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Unfolding the therapeutic potential of Ayurvedic Herbal Plants in the management of Arbuda (Cancer) - A Conceptual Study

Kodle P[1*], Sharma S[2], Shukla R[3]

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[1*] Pallavi Kodle, Post Graduate Scholar, Department of Dravyaguna Department of Dravyaguna, Pt Khushilal Sharma Govt Ayu College and Institute, Bhopal, Madhya Pradesh, India.

[2] Shraddha Sharma, Assistant Professor, Department of Kayachikitsa, Pt Khushilal Sharma Govt Ayu College and Institute, Bhopal, Madhya Pradesh, India.

[3] Ratnesh Shukla, Post Graduate Scholar, Department of Kayachikitsa, Pt Khushilal Sharma Govt Ayu College and Institute, Bhopal, Madhya Pradesh, India.

Introduction: Cancer is a devastating disease characterized by the abnormal, uncontrolled proliferation of cells. It invades surrounding tissues and metastasis to other parts of the body. Despite significant strides in modern cancer treatment, the search for effective and less invasive therapies continues. Ayurveda, an ancient Indian system of medicine, offers a holistic approach to healthcare, including the management of chronic diseases such as cancer.

Materials and Methods: This study involved a thorough review of various Ayurvedic texts, research papers, and scientific articles focusing on the Ayurvedic and modern understanding of cancer and the potential role of herbal plants in its management.

Discussion: The herbal plants may be reducing the oxidative effects and inflammation caused by tumour cells. These herbs may improve mitochondrial membrane permeability which improves DNA binding, blocks the use of glucose by cancer cells, blocks the cellular signalling pathways of cancer genes and DNA mutations in normal cells, inhibition of invasion of cancer cells in the body.

Conclusion: Numerous studies have demonstrated the efficacy of herbal plants in cancer prevention and treatment. These plants may offer promising therapeutic benefits by modulating various cellular pathways involved in cancer development and progression. Further research is crucial to fully understand the mechanisms of action of these herbs and to develop safe and effective herbal-based therapies for cancer.

Keywords: Arbuda, Cancer, Ayurveda, Herbal plants, Anticancer

Corresponding Author

Pallavi Kodle, Post Graduate Scholar, Department of Dravyaguna Department of Dravyaguna, Pt Khushilal Sharma Govt Ayu College and Institute, Bhopal, Madhya Pradesh, India.
Email: ppallavikodle@gmail.com

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Introduction

According to the WHO, in 2022, there were an estimated 20 million new cancer cases and 9.7 million deaths. The estimated number of people who were alive within 5 years following a cancer diagnosis was 53.5 million. About 1 in 5 people develop cancer in their lifetime, approximately 1 in 9 men and 1 in 12 women die from the disease. Over 35 million new cancer cases are predicted in 2050, a 77% increase from the estimated 20 million cases in 2022.**[1]** Cancer is a leading global health concern, posing a significant threat to human life. Characterized by uncontrolled cell growth and the potential to spread, it presents a complex challenge in both developed and developing nations. While modern medicine offers valuable treatment options, exploring traditional approaches like *Ayurveda* can provide valuable insights and complementary therapies. Cancer is an abnormal, irreversible, uncoordinated, autonomous, unregulated, and purposeless proliferation of cells that is beyond the control of the body. It is often harmful, has a tendency to persist, spread to other sites of the body, and increase very rapidly. In recent decades, there has been a marked increase in the number of cancer cases in females and younger persons. It has become a global threat nowadays.

Aim and Objectives

Aim: To explore Ayurvedic perspectives on cancer and shed light on this critical disease.

Objectives

1. To investigate the diagnosis and treatment of cancer patients using Ayurvedic herbs.
2. To raise awareness for early detection and effective cancer control.
3. To provide fundamental knowledge and cover all essential aspects of cancer.
4. To promote a balanced approach integrating prevention, treatment, and Ayurvedic herbal therapies to reduce cancer incidence and mortality.

Ayurvedic Approach

India is known for its rich medicinal plant heritage. *Ayurveda*, the Indian system of medicine, is based mainly on traditional knowledge of herbs. The uses of medicinal plants are in great demand in both developing and developed countries for the treatment and prevention of many diseases.

