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Integrative Approaches to Cancer Care and Research through *Yoga* and Herbal Medicines during the Chemotherapy Treatment

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ABSTRACT

The present communication is a review on various integrative approaches for the cure of cancer with an involvement of modern methodology, the chemotherapy, radiation, *Yoga*, and use of herbal medicines. In general, the cancer is manageable as pre and post treatment management by the use of *Yoga* and herbal medicines. Various types of *Yoga* and *Pranayama* keeps the body free from ailments even the serious diseases like cancer. During chemo and radiation therapy of the cancer patient's number of body disorders are reported, viz., giddiness, nausea, vomiting, and fatigue, etc. To manage these upcoming symptoms *Yoga* and herbal medicines play very vital role for the management of these disorders. On various literature survey from the world 42 medicinal plants were recorded to manage cancer disorders out of which *Allium sativum*, *Curcuma longa*, *Coptis chinensis*, *Hemidesmus indicus*, *Pistacea integerrima*, *Tinospora cordifolia* and *Withania somnifera* plays vital role as a preventive and post therapy management of cancer.

Key words: Cancer Care, Herbal Medicines, Chemotherapy, *Yoga*, *Pranayama*, Radiation Therapy

INTRODUCTION

Cancer is an abnormal growth of cells in body and is not a single step disease. It gradually starts with mutation in single cell which then proliferates, invades other cells and divide abnormally and can occur in any part of body at any stage in life.^[1] In 2018 worldwide approximately 18 million cases of cancer were reported and by 2025 approximately 420 million new cases will be reported as predicted by global demographic characteristics.^[2]

The treatment of cancer may require a combination of

two or more strategy depending on severity of it. Surgery with radiation therapy is generally used for solid tumors. In radiotherapy high doses of radiation are used either to shrink a cell or kill a cell thereby resulting in DNA damage thus minimizing the growth of cancerous cells.^[1] Chemoprevention is an effective means for the treatment of cancer done with the help of specific molecules, i.e., nutrients or chemicals.^[3] These can be of synthetic origin or plant based origin. The bioactive phytoconstituents present in the plants even in low amounts are able to produce great impact in cancer treatment.^{[4],[5]} Since ancient times in *Ayurveda* and Latin American folk medicine long pepper, citrus fruits, leaves of tea and seeds of coffee and many more plants have been reported for their anticancer potential.^{[4],[6]} The consumption of whole plant foods or either pure extracts from plants.

To prevent cancer is also known as 'Green chemoprevention'.^{[7],[8]} A close association between dietary intake with active phytoconstituents and reduced risk of cancer^[9] has been observed in epidemiologic studies conducted during last three decades. There had been reports that some individual

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constituents did not show activity when used alone, however in combination exhibited biological activity.^[10] The research carried out each day's highlights the use of dietary sources as effective cancer chemopreventive agents. The scientific investigations reveal that cruciferous vegetables, rice bran, barley grain and grass powder, rye, wheat, oats holds a promising role as functional foods during cancer treatment.^{[11],[12],[13],[14]} Wattenberg first proposed that daily dietary intake of fruits and vegetables might provide protection from cancer as they are rich source of specific phytoconstituents.^[15] In different studies it has been shown that majority of cancers (upto 90%) are due to environmental and life style issues and rest are caused due to genetic defects. Therefore, approximately up to 40% of cancer cases can be prevented and cured to some extent by dietary means.^[16] The exposure to radiations and chemotherapy results in overall weakness in body of cancer patient as well as deterioration in mental health also. Nowadays integrated approaches are taken in order to cure and treat cancer patients. This approach includes specific treatment of cancer as prescribed by oncologist as well as intake of good diet, practice of *Yoga*, *Panchkarma*, etc., commonly known as *Ayurvedic* regime in Indian subcontinent. However very few studies have been conducted so far in this type of integrated therapy culture.

METHODOLOGY

A comprehensive search for cancer, herbal remedies for cancer, integrated approaches for cancer, phytoconstituents in plants used for cancer cure, *Yoga*, post chemotherapy *Yoga*, *Asanas*, etc., related papers and literatures were collected with the help of search on PubMed (Medline) and PMC (PubMed Central) database of the US National Library of Medicine; National Institutes of Health.

