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AN UPDATE ON DISEASE PROFILE OF CANCER WITH HERBAL TREATMENT

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ABSTRACT: There has been a vast growth in the field of herbal medicine and these drugs popularly are increasing both in developing and developed countries because of their natural origin, more therapeutic effect and less side effects. Since ancient cultures, tribal people methodically collected information on herbs and developed well-defined herbal drugs for the treatment of many diseases. In cancer, cells divide and grow uncontrollably, forming malignant tumors, and invade nearby parts of the body. The cancer may also spread to more distant parts of the body through the lymphatic system or bloodstream. Cancer grows out of normal cells in the body. Normal cells multiply when the body needs them, and die when the body doesn't need them. Mostly, cancer patients are gaining benefit from treatment with herbal medicine. This review article covers the possible mechanism of action of some of the herbal medicine and ayurvedic herbs used as anticancer therapy.

INTRODUCTION: Cancer known medically as a malignant neoplasm, is a broad group of various diseases, all involving unregulated cell growth. In cancer, cells divide and grow uncontrollably, forming malignant tumors, and invade nearby parts of the body. The cancer may also spread to more distant parts of the body through the lymphatic system or bloodstream.

Not all tumors are cancerous. Benign tumors do not grow uncontrollably, do not invade neighboring tissues, and do not spread throughout the body. . There are over 200 different known cancers that afflict humans. Determining what causes cancer is complex.

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Many things are known to increase the risk of cancer, includingtobacco use, certain infections, radiation, lack of physical activity, obesity and environmental pollutants [1]. These can directly damage genes or combine with existing genetic faults within cells to cause the disease [2]. Approximately five to ten percent of cancers are entirely hereditary.

Cancer can be detected in a number of ways, including the presence of certain signs and symptoms, screening tests, or medical imaging. Once a possible cancer is detected it is diagnosed by microscopic examination of a tissue sample. Cancer is usually treated with chemotherapy, radiation therapy and surgery. The chances of surviving the disease vary greatly by the type and location of the cancer and the extent of disease at the start of treatment. While cancer can affect people of all ages, and a few types of cancer are more common in children, the risk of developing cancer generally increases with age. In 2007, cancer caused about 13% of all human deaths worldwide (7.9 million).

Rates are rising as more people live to an old age and as mass lifestyle changes occur in the developing world [3].

Symptoms: Symptoms of cancer depend on the type and location of the cancer. For example, lung cancer can cause coughing, shortness of breath, or chest pain. Colon cancer often causes diarrhea, constipation, and blood in the stool. Some cancers may not have any symptoms at all. In certain cancers, such as pancreatic cancer, symptoms often do not start until the disease has reached an advanced stage [4].

The following symptoms can occur with most cancers:

1. Chills
2. Fatigue
3. Fever
4. Loss of appetite
5. Malaise
6. Night sweats
7. Weight loss

Causes: Cancers are primarily an environmental disease with 90–95% of cases attributed to environmental factors and 5–10% due to genetics. Environmental, as used by cancer researchers, means any cause that is not inherited genetically, not merely pollution.[5] Common environmental factors that contribute to cancer death include tobacco (25–30%), diet and obesity (30–35%), infections (15–20%), radiation (both ionizing and non-ionizing, up to 10%), stress, lack of physical activity, and environmental pollutants.

1. **Chemicals:** Cancer pathogenesis is traceable back toDNA mutations that impact cell growth and metastasis. Substances that cause DNA mutations are known as mutagens, and mutagens that cause cancers are known as carcinogens. Particular substances have been linked to specific types of cancer. Tobacco smoking is associated with many forms of cancer, and causes 90% of lung cancer [6].

2. **Diet and exercise:** Diet, physical inactivity, and obesity are related to approximately 30–35% of cancer deaths. Physical inactivity is believed to contribute to cancer risk not only through its effect on body weight but also through negative effects on immune system and endocrine system [7].

3. **3.3. Infection:** Worldwide approximately 18% of cancer deaths are related toinfectious diseases. This proportion varies in different regions of the world from a high of 25% in Africa to less than 10% in the developed world. Viruses are the usual infectious agents that cause cancer but bacteria and parasites may also have an effect. A virus that can cause cancer is called an oncovirus [8].

4. **Radiation:** Up to 10% of invasive cancers are related to radiation exposure, including both ionizing radiation and non-ionizing radiation.[1] Additionally, the vast majority of non-invasive cancers are non-melanoma skin cancers caused by non-ionizing ultraviolet radiation. Sources of ionizing radiation include medical imaging, and radon gas. Radiation can cause cancer in most parts of the body, in all animals, and at any age, although radiation-induced solid tumors usually take 10–15 years, and can take up to 40 years, to become clinically manifest, and radiation-induced leukemias typically require 2–10 years to appear [9].

5. **Physical agents:** Some substances cause cancer primarily through their physical, rather than chemical, effects on cells. A prominent example of this is prolonged exposure toasbestos, naturally occurring mineral fibers which are a major cause of mesothelioma, a type of cancer of the serous membrane. Nonfibrous particulate materials that cause cancer include powdered metallic cobalt and nickel, and crystalline silica [10].

6. **Hormones:** Somehormones play a role in the development of cancer by promoting cell proliferation. Hormones are important agents in sex-related cancers such as cancer of the breast, endometrium, prostate, ovary, and testis, and also of thyroid cancer and bone cancer [11].