Different research studies have proven that there are many herbal plants like *Withania somnifera* etc. are exhibit antitumor, antiproliferative, and anticancer activities. The details are below-

***1. Withania somnifera* (*Ashwagandha*):** Variations in the anti-tumor constituents of W. somnifera were observed, and in-vivo growth inhibitory effects of the root extracts of the plant were demonstrated in a transplantable mouse tumor sarcoma 180 in 1992 (1527) BALB/c mice.

The extracts of the plant as well as the isolated withanolides, withaferin A, have emerged as potent anticarcinogenic agents in lung, breast, colon, cervical, brain, prostate, and other cancers. WFA, Withanolide D, Withalongolide A, and its triacetate derivatives have been found to possess anticarcinogenic activities in cells (Devi P U et al., 1992).**[3]**

***2. Curcuma longa* (*Haridra*):** Anti cancer activity of turmeric(curcumin) was evaluated, in vitro and in vivo studies in mice. The active constituent was curcumin showed cytotoxicity in different cancer cells. (Kuttan R et al 1985)**[4]**

***3. Abrus precatorius* (*Gunja*):** The in vitro anti-cancer activity of the ETA extract was evaluated against P815 tumour cells. (M. lebri *et al.* 2015)**[5]**

***4. Semecarpus anacardium* (*Bhallatak*):** Water, alcoholic and oil extract of semicarpus anacardium were antimutagenic on human lymphocytes (A B Kothari *et al.* 1997)**[6]**

***5. Vinca rosea* (*Sadabahar*):** Vinca alkaloids are vincristine and vinblastine where isolated from the plant and were given to patients with breast cancer, Hodgkin's lymphoma, leukaemia, testicular cancer and lung cancer (Cragg and Newman 2005, Mann 2002)**[7]**

The main mechanism of action of these agents are that they bind to tubulin and disrupt the function of micro tubules particularly those comprising the mitotic spindle apparatus by arresting metaphysic of the cell cycle (Moudi *et al.* 2013)**[8]**

***6. Taxus baccata* (*Sthouneyak*):** The in vitro cytotoxic effect of aqueous, ethanolic, methanol and ether extract of plant T. Baccata on BHK-21. The cytotoxic effects were determined for leaves and Bark of T. baccata on BHK -21 fibroblast cell line (Ankita joshi *et al.* 2012)**[9]**

***7. Tinospora cordifolia* (*Guduchi*):** The methanolic extract of T. Cordifolia shows cell cytotoxicity against human breast cancer cells with less effect on normal cell. Cytotoxic effect on human cancer cell line MDA-MB-231 was studied by MTT assay. (Rumana ahmed *et al.* 2015)**[10]**

***8. Plumbago zeylanica* (*Chitrak*):** zeylanica have significant anticancer activity. Studies shows that ethanolic extract of the plant reduces the tumour volume, packed cell volume and viable tumour cell count in male swiss albino mice. (Sachin hiradeve *et al.* 2010)**[11]**

***9. Bauhinia variegata* (*Kanchnar*):** In-vitro antitumor potential was found in B. variegate. Hydro-methanolic leaf, stem bark and flower extracts were evaluated for its effect on the cell viability against melanoma tumour cell line (B16F10) in C57BL mice. (Pandey, S. *et al.* 2017) **[12]**

***10. Glycyrrhiza glabra* (*Mulethi*):** In vivo cytotoxic effect of ethanol extract of G. glabra on HSP 90 growth and apoptosis in the HT -29 colon cancer cell line. (Seyed Manuchehr nourazarian *et al.* 2015)**[13]**

***11. Allium sativum* Linn (*Rason*):** Ethanolic plant extract of A. Sativum has properties that antagonize the proliferating process of carcinogenesis in the liver cancer in albino rats. (G Offumobi ogar *et al.* 2022)**[14]**

***12. Moringa oleifera* (*Shigru*):** Moringa leaf extract against H2O2 induce cytotoxicity and oxidative damage in the Hela-derived KB cell line. (Shreelatha *et al.* 2011). Methanol, ethanol, ethyl acetate and chloroform extract of the moringa leaf extract has cytotoxic activity against u 266B cells. It indicates that the extract has high anticancer activity. (Parvathy *et al.* 2007)**[15]**

***13. Asparagus racemosus* (*Shatavari*):** Methanol and chloroform root extracts of A. racemosus inhibited the cell growth, migration and induced changes in the cell morphology attributing apoptosis in non-small lung cancer A 549 cells. (Debaashish Biswas *et al.* 2018)**[16]**