Cancer in Ayurveda

In *Ayurveda* three types of control system exist in our body which mutually are responsible for performing different bodily functions and maintenance of good health also. These systems are the venous system (*Pitta* or fire), the nervous system (*Vata* or air), and the

arterial system (*Kapha* or water). In ancient *Ayurvedic* text like *Charaka Samhita* and *Sushruta Samhita* the description of today's deadly disease cancer is also mentioned. Cancer is considered and described as non-inflammatory or inflammatory swelling and mentioned as *Arbuda* (major neoplasm) or *Granthi* (minor neoplasm), and their detailed classification depends on various clinical symptoms in relation to the *Tridoshas*.^{[17],[18]}

Group I: The *Arbuda* and *Granthi*, can be named as clear malignancy, and includes *Mamsarbuda* (melanoma) and *Raktarbuda* (leukaemia), mukharbuda (oral cancer), etc.

Group II: It includes as incurable ulcers as *Tridosaj Gulmas* (abdominal tumours like carcinomas of the stomach and liver or lymphomas) and can be considered as cancer of today.

Group III: This group includes diseases with the possibility of malignancy, like, *Asadhya Kamala* (incurable jaundice), *Visarpa* (erysipelas) and *Nadivrana* (sinusitis).^{[19],[20]}

The *Tridosaja* (malignant tumors) are very harmful because all the three major bodily systems lose mutual coordination and thus cannot prevent tissue damage, resulting in a deadly morbid condition, however in benign neoplasm (*Vataja*, *Pittaja* or *Kaphaja*) one or two of the three bodily systems are out of control and is not too harmful because the body is still trying to coordinate among these systems.^[19]

Cancer Pathophysiology

The initiation of cancer is generally through carcinogen which can bring about mutations in the cells leading to development of cancer. The carcinogens not only can bring mutation in cell but also can stimulate cell proliferation and are known as tumor promoters. The compounds like phorbol esters, viruses, radiations or few plant constituents from tobacco, few hormones, chemicals, etc., can be cause of cancer.^{[3],[21]}

These genetic mutation results in copying of gene twice and results in rapid cell division thereby stopping the production of protein requiring for normal cell growth thus leading to abnormal cell growth resulting in

abnormal proliferation of a single cell. At the molecular level inappropriate expression of gene occurs leading to instability of genome. As the cell divide abnormally so here can be additional mutation within the cells the immature cells also become deprived of functioning normally. The circulatory and lymphatic system helps these damaged cells to spread easily within the body in different tissues and organs thereby forming new tumors at different body parts. Cancers can generally be classified into (a) Malignant tumor cells which invade neighboring cells and spread through circulatory system or lymphatic system to other parts of body (metastasis) and (b) Benign tumors can retain their original location and do not spread/invade the neighboring cells. These both tumor types are classified on the basis of their place of origin, however malignant ones are considered to be dangerous as they can invade and undergo metastasis. The liver, brain, bones develop cancer through blood stream, and named as metastatic cancer while the lymph nodes located in neck, underarms, groin area, etc., are easily attacked by cancerous cells via lymphatic circulation.^[1,22,23] There are many other factors which help to stimulate own cell proliferation, certain enzymes help to invade other cells and also help in angiogenesis. The pathophysiology of cancer also involves different biochemical mechanisms involving free radicals, matrix metalloproteinases, etc., responsible for expression of different pathological conditions of cancer like cataract, cardiovascular problems, rheumatoid arthritis and even some neurodegenerative conditions. Initially there are no signs of cancer only with few symptoms prevailing in body like change in bowel movements, change in urination persistent cough or blood in stool, blood tinged saliva, weight loss, breast lump or discharge, unexplained anemia, lumps in testicles, etc., are probable indications for it.^[24,25]

Integrated Approach for Cancer cure

The integrated approaches to cure cancer as per *Ayurveda* involves *Prakritistani Chikitsa* (maintenance of health), *Naishthiki Chikitsa* (spiritual approach), *Rasayana Chikitsa* (restoration to normal) and *Roganashani Chikitsa* (cure of disease). All these

approaches involve use of dietary modifications, herbal remedies, stress management therapy involving yoga, meditation, astrology, gem therapy, etc. However very less information on the scientific validation of all these approaches are available in literature.

