	Family	Part used	Phytochemicals	Specific cancer suppressed
1	<i>Curcuma longa</i> L.	Zingiberaceae	Rhizomes	Curcumin, ascorbic acid	Leukemia, glioblastoma and colon cancer (In vitro)
2	<i>Ocimum sanctum</i> L.	Lamiaceae	Leaves	Eugenol, orientin, vicenin	Breast, liver and fibrosarcoma cancer (In vitro)
3	<i>Solanum nigrum</i> L.	Solanaceae	Leaves	Solamargine, solasonine	Breast, liver, lung and skin cancer (In vitro)
4	<i>Glycyrrhiza glabra</i> L.	Leguminosae	Roots	Licochalcone-A, licoagrochalcone	Prostate, breast, lung, stomach and kidney cancer (In vivo)
5	<i>Psoralea corylifolia</i> Linn.	Leguminosae	Seeds	Psoralidin	Stomach and prostate cancer
6	<i>Nigella sativa</i> L.	Ranunculaceae	Seeds	Thymoquinone	Colon, prostate, breast and pancreas cancer
7	<i>Ocimum sanctum</i> L.	Lamiaceae	Leaves	Eugenol, orientin, vicenin	Breast, liver and fibrosarcoma
8	<i>Moringa oleifera</i> Lam.	Moringaceae	Flowers, leaves	Moringaoleifera protease inhibitor (MoPI)	Abdominal cancer (Both in vitro and in vivo)
9	<i>Bauhinia variegata</i>	Fabaceae	Flower	Kaempferolgalactoside	Breast, lung and liver cancer (In vivo)
10	<i>Withania somnifera</i> (L.)	Solanaceae	Roots	Withaferin A, D	Breast, cervix, prostate and colon cancer

	Dunal				(In vivo)
11	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Rhizomes	6-Shogaol	Ovary cancer (In vitro)
12	<i>Aegle marmelos</i> Correa	Rutaceae	Bark, root	Lupeol	Lymphoma, melanoma, leukemia and breast cancer (In vitro)
13	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Ginger	Gingerol	Ovary, cervix, colon, liver and urinary cancer (In vitro and in vivo)
14	<i>Aegle marmelos</i> Correa	Rutaceae	Stem bark	Skimmianine	Liver cancer (Both in vitro and in vivo)
15	<i>Boswellia serrate</i> Triana & Planch.	Burseraceae	Gum	Boswellic acid	Prostate cancer (In vitro)
16	<i>Curcuma longa</i> Linnaeus	Zingiberaceae	Dried rhizome	Curcumin	Colon adenocarcinoma (In vitro)
17	<i>Alstonia scholaris</i> R. Brown	Apocynacea	Root bark	O-methylmacralstonine, talscarpine, villalstonine, pleiocarpamine	Lung cancer (Both <i>in vitro</i> and <i>in vivo</i> )
18	<i>Andrographis paniculata</i> (Burm. F.) Nees	Acanthaceae	Whole plant	Andrographolide	Colon cancer (Both <i>in vitro</i> and <i>in vivo</i> )
19	<i>Betula utilis</i> D. Don	Betulaceae	Bark	Betulinic acid	Melanomas (In vitro)
20	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Leaves	Plumbagin	Liver, fibrosarcoma, leukemia and breast cancer (In vitro)
21	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	Root stem and leaves	Adriamycin and 5-fluorouracil	Human cervical cancer cell ( <i>In vitro</i> )
22	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	Flower	Butrin, (7,3',4'-trihydroxyflavanone-7,3'-diglucoside)	Liver cancer ( <i>In vitro</i> and <i>in vivo</i> )
23	<i>Vitex negundo</i> L.	Lamiaceae	Fruit	Chrysoplenetin	Human pancreatic cancer ( <i>In vitro</i> )

## CONCLUSION

Ayurvedic traditional medicines are increasingly being used in different parts of the world. Plants are loaded with chemicals having chemo-protective activities, some of which are still undergoing clinical trials. Plant derived anticancer agents are very effective inhibitors of cancer cells lines, leading them to be in high demand. Utilization of these agents upto their full potential is need of the hour so as to keep in pace with the rising demands and to maintain their sustainability. Therefore, a brief list has been created which can give an idea about the huge variety of medicinal plants available throughout the world which can be used for their anticancer activities for the benefit of mankind as a whole.

Further, detailed study of the plants having anti-cancer properties have suggested that the herbs which are having *Katu*, *Tikta*, *Kasāya Rasa* (bitter, pungent, and astringent taste), *Usna Virya* (e.g., hot biopotency), and *Katu Vipāka* (catabolic active metabolites), have significant anticancer properties. In addition, the herbs which have dry, coarse, light, and sharp biophysical properties also have anticancer properties.

**CONFLICT OF INTEREST:** We declare that we have no conflict of interest.

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