***14. Cynodon dactylon* (*Durva*):** The methanolic extract of roots of dynodon dactylon shows its hepto-protective activity against liver cancer of Swiss albino mice. (R kowsalya *et al.* 2015)**[17]**

***15. Aegle marmelos* (*Bilva*):** The hydro- alcoholic extract of A. Marmelos shows antiproliferative activity of transplanted Ehrlich ascites carcinoma in swiss albino mice. (A Ganesh Chandra jagetia *et al*. 2005)**[18]**

***16. Vitex negundo* (*Nirgundi*):** Chloroform, ethanol and aqueous root extracts of V. negundo shows potent anticancer activity, the in- vitro evaluation method against Dalton's ascites lymphoma cell lines. (B Edwin jose *et al.* 2021)**[19]**

***17. Cannabis sativa* (*Bhanga*):** Cannabidiol and *Cannabis sativa* found as potent anticancer in prostate cancer cells. (R kowsalya *et al.* 2015)**[20]**

***18. Ocimum sanctum* (*Tulasi*):** An in vitro study, aqueous and dry extract of the *Ocimum sanctum* plant has shown cytotoxic agent against oral squamous cancer line (ca 9-22). O. Sanctum can be used as an anticarcinogenic and chemotherapeutic agent. (A M Luke *et al.* 2021)**[21]**

***19. Calotropis procera* (*Arka*):** In vitro study of methanolic, hexane, aqueous and ethyl acetate extracts of the *Calotropis procera* root shows antiproliferative property against human Hep 2 cancer cell line. (R Mathur *et al.* 2009)**[22]**

***20. Achyranthes aspera* (*Apamarga*):** The in vitro study of *Achyranthes aspera* leaf, stem and root acetone extract has shown the cytotoxicity against the Hela cell line. (Nafisehsadat *et al.* 2020) **[23]**

Modern View of Cancer

Cancer encompasses a diverse range of diseases characterized by the uncontrolled growth of abnormal cells in organs or tissues. These cells proliferate uncontrollably, extending beyond their usual boundaries to invade adjacent tissues and potentially spread to distant organs - a process known as metastasis. Common terms used interchangeably with cancer include neoplasm and malignant tumour.

Globally, cancer ranks as the second leading cause of death, claiming an estimated 9.6 million lives in 2018 alone, representing approximately 1 in 6 deaths worldwide. Among men, lung, prostate, colorectal, stomach, and liver cancers are prevalent, while breast, colorectal, lung, cervical, and thyroid cancers are more common among women.

Factors that can cause those changes include:

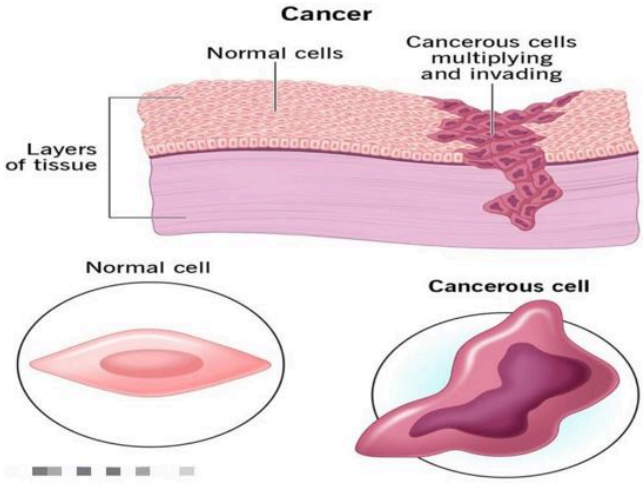
A) Hereditary
B) Cell multiplication errors
C) DNA damage
D) Irritation

Differences between Normal Cells and Cancer Cells:

1. Cell multiplication Regulation: Cancer cells divide independently and are resistant to apoptosis, or programmed cell death.

2. Nutrient conservation and Growth: Cancer cells utilize different nutrients and pathways for energy production, enabling faster proliferation.

3. Cell Behaviour: Cancer cells invade surrounding tissues and metastasize to distant organs and in malignant type of cancer various organ can be affected by secondary mechanism.



Types of Cancer: The main types of cancer originate from various cells and tissues in the body. Our bodies comprise billions of cells, which form tissues and organs with distinct structures and functions. Over 200 types of cancer exist, categorized by their origin within the body or the type of cell they originate from.