Herbal Remedies - Plants commonly used in Cancer Cure

Since ancient times various plants have been used in the management of health and immunity of the body as are considered to provide preventive measures for the occurrence of various disease symptoms.

Since ancient times plants have been commonly used by various *Ayurvedic* practitioners for the treatment of various types of *Gulmas* (cancer). *Allium sativum* L. (*Lasuna* - garlic), *Aloe vera* (*Kumari*-Aloe), *Alstonia scholaris* (L.) R.Br. (*Sapta Parni* - Milky pine), *Abrus precatorius* (*Gunja* - Coral bead vine), *Boswellia serrata* (*Shallaki* - Indian olibanum), *Berberis aristata* DC. (*Daruharidra* - Indian ophthalmic barberry), *Curcuma longa* L. (*Haridra* - Turmeric), *Heliotropium indicum* L. (White clary), *Moringa olifera* Lam. (*Shigru* - Horse radish tree), *Nigella sativa* L. (*Krishna Jeeraka* - Black cumin), *Ocimum tenuiflorum* L. (*Tulasi* - Holy basil), *Plumbago zeylanica* (*Chitraka* - Leadwort), *Catharanthus roseus* (*Sadabahar* -Periwinkle) are still being used for cancer cure in many parts of world as per their ancient traditional medicinal practices. However, the anticancer role of few plants like *Lasuna*, *Kumari*, *Shallaki*, *Haridra*, *Chitraka*, *Sadabahar* have been proven in terms of modern scientific evidences. Besides these there are several other plants which possess the anticancerous properties and inhibits the growth of cancer cells.^[26] More than 25000 different phytoconstituents either from plant, animal or other food based products are known to have anticancer potential and can interfere the pathophysiological cycle of cancer. ^[22] The medicinal plants are rich in the chemical constituents and having pharmacological actions either in the prevention of occurrence of cancer cells in the body or inhibiting the growth of cancer cells to reduce the tumors developing in the body. The various phytoconstituents present in plants like *Adenanthera pavonina* L., *Artemisia annua* L.,

Boerhavia diffusa L., *Cannabis sativa* L., *Catharanthus roseus* (L.) G. Don, *Clerodendrum infortunatum* L., *Coptis chinensis* Franch, *Garcinia oblongifolia* Champ. ex Benth., *Garcinia indica* (Thouars) Choisy, *Hemidesmus indicus* (L.) R. Br., *Isodon rubescens* (Hemsl.) H. Hara, *Morus alba* L., *Munronia pinnata* (Wall.) W. Theob., *Oroxylum indicum* (L.) Kurz, *Paris polyphylla* Sm., *Perilla frutescens* (L.) Britton, *Phyllanthus emblica* L., *Platycodon grandiflorus* (Jacq.) A. DC., *Prunus armeniaca* L., *Scleromitron diffusum* (Willd.) R. J. Wang, *Scutellaria baicalensis* Georgi, *Scutellaria barbata* D. Don, *Scurrula parasitica* L., *Smilax zeylanica* L., *Sphagneticola calendulacea* (L.) Pruski, *Taxus wallichiana* Zucc., *Tinospora cordifolia* (Willd.) Hook. f. and Thomson, *Thespesia populnea* (L.) Sol. ex Corrêa, *Tripterygium wilfordii* Hook. f., *Tussilago farfara* L., *Withania somnifera* (L.) Dunal, *Zingiber officinale* Roscoe, *Zygophyllum indicum* (Burm. f.) Christenh. and Byng have been effectively exhibiting the anticancer potential in different studies conducted so far.^[26,27] In different parts of India as well as in Sri Lanka, China and other adjoining countries the medicinal plants are also used in cancer cure for sleeping problems occurring during cancer treatment. The most commonly used plants are *Ashwagandha* (*Withania somnifera*) and *Bhanga* (*Cannabis sativa*). Each and every day new research is being carried out to explore the anticancer potential from plants hence a complete cumulative list of plants for cancer cure is tough task; however for simplicity only names of few important plants are described here which have anticancer potential as validated by ongoing researches [Table-1].

Table 1: Details of some selected plants having anticancerous properties.