Carcinoma: This type of cancer initiates in the skin or in tissues lining internal organs. Subtypes include adenocarcinoma, basal cell carcinoma, squamous cell carcinoma, and transitional cell carcinoma.

Classification of Carcinoma:

1. Carcinoma in situ
2. Invasive carcinoma
3. Metastatic carcinoma

Types of Carcinomas:

Adenocarcinoma: Originates in glandular epithelial cells lining organs, i.e., The prostate, breast, large intestine, pancreas, and renal parenchyma. It includes renal cell carcinoma (RCC) and hepatocellular carcinoma (HCC).

Basal Cell Carcinoma (BCC): Epidermis is the most common form of skin cancer.

Squamous Cell Carcinoma (SCC): Arises from the squamous cell epithelial part of the skin epidermis, commonly occurring in the sun-exposed part like the whole face, ears, neck, arms, and feet, and also in the mucous membranes of pulmonary tissue, oesophagus, and scalp and throat.

Ductal Carcinoma in Situ (DCIS): mostly in milk ducts. DCIS is non-invasive and curable.

Invasive Ductal Carcinoma: it is also found on breast milk ducts, like DCIS, but it can spread into surrounding tissue. If left untreated, it can metastasize. Most common type of breast cancer.

Sarcoma: Sarcomas develop in connective tissues such as Blood, bone, cartilage, fat, muscular part of body. Sarcomas can originate in different regions of the body, spanning from the head to the toes:

Most common 40%	the lower extremities, I.e. the legs, ankles, and feet.
About 15%	the upper extremities, I e. the shoulders, arms, wrists, and hands.
Around 30%	trunk, chest wall, abdomen, or pelvis.
Roughly 15%	head and neck region.

Leukaemia: This cancer affects white blood cells and originates in tissues responsible for blood cell production, like the bone marrow. Leukaemia refers to cancers originating from blood cells, beginning in blood-forming tissues like the bone marrow. The bone marrow produces cells that mature into white blood cells, red blood cells, and platelets, each serving distinct functions:

White blood cells combat infections.
Red blood cells transport oxygen from the lungs to tissues and organs.
Platelets aid in clot formation to prevent bleeding.

In leukaemia, the bone marrow generates an excessive number of abnormal cells, primarily affecting white blood cells. These abnormal cells accumulate in the bone marrow and bloodstream, hindering the normal functions of blood cells.

Types of Leukaemia: Leukaemia is categorized based on the type of blood cell affected and the pace of cell growth:

Acute leukaemia: it is characterized by rapid cell growth and progression. - Chronic leukaemia: Chronic leukaemia is involving very slow cell growth. The main types include:

Lymphoma: These cancers originate in immune system cells. Lymphoma is a type of cancer affecting the lymphatic system, which comprises tissues, vessels, and organs crucial for fighting infections. It is classified as a blood cancer since it originates from white blood cells, specifically lymphocytes, within the lymphatic system.

Lymphoma is broadly categorized into two main types: Hodgkin lymphoma and non-Hodgkin lymphoma. Within these categories, there exist over 70 subtypes of lymphoma.

Myeloma: Multiple myeloma is a malignancy originating from plasma cells, a subset of white blood cells responsible for producing antibodies to combat infections. In the bone marrow, where blood cells are generated, cancerous plasma cells accumulate, displacing healthy blood cells. Instead of generating functional antibodies, these aberrant cells produce dysfunctional proteins, contributing to the complications associated with multiple myeloma.

Acute lymphocytic leukaemia (ALL)	Predominant in children but can also occur in adults.
Acute myeloid leukaemia (AML)	More prevalent in older adults but can affect children as well.
Chronic lymphocytic leukaemia (CLL)	Common among adults, often occurring during or after middle age.
Chronic myeloid leukaemia (CML)	Typically diagnosed in adults during or after middle age.

Tumour Markers

Tumour Marker	Cancer
CA 125 (cancer antigen 125)	Ovarian cancer.
CA 15-3 and CA 2729	Breast cancer.
PSA (prostate-specific antigen)	Prostate cancer.
CEA (carcinoembryonic antigen)	Colorectal cancer, lung, stomach, thyroid, pancreatic, breast, and ovarian cancers.
AFP (Alpha-fetoprotein)	Liver cancer, ovarian cancer, and testicular cancer.
B2M (Beta 2microglobulin)	Multiple myeloma, certain lymphomas, and leukaemia's.

Different types of tumour markers are used based on an individual's health history, cancer diagnosis, and presenting symptoms. Here are some common tumour markers and their applications, some of which are specific to certain cancers while others are associated with multiple cancer types:

Conventional Treatment Modalities for Cancer Chemotherapy: Chemotherapy involves the use of drugs to eradicate cancer cells. Discover how chemotherapy functions against cancer.

Hormone Therapy: Hormone therapy is employed to impede the growth of hormone-dependent breast and prostate cancers.

Hyperthermia: Hyperthermia entails heating body tissues to temperatures up to 113°F to induce damage and destruction of cancer cells while minimizing harm to healthy tissue.

Immunotherapy: Immunotherapy harnesses the immune system to combat cancer.

Photodynamic Therapy: Photodynamic therapy employs light-activated drugs to eliminate cancer and abnormal cells.

Radiation Therapy: Radiation therapy utilizes high-dose radiation to eradicate cancer cells and reduce tumour size.

Stem Cell Transplant: Stem cell transplants restore stem cells that produce blood cells in individuals whose cells have been depleted by intensive chemotherapy or radiation.

Surgery: Surgery involves the removal of cancerous tissue from the body.

Targeted Therapy: Targeted therapy focuses on specific changes in cancer cells that facilitate their growth, division, and spread.

Ayurvedic Perspective on Cancer

***Arbuda Samprapti* (Su.Ni.11/13-15)**

गात्रप्रदेशे क्वचित दोषाः सम्मूच्छिता मांसमभिप्रदूष्य \\
वृत्तं स्थिरं मन्दरूजं महान्तमनल्पमूलं चिरवृद्धयपाकम \\
कुर्वन्ति मांसोपचयं तु शोफं तदर्बुदं शास्त्रविदो वदन्ति \\
वातेन पित्तेन कफेन चापि रक्तेन मांसेन च मेदसा च \\
तज्जायते तस्य च लक्षणानि ग्रन्थेः समानानि सदा भवन्ति ।। १५ ।। [30]

Sometimes the defects in the region of the body are stunned and contaminate the *Mams*, the circle is stable, slowly painful, great, not small,

And cooked for a long time they cause meat digestion but swelling is called tumor by the scientists. By *Vayu, Pitta, Kapha, Rakta, Mams* and *Meda*, it is born and its characteristics are always the same as those of the text. According to *Charaka* and *Sushruta*, cancer manifests as inflammatory or non-inflammatory swelling, resembling *Arbuda* and *Granthi*. In *Ayurveda,* cancer is not viewed as a distinct illness category but rather as a manifestation of severe systemic *Dosha* imbalances. All illnesses stem from these imbalances, with specific diseases like cancer arising from interactions between aberrant *Doshas* and weak *Dhatus*. While *Ayurvedic* texts may not explicitly mention cancer, they provide insights into its understanding and management through the broader principles of balancing *Doshas* and strengthening *Dhatus.*

The Ayurvedic classification of neoplasms relies on clinical symptoms in relation to *Tridoshas.*

Conditions falling under clear malignancy include *Arbuda* and *Granthi*, such as *Mamsarbuda* (melanoma*), Raktarbuda* (leukaemia), and *Mukharbuda* (oral cancer).

Diseases that share characteristics with cancer include persistent ulcers, such as *tridosaj* gulmas, which are abdominal tumours like carcinomas of the stomach and liver, or lymphomas.

Diseases with potential malignancy include *Visarpa* (erysipelas), *Asadhya Kamala* (incurable jaundice), and *Nadi-Vrana* (sinusitis).

According to *Sushruta*, the primary cause of major neoplasms is pathogens that affect all parts of the body. He referred to the sixth layer of the skin as '*Rohini*' (epithelium). Pathogenic injuries to this layer, in muscular tissues and blood vessels due to lifestyle errors, unhealthy foods, poor hygiene, and bad habits, result in dosha derangement, leading to tumour formation. The excess of water or fat in the tumour and the stable and rigid confinement of doshas in a particular place were cited as reasons for the non-infectious and non-suppurative nature of these abnormal growths. Cancer manifestation varies based on individuals' exposure to pathogens and genetic constitutions, causing diverse reactions to the same diet. *Ayurveda*, a science focused on health and longevity, has explored numerous herbals and *Rasayana* remedies, varying in their effectiveness.