SN	Plant Name	Family	Native Plant	Part Used
1.	<i>Adenanthera pavonina</i> L.	Fabaceae	Tropical Asia to North Australia	Stem bark
2.	<i>Allium sativum</i> L.	Amaryllidaceae	Central Asia to North East Iran	Bulb

3.	<i>Aloe vera</i> (L.) Burm. f.	Asphodelaceae	North Oman (Hajar Mountains)	Leaf pulp
4.	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Tropical and Subtropical Asia to North Australia	Stem bark
5.	<i>Artemisia annua</i> L.	Asteraceae	North Africa to Eurasia	Whole plant
6.	<i>Berberis aristata</i> DC.	Berberidaceae	Himalaya to South Tibet and Central India	Stem bark
7.	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Tropics and Subtropics.	Root
8.	<i>Cannabis sativa</i> L.	Cannabaceae	Central Asia to Xinjiang and Pakistan	Leaf
9.	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae	East and South Madagascar.	Flower
10.	<i>Clerodendrum infortunatum</i> L.	Lamiaceae	Indian Subcontinent to China (Yunnan) and Indo-China, Philippines	Leaf, root
11.	<i>Coptis chinensis</i> Franch,	Ranunculaceae	Central and East Central China	Root
12.	<i>Curcuma longa</i> L.	Zingiberaceae	cultigen from South West India	Rhizome
13.	<i>Garcinia oblongifolia</i> Champ. ex Benth.	Clusiaceae	China (Guangxi, Guangdong) to Vietnam	Fruit
14.	<i>Garcinia indica</i> (Thouars) Choisy	Clusiaceae	West and South West India, Assam.	Fruit
15.	<i>Heliotropium indicum</i> L.	Boraginaceae	Peru to Brazil and North Argentina.	Whole plant

16.	<i>Hemidesmus indicus</i> (L.) R. Br.	Apocynaceae	Indian Subcontinent to Indo-China and Peninsula Malaysia	Stem
17.	<i>Isodon rubescens</i> (Hemsl.) H. Hara	Lamiaceae	Central and South China	Leaf
18.	<i>Moringa oleifera</i> Lam.	Moringaceae	North East Pakistan to North West India	Fruit/seed
19.	<i>Morus alba</i> L.	Moraceae	Central China	Leaf
20.	<i>Munronia pinnata</i> (Wall.) W. Theob.	Meliaceae	India to South China and Peninsula Malaysia (Langkawi), Jawa to Lesser Sunda Islands	Leaf
21.	<i>Nigella sativa</i> L.	Ranunculaceae	Romania to West and South West Iran.	Seed
22.	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Tropical and Subtropical Asia to West Pacific	Leaf
23.	<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae	South China to Tropical Asia	Root bark
24.	<i>Paris polyphylla</i> Sm.	Melanthiaceae	Himalaya to Central China and North Myanmar.	Root
25.	<i>Perilla frutescens</i> (L.) Britton	Lamiaceae	South Russian Far East to Pakistan.	Whole plant
26.	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	Tropical and Subtropical Asia.	Fruit

27.	<i>Platycodon grandiflorus</i> (Jacq.) A. DC.	Campanulaceae	South East Siberia to Japan and China	Root
28.	<i>Prunus armeniaca</i> L.	Rosaceae	Central Asia to North and Central China	Fruit
29.	<i>Scleromitron diffusum</i> (Willd.) R. J. Wang	Rubiaceae	Tropical and Subtropical Asia	Whole plant
30.	<i>Scutellaria baicalensis</i> Georgi	Lamiaceae	South Siberia to North Korea and Vietnam	Leaf
31.	<i>Scutellaria barbata</i> D. Don	Lamiaceae	Himalaya to Temperate East Asia	Leaf
32.	<i>Scurrula parasitica</i> L.	Loranthaceae	Tropical and Subtropical Asia	Leaf
33.	<i>Smilax zeylanica</i> L.	Smilacaceae	Tropical Asia	Root
34.	<i>Sphagneticola calendulacea</i> (L.) Pruski	Asteraceae	China to Central and South Japan and Tropical Asia	Leaf
35.	<i>Taxus wallichiana</i> Zucc.	Taxaceae	Central Himalaya to China (North West Yunnan), South East Vietnam, Sumatra, Philippines, Sulawesi	Leaf, stem bark
36.	<i>Tinospora cordifolia</i> (Willd.) Hook.f. and Thomson	Menispermaceae	Indian Subcontinent to Indo-China	Stem
37.	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	Malvaceae	North East Sudan to Indian Ocean, Tropical and	Whole plant