However, its primary emphasis lies in preventive measures. Hartwell compiled data on approximately 3000 plants with documented anti-cancer properties, many of which have been utilized as potent anti-cancer drugs (Balachandran and Govindrajan, 2005). Among *Ayurvedic* herbs, around 30 have demonstrated antitumor activities, with the potential for this number to increase as more herbs are investigated (Ramakrishnan et al., 1984).

***Samprapti* of *Arbuda* (Cancer)**

The *Ayurvedic* perspective on cancer is primarily rooted in the *Dosic* theory, focusing on *Vata, Pitta,* and *Kapha.* Cancer development, according to this theory, occurs due to an imbalance among the *Doshas*. *Vata*, being the active *Dosha,* plays a role in the metastatic process. *Pitta,* with its increased metabolic activity, fuels the growth of cancerous cells, while *Kapha,* characterized by its bulkiness, contributes to the aberrant multiplication of cells.

Various types of *Arbuda* (tumours) are classified based on *Doshas and Dhatus*. *Dosha*-based classifications include *Vata, Pitta, Kapha*, and *Tridoshja,* while *Dhatu*s-based classifications include Rakta (blood), *Mamsa* (muscles), and *Medas* (fat).

The development of *Arbuda* can be triggered or precipitated by irritability and trauma. For instance, *Mamsarbuda*, arising from trauma, manifests as a painless, immovable, stone-like swelling at the site of the injury and is deemed incurable. Certain types of tumours, particularly those that exude heavily or are located in critical organs, are also considered incurable.

Arbudas, by nature, do not generate pus due to the prevalence of *Kapha* and *Medas*, which contribute to the stability of the *Doshas* and the formation of hard masses.

In the quest for medicinal herbs with potential antitumor properties within *Ayurveda*, numerous herbs exhibit diverse pharmacological actions. However, identifying them can be challenging, as some are scarce, have toxic side effects, or are rarely used. Consequently, we have opted to focus on a select few herbs that are well-established, readily available, cost-effective, uncontroversial in identity, devoid of known toxicity, and have been in use for centuries.

Result

Table 1: *Rasadi Gunas* of Herbal Plants

SN	Herbs Name	Rasa	Guna	Virya	Vipaka
1.	Withania somnifera	Katu, Tikta	Laghu, Snigdha	Madhur	Ushna
2.	Curcuma longa	Katu, Tikta	Laghu, Ruksha	Katu	Ushna
3.	Abrus precatorius	Tikta, kashay	Laghu, Ruksha, Tikshna	Katu	Ushna
4.	Semicarpus anacardium	Madhura, Katu, Tikta	Laghu, Snigdha, Tikshna	Madhura	Ushna
5.	Vinca rosea	Tikta, Kashaya	Laghu, Ruksha	Katu	Ushna
6.	Taxus baccata	Katu, Madhura	Snigdha	Katu	Sheeta
7.	Tinospora cordifolia	Tikta, kashay	Snigdha, Guru	Madhura	Ushna
8.	Plumbago zeylanica	Katu	Laghu, Ruksha, Tikshna	Katu	Ushna
9.	Bauhinia variegata	Kashaya	Laghu, Ruksha	Katu	Sheeta
10.	Glycirrhiza glabra	Madhura	Guru, Snigdha	Madhura	Sheeta
11.	Allium sativum	Madhura, lavan, Katu,	Snigdha, Tikshna, Pichhil	Katu	Ushna
12.	Asparagus racemosus	Madhura, Tikta	Snigdha, Guru	Madhura	Sheeta
13.	Cynodon dactylon	Kashaya	Laghu	Madhura	Sheeta
14.	Aegle marmalos	Katu, Tikta, Kashaya	Laghu, Ruksha	Katu	Ushna
15.	Vitex negundo	Katu, Tikta	Laghu, Ruksha	Katu	Ushna
16.	Moringa oleifera	Katu, Tikta	Laghu, Ruksha	Katu	Ushna
17.	Cannabis sativa	Tikta	Laghu, Tikshna	Katu	Ushna
18.	Ocimum	Katu, Tikta, Kashaya	Tikshna, Ruksha, Laghu	Katu	Ushna
19.	Calatropis procera	Katu, Tikta	Laghu	Katu	Ushna
20.	Achyranthus aspera	Katu, Tikta	Tikshna, sara	Katu	Ushna