			Subtropical Asia to Pacific	
38.	<i>Tripterygium wilfordii</i> Hook. f.	Celastraceae	South China to North East Myanmar, Taiwan	Root
39.	<i>Tussilago farfara</i> . L.	Asteraceae	Temperate Eurasia to North Africa and Nepal	Whole plant
40.	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	South Europe to Central China, Africa to Myanmar.	Root
41.	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	India to South Central China.	Rhizome
42.	<i>Zygophyllum indicum</i> (Burm. f.) Christenh. and Byng	Zygophyllaceae	Mauritania to India	Whole plant

Phytoconstituents from plants as Chemopreventive agent

The phytoconstituents in plants can interfere within the pathophysiological cycle of cancer probably starting from DNA damage till the formation of malignant neoplasm. These different compounds act as free radicals, apoptosis inhibiting factors antiproliferative agents, antiangiogenesis agents, etc., thereby exhibiting their anticancer potential. They also show anti-inflammatory properties due to their antioxidant capacity and free radical property thereby affecting various signaling pathways. These active phytoconstituents belongs to different chemical classes and are capable of bringing some detrimental influences as well as other beneficial synergic activities.^[2,10,27] Some studies indicates that in Asia, the incidence of cancer are lower as compared to America and Europe. It can be probably due to the beneficial effects of plant based diet in their daily food ^[2,28] however the exact list of phytochemicals and their protective role data is incomplete as each day new scientific research highlights their effective role as cancer chemo preventive agents. US FDA has

approximately approved 70% of plant based (natural source) anticancer drugs.^[29] Paclitaxel and docetaxel derived from vinblastine, vincristine and taxanes (natural vinca alkaloids) are the most commonly used anticancer agents. Podophyllotoxin derivatives as etoposide and teniposides and camptothecins are also plant derived anticancer agents. A novel peptide lunasin isolated initially from soya but also found in other cereals^[30] also exhibit cancer preventive activities.

Classification of Cancer chemo preventive plant phytoconstituents

The different biochemical reactions in the body of all living organisms produce numerous phytochemicals and are classified mainly based on the parent compound. The secondary metabolites are further produced within cell depending on numerous other factors including the geographical and genetic constitution. Thus the classification of specific phytochemicals for cancer treatment can be variable as per the researcher, however in general are broadly classified as alkaloids, phenolics, terpenes, terpenoids, carotenoids, etc.^[2,22,27] The alkaloids basically contain nitrogen ring structure and differentiated on the basis of their structural characteristics and are mainly of pyrrolizidine and dendrobine type. These compounds prevent enzymatic activity of topoisomerase mainly responsible for imitating DNA inducing apoptosis as well as p53 gene expression, inhibit the growth of tumor cells as well as perform modification of its metabolism as well as carcinogen metabolism.^[27,31,32] The phenolics are present in almost all plants and there are approximately more than 4000 diverse flavonoids classified on the basis of their structural pattern containing the basic moiety of phenolic group. These show high antioxidant activity and possess potential to minimize the risk of almost all chronic diseases.^[33] These also play an important role in inhibiting cell proliferation and differentiation, promotion process, metabolic activation, oncogene expression signal transduction pathway, cyclooxygenase -2, phase I enzyme, xanthine oxidase enzymes and cell adhesion and invasion. These are also inducers of glutathione peroxidase tumor suppressor gene expression, cell

cycle arrest, and enhance detoxification of superoxide dismutase, catalase, and phase II enzyme. These compounds also inhibit kinases by reducing hyper proliferation of epithelial cells and also prevent the formation of carcinogenic nitroamides and nitrosamines in food.^[2,22,27] Another important class of phytochemicals are terpenes (volatile unsaturated hydrocarbons) found in essential oils of mainly citrus and coniferous trees. The triterpenoids are present in different fungi, ferns, animal's higher plants and marine organism. These compounds possess cell toxicity, cell apoptosis and cell cycle arrest properties as, curcumol present in the volatile plant root oil in curcuma rhizomes,^[31] lucidenic acid and ganoderic acid from members of Ganodermataceae.^[34] The carotenoids widely present in pepper, coffee, tea leaves tomatoes, etc., are regarded as one of the most important natural pigment for their provitamin and antioxidant properties and prominently act as inducers of cell differentiation.^[35,36] The organosulphur compounds present in members of *Allium* species are responsible for apoptosis, proliferation of tumor cell, induction of carcinogen detoxification, and cell cycle arrest. These compounds are also good free radical scavengers and inhibits DNA adduct formation.^[27] Quinones commonly occur as biological pigments commonly in lower plants like fungi, higher plants, certain bacteria and in certain animals and are capable to form active oxygen species and some get converted to DNA binding semiquinone free radicals, thereby exhibiting anticancer activity.^[37] Besides these main class of compounds, there are many other phytochemicals from plant sources interfering in different steps of carcinogenesis as taxanes including docetaxel and paclitaxel, phytosterols, L-asparagine, mainly found in grains, beans, rapeseed oil, dioscin from roots of ginger plant, solasonine from black night shade, etc. The fruits, leaves and roots of many plants like grapes, plums, eucalyptus, rhubarb, raspberries, pomegranate, etc., are rich in organic acids and esters which plays an important role for adding the medicinal attributes of these plants.^[27,38] These phytochemicals are responsible for different inhibition mechanism and certain other mechanism both at molecular as well as biochemical level in such a manner that it ultimately

inhibits/ stops cancerous growth. Angiogenesis in a simple manner is formation of new blood vessel from the existing one. It is basically dysfunctional imbalanced blood vessel growth resulting in pathophysiological condition of cancer. The food consisting of garlic, walnuts, turmeric, green tea, grapes, etc., are rich source of phytochemicals like acacetin, aloin, arenobufagin, aspfalcholid, bigelovin, boswellicacid, beta-eudesmol, caffeic acid, ellagicacid, emodin, farnesiferol C, glyceollins, plumbagin, pterogynidne, punarnavine, quercetin, raddeanin A, santalol, vincristine, withaferin A, xanthohumul, zerumbaneetc and are potent inhibitors of angiogenesis and responsible for inhibition of PDGF receptors or TRAFG, VEGF-induced endothelial proliferation, HIF-1 α - MMP9 signalling pathways, etc. Besides these the phytoconstituents like artemisinin, artesunate, barbatolic acid, β escin sodium, celastrol, herboxidiene, honokiol, indole 3 carbinol, leucosesterterpenone, platycodin D, rhamnazin, rhein, rottlenin, salvicine, secalonic acid D stibinin, sprengerinin C, streptochlorin and tabectedin are considered as antiangiogenic compounds acting via different mechanism.^[24,27] The compounds like epigallocatechin -3- gallate inhibits VEGF signaling and thereby prevents the formation of new blood vessels. Compound like taxol, docetaxel (taxotere) have been approved as antiangiogenic drug by FDA (US Food and Drug Administration).^[24,27,39,40] The phytoconstituents mainly act to enhance the level of antioxidation within the body and clear these reactive oxygen species in cancerous cells. The different compounds present in citrus fruits, cruciferous vegetables, onion, tomato, green tea, blue berry, black berry are good source of antioxidants and are helpful to rebalance oxidative processes.^[27,41] The phytoconstituents present in green leafy vegetables, mushrooms, cheese, certain cereals, strawberries are rich source of folic acid, methionine and choline responsible for methylation of DNA thereby playing important role in cancer chemoprevention.^[27] The polyphenols from tea inhibited MMP-1,2,3 and 9 and turmeric, curcumin showed inhibition of MMP-14 and MMP-2 similarly phenolic compound from Amla inhibited MMP-1, reflecting their potential as chemopreventive

agent.^[24,42] Besides these other phytoconstituents like capsaicin, catechins, cucurbitacin B, lycopenes, isoflavones, piperlongumine, benzyl isothiocyanate and phenethylisothiocyanate have also shown inhibitory effects on cancer cells. There are several studies which elucidates even the mechanism to prove the therapeutic effect of plant based phytochemicals against several molecular targets. Compounds like isoflavone, genistein, peptide lunasin has shown promising chemopreventive properties.^[42,43,44,45]