Table 2: *Doshashaktva* of Herbal Plants

SN	Herb Name	Doshashamakatva	Active Phytoconstituents	Useful Parts
1.	Withania somnifera	Kaphavatashamak	Withanolide, withaferin A, withanone	Root, Leaves
2.	Curcuma longa	Kapha Pittahar	Curcumin	Stem
3.	Abrus precatorius	Vata Pittashamak	Glycyrrhizine, abrin, abrus lactine	Seed, Root, Leaves
4.	Semicarpus anacardiu	Kaphavatahar	Anacardic acids, bhilawanol, flavanoids	Seed, Oil
5.	Vinca rosea	Kaphavatashamak	Vinblastine, vincristine, vinorelbine	Leaves
6.	Taxus baccata	Tridoshashamak	Taxol, taxanes	Leaves
7.	Tinospora cordifolia	Tridoshashamak	Berberin	Stem
8.	Plumbago zylanica	Kaphavatashamak	Plumbagine	Root, Leaves
9.	Bauhinia variegata	Kaphapittashamak	Leupeol, kaempferol, sitosterol, glucopyra	Leaves, Stem, Bark
10.	Glycirrhiza glabra	Vatapittashamak	Glycyrrhizine, glycyrrhezic acid	Root
11.	Allium sativum	Kaphapittashamak	S-allylcysteine, s-allyl mercapto-l-cystein	Bulb
12.	Moringa oleifera	Kaphavatashamak	Niazirin, kaempferol, chlorgenic acid, ella	Leaves
13.	Asperagus racemosus	Kaphavatadhna, Pittahar	Shatavrin IV	Root
14.	Cynodon dactylon	Kaphapittashamak, Vatakaphahar	Hydroquinone, levoglucosenone, furfural	Panchang
15.	Aegle marmalos	Kaphavatahar	Aegeline, aegelenine, marmelosin, lupeol	Leaves, Fruit
16.	Vitex negundo	Kaphavatahar	Artemetin, vitexicarpin, pendultin	Leaves, Fruit
17.	Cannabis sativa	Vatakaphahar, Pittavardhak	Cannabinoids, terpenes	Leaves
18.	Ocimum sanctum	Kaphavatahar	Eugenol, methyl cinnamate, linalood,B-ela	Leaves
19.	Calatropis procera	Kaphavatahar	Catechol, caffeic acid	Leaves, Stem
20.	Achyranthus aspera	Kaphavatahar	Urosolic acid, corrosolic acid, achyrantheric acid	Root, Stem, Leaves

Table 3: Mode of Actions of Herbal Plants

SN	Herbs Name	Mode of Actions on Cancer Cells	Type of Cancer
1.	Withania somnifera	Chemoprotective, cytotoxic, inhibit metastasis, repairs oxidative effects, Neuroprotective, immunomodulator	Neuroblastomas, breast cancers, prostate cancers.
2.	Curcuma longa,	Antimutagenic, antitumor, induce apoptosis, inhibit proliferation	Breast colorectal prostate skin pancreatic brain head and neck cancers

SN	Herbs Name	Mode of Actions on Cancer Cells	Type of Cancer
3.	Abrus precatorius	Antitumor, cytotoxic, induce apoptosis, supression cell growth	Fibrosarcoma, lymphoblast leukemia, breast, hepatoma, stomach, kaposis sarcoma
4.	Semicarpus anacardium	Reduce viability and increase apoptosis, control chromosomes, antitumor, cytotoxic	Esophageal, chronic myeloid leukemia, urinary bladder, melanoma, glioma, hepatocellular, breast cancers
5.	Vinca rosea	Myelosuppression, alter microtubular dynamics, inhibit cell proliferation	Lymphatic Leukemia, myeloid leukemia, Wilms tumor, Ewing sarcoma, Kaposi sarcoma, neuroblastoma, rhabdo sarcoma
6.	Taxus baccata	Terminate cell division, induce apoptosis, prevent spindle formation, inhibit tumor	Ovarian, breast, lung, Kaposi's, sarcoma, melanoma, uterine, bladder, esophagus, prostate, pancreas.
7.	Tinospora cordifolia	Induce apoptosis reduce cell proliferation, inhibit the expression of cancer gene	Oral, melanoma, breast, colon, cervical
8.	Plumbago zeylanica	Induce cell death, autophagy, cell cycle arrest, cytotoxicity, inhibit cell migration	Cervical, breast, hepatoma, esophageal, oral, lung, kidney, tongue, brain, prostate, melanoma, leukemia, Ehrlich
9.	Bauhinia variegata	Protective effect against cell proliferation, cytotoxic, antitumor, antioxidant	Ovary, lung, breast, leukemia, prostate, Ehrlich ascites, Delton's melanoma, glioma, colon, lymphoma
10.	Glycyrrhiza glabra	Autophagy, inhibit abnormal cell proliferation, cytotoxic, induce apoptosis	Breast, lung, liver, skin, cervical, hepatoma, colon, pancreas, prostate fibrosarcoma
11.	Allium sativum	Chemoprotective, anti-oxidant, tumor growth inhibition, antimutagenic	Hepatocellular carcinoma
12.	Moringa oleifera	Antiproliferative, cytotoxic, antioxidant	Breast, Dalton`s lymphoma, ovarian, hepatic, skin papilloma
13.	Asparagus racemosus	Cytotoxic, cell growth inhibition, attributing apoptosis, cell cycle arrest	Adenocarcinoma, breast, Ehrlich ascites, kidney
14.	Cynodon dactylon	Chemoprotective, cytotoxic, antioxidant, immunomodulator, antiproliferative	Colon, Ehrlich ascites, nasopharyngeal, liver
15.	Aegle marmelos	Cytotoxic, activate apoptosis, decrease cell survival, antiproliferative activity	Breast, Ehrlich ascites cancer, papilloma, skin
16.	Vitex negundo	Activation of macrophages, cytokine production, induces cell death and cytotoxic effect in cancer cell, antiproliferative activities.	Hepatocellular carcinoma, breast cancer, lung Ehrlich ascites tumor, Deltons ascites tumor, lymphoma
17.	Cannabis sativa	Tumor suppression, modulate multiple cancer pathways, block cell growth	Leukemia, lymphoma, glioblastoma, breast, colorectal, pancreas, cervical, prostate
18.	Ocimum sanctum	Antioxidant, immunomodulator, antiradiation, cancer preventive, cytotoxic	Sarcoma, cervical, epithelial, skin, papilloma, fibroblast
19.	Calotropis procera	Immunomodulator, cytotoxic, antiproliferative, increase apoptosis, antioxidant	Hepatocellular, sarcoma, leukemia, colon
20.	Achyranthus aspera	Inhibit metastatic gene, anti-proliferative activity.	Skin, pancreas, colon, breast, lung, prostate, non-Hodgkin lymphoma

Discussion

Herbal plants may repair the oxidative effects caused by tumor cells and reduce inflammation. These herbs may improve mitochondrial membrane permeability, which improves DNA binding, blocks the use of glucose by cancer cells, blocks the cellular signaling pathways of cancer genes and DNA mutations in normal cells, inhibits the invasion of cancer cells in the body, controls the cancer cell cycle or blocks further division, and inhibits microtubular dynamics in cancer cells. They may also enhance antioxidative changes, strengthen the inhibition of abnormal proliferation and cell migration of cancer cells in other body tissues, induce apoptosis (natural cell death), increase cytotoxicity and autophagy in cancer cells, suppress cancer growth, induce antimicrobial activities, enhance immunity, and provide higher stability and strength to individuals to survive cancer.

Conclusion

Herbal plants have been used for centuries in traditional medicine and are recognized for their diverse health benefits. Numerous studies have demonstrated the potential anti-cancer properties of various herbal compounds. Plants play an important role in our daily lives. Plants have many nutritional and therapeutic benefits for humans. Many constituents extracted from herbal plants have been studied. Various studies have shown clear evidence that herbal constituents have efficacy in preventing and treating cancer, and exhibit anti-proliferative bioactivities with extensive safety against cancer. In the recent decade, treatment with herbal plants has increased worldwide. Prevention is an active measure to decrease the risk of cancer. Improper dietary habits, an unhealthy lifestyle, environmental, and genetic factors are major contributors to carcinogenesis.

Herbs can delay development and metastasis process of the disease. If taken in early stages, they can provide relief from many side effects of chemotherapy and radiation therapies. Cancer deaths could be prevented by avoiding excessive tobacco and alcohol consumption, excess weight, poor hygiene and diet, lack of physical activity, sexually transmitted infections, pollution, and radiation. Herbs can also provide rehabilitative therapy after cancer surgeries. In the future, it is expected that a permanent solution for cancer will be found with the help of herbal plants.

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