Yoga for the management of Stress and Toxicities developed during Cancer Treatment

The word *Yoga* is derived from its Sanskrit word “Yuj,” means “to Yoke” or join together, i.e., joining the mind and the body. *Yoga* is a therapy related with mind set up including three components (a) *Asanas*-the physical alignment poses, (b) *Pranayama*- the breathing techniques and (c) *Dhayana*- the meditation, i.e., mindful exercises.^[46,47] These three components are derived on the basis of several traditions from India (Classical, *Advaita Vedanta*, *Tantra*), Tibet (Tibetan) and China (Chi Kung, Tai Chi).^[46,48,49] The treatment of cancer involves chemotherapy, which weaken the mental as well as physical strength of patient. The practice of *Pranayama* done by cancer patients receiving chemotherapy helped them to cope up with the anxiety and stress received during treatment as evidenced by different studies. *Pranayama* is the practice of breath regulation and is main component of *Yog* which is basically an exercise and meditational process for physical and mental wellness. The practice of *Pranayama* strengthens the connection between mind and body, promoting mindfulness and relaxation. As it is breathing exercise so this practice helps in proper blood circulation and also removes toxins from it. The *Pranayama* like *Sheetali* and *Sheetkari* help to cool down the heat generated in the body due to radiotherapy and chemotherapy. *Nadi Shodhana Pranayama*, *Bhramari Pranayama*, *Ujjayi Pranayama* has also been found useful for cancer patients. In general *Pranayama* helps to get relieve from fatigue, reduce stress, improves sleep and helps to increase mindfulness during *Asanas*, which are physical *Yoga*

posture performed to improve physiological function of the body. There are many *Asana* but the ease to do, depend on the complex condition of patients in general *Vrikshasana* can bring calmness and relaxation to the mind and body. *Mudras* are special poses created by hands. These are also beneficial during cancer treatment, mainly *Vayu Mudra*, *Sprasha Mudra*, *Garuda Mudra* and *Prana Mudras* helps in removing the toxins, stress and anxiety from the individuals. *Dhayana* (meditation) has been shown to help relieve anxiety, stress, fatigue, improving sleep and mood when used along with standard medical treatment for cancer patients. The practice of *Pranayama*, *Asana*, *Mudra*, *Dhayana* do not claim to cure cancer but the practice of them help the patients to cope with the symptoms associated with cancer treatment as well as help to heal the mental and emotional stress they experience during treatment process of their journey towards cancer. Several references are available on various aspects of *Yoga* practices for prevention of cancer as well as post chemotherapy exercises, *Asanas*, *Pranayama* and *Dhayana*. The total time duration prescribed for the *Yoga* practice can vary from 60-90 minutes, with a minimum participation of three times a week, depending upon the condition of the patient. Self-practice at home was also allowed/encouraged in some studies. The study duration varied from 6weeks to 12 weeks. In most study individuals participated for a minimum of 18 sessions of *Yoga*. In case of occurrence of somebody disorders an *Yoga* expert must be consulted for duration and type of practice related to the symptoms of the body disorders. Not only for cancer, the practice of *Yoga* triggers many types of human disease like include neurological, psychological, orthopedic, cardiovascular and pulmonary ailments and the diseases are widely being managed through practice of *Yoga*.^[50-56]

Presently the Patanjali Yogpeeth, Haridwar and many other *Yoga* centers are contributing a lot in reviving the lost tradition of *Yoga* and making the people aware about the effectiveness of various *Asana* and *Pranayama* for various treatments related with symptomatic cancers.

DISCUSSION

Cancer being a serious disease as is incurable or occasionally curable through surgery and chemotherapy causing several side effects in the body as well as weaken the immune system of body. Since ancient times in Ayurveda as well as other traditional medicinal systems of world the plants have been used as a remedy for cancer cure which directly or indirectly either interfere with the pathophysiology of cancer or strengthen the immune system of body, thereby combating the effect of chemotherapy or radiotherapy during cancer treatment. The ongoing researches scientifically validate the mechanism involved during the line of treatment, be it the phytoconstituents or different plants in combinations. In India and adjoining countries in traditional medicine practice, these plants are usually used in single or in combination form with other plant parts as mixture of ingredients to bring formulation to be used for cancer cure. This approach of combining many ingredients enhances the synergetic effect of all the plant ingredients in improving the efficacy of the treatment and decreasing the side effects. This type of therapy using combination of ingredients causes effects on the development of resistant cancer cells with target of multiple signaling pathways usually activated in a cancer like complex disease. The present paper presents review of various literatures on various aspects of cancer management either through preventive measures or post treatment management. Besides using different plant based remedies, dietary improvement, the immune system of the body can also be maintained by some physical exercise including *Yoga* and *Pranayama*, *Dhayana*. Researches on these different aspects are being carried out all over the world. The use of these integrated approaches are more helpful in post chemotherapy effects like, nausea, vomiting, insomnia.^[57] Out of 42 selected plants useful in cancer management, maximum plants belong to the family Lamiaceae (6) followed by Apocynaceae and Asteraceae (3&3) followed by Ranunculaceae and Zingiberaceae (2&2) and the other remaining plants are one only from each family as provided. [Table 1, Fig. 1].

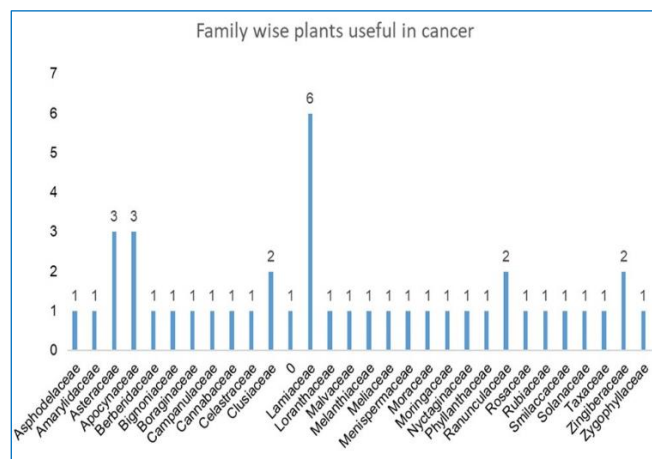


Figure 1. Graph showing number of plants per family.

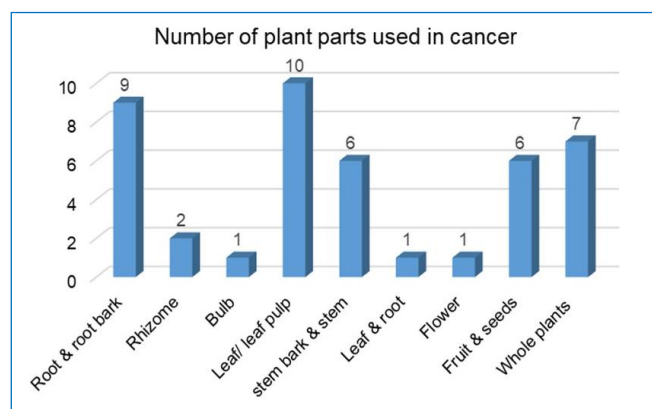


Figure 2. Graph showing number of plants part having anticancer property.

The analysis of different parts used during cancer care, it was found that mostly the leaves are useful (10), followed by roots (9), whole plants (7), fruit and seeds (6), rhizome (2) and other plant parts like bulb, and root, leaf and stem bark both, are considered from only one plant each (Fig 2).

CONCLUSION

Cancer being one of the deadliest diseases all across the globe is tough to completely cure due to its complex pathophysiology. However, the use of plant based formulations, herbal diet, practicing *Yoga*, *Pranayama*, *Dhayana*, helps to improve the immune system of the body which gets weakened due to chemotherapy and radiotherapy, and ultimately helps to cure cancer. Each day researches are being carried out to find effective solutions for cancer care. The use of plants and their specific phytoconstituents have

been successfully elucidated for the mechanism involved in blocking the pathways of cancer cell proliferation. Approximately 2500 phytoconstituents are involved in different cancer related researches globally. Some of the plants used traditionally in *Ayurveda* for treatment of *Granthi / Gulma* have also been scientifically validated in terms of modern research, signifying the glory of our ancient medicinal practice.

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