Prevention: You can reduce the risk of getting a cancerous (malignant) tumor by:

1. Eating a healthy diet
2. Exercising regularly
3. Limiting alcohol
4. Maintaining a healthy weight
5. Minimizing your exposure to radiation and toxic chemicals
6. Not smoking or chewing tobacco
7. Reducing sun exposure, especially if you burn easily

Cancer screenings, such as mammography and breast examination for breast cancer and colonoscopy for colon cancer, may help catch these cancers at their early stages when they are most treatable. Some people at high risk for developing certain cancers can take medication to reduce their risk [12].

Types of Cancer:

1. **Bladder Cancer:** Bladder cancer is easily cured if found and treated early. Symptoms of bladder cancer include painful urination and blood in the urine. Causes are unknown. Treatment includes surgery, chemotherapy, and radiation. Bladder cancer is the rapid, uncontrolled growth of abnormal cells in the bladder. Cancer usually begins in the lining of the bladder. The cancerous cells may spread through the lining into the muscular wall of the bladder. Invasive bladder cancer may spread to lymph nodes, other organs in the pelvis (causing problems with kidney and bowel function), or other organs in the body, such as the liver and lungs [13].

2. **Brain Cancer:** Cancers of the brain are the consequence of abnormal growths of cells in the brain. Brain cancers can arise from primary brain cells, the cells that form other brain components (for example, membranes, blood vessels), or from the growth of cancer cells that develop in other organs and that have spread to the brain by the bloodstream (metastatic brain cancer) [14].

3. **Breast Cancer:** Breast cancer is a cancer that starts in the tissues of the breast. Breast cancer may be invasive or noninvasive. Invasive means it has spread from the milk duct or lobule to other tissues in the breast. Noninvasive means it has not yet invaded other breast tissue. Many breast cancers are sensitive to the hormone estrogen. This means that estrogen causes the breast cancer tumor to grow. Such cancers have estrogen receptors on the surface of their cells. They are called estrogen receptor-positive cancer or ER-positive cancer [15].

4. **Cervical Cancer:** Cervical cancer is mostly caused by the human papilloma virus, or HPV. An HPV vaccine may reduce the risk of cervical cancer. Symptoms include painful sex, vaginal bleeding, and discharge. Cervical cancer can be prevented. Cervical cancer happens when abnormal cells on the cervix grow out of control. Cervical cancer can often be successfully treated when it's found early. It is usually found at a very early stage through a Pap test [16]. If cervical cancer isn't treated, it may spread from the cervix to the vagina, and then into deeper tissue layers of connective tissue around the uterus. As it progresses, it may spread to the pelvic lymph nodes and other pelvic organs. Advanced-stage cancer may spread to lymph nodes; to other organs in the pelvis, causing problems with kidney and bowel function; or to other organs in the body, such as the liver and lungs [17].

5. **Colorectal Cancer:** Colorectal cancer, commonly known as colon cancer or bowel cancer, is a cancer from uncontrolled cell growth in the colon or rectum (parts of the large intestine), or in the appendix. Genetic analysis shows that colon and rectal tumors are essentially genetically the same cancer. Symptoms of colorectal cancer typically include rectal bleeding and anemia which are sometimes associated with weight loss and changes in bowel habits [18].

6. **Ovarian Cancer:** Ovarian cancer occurs when a cancerous tumor is in a woman’s ovary. In most cases, there are no known causes. There are often no symptoms, but ovarian cancer warning signs include ongoing pain or cramps in the belly or back, abnormal vaginal bleeding, and nausea and bloating.

Depending on the cancer stage, ovarian cancer treatment includes surgery and chemotherapy [19].

7. **Non-Hodgkin's Lymphoma:** Non-Hodgkin's lymphoma is cancer of the lymph nodes. The cause is unknown; it may be triggered by infections or a compromised immune system. Symptoms include fever, night sweats, swollen glands, fatigue, and weight loss [20]. Non-Hodgkin's lymphoma (NHL) is cancer of the lymphatic system, which is part of the immune system. The lymphatic system is found throughout the body. When you have this disease, cells in the lymphatic system either grow without control or do not die as cells normally do [21].

8. **Lungs cancer:** Lung cancer is cancer that starts in the lungs. The lungs are located in the chest. When you breathe, air goes through your nose, down your windpipe (trachea), and into the lungs, where it spreads through tubes called bronchi. Most lung cancer begins in the cells that line these tubes [22].

9. **Prostate cancer**: Prostate cancer is cancer that starts in the prostate gland. The prostate is a small, walnut-sized structure that makes up part of a man's reproductive system. It wraps around the urethra, the tube that carries urine out of the body [23].

10. **Pancreatic cancer**: Pancreatic cancer occurs when this uncontrolled cell growth begins in the pancreas. Rather than developing into healthy, normal pancreas tissue, these abnormal cells continue dividing and form lumps or masses of tissue called tumors. Tumors then interfere with the main functions of the pancreas. If a tumor stays in one spot and demonstrates limited growth, it is generally considered to be benign [24].

11. **Skin cancer**: Skin cancer is the most common form of human cancer. It is estimated that over 1 million new cases occur annually. The annual rates of all forms of skin cancer are increasing each year, representing a growing public concern. It has also been estimated that nearly half of all Americans who live to age 65 will develop skin cancer at least once. The most common warning sign of skin cancer is a change in the appearance of the skin, such as a new growth or a sore that will not heal [25].

12. **Thyroid cancer**: The next most common type of cancer of the thyroid is called medullary thyroid cancer (5%), which is derived from the parafollicular "C" cells of the thyroid. In about 15% of patients with this cancer, there is a familial genetic predisposition to develop other types of endocrine tumors. Medullary thyroid cancer is more aggressive than papillary or follicular cancer, and is more likely to spread to lymph nodes and outside of the neck. The other major type of thyroid cancer often described is called anaplastic thyroid cancer (1%). This cancer usually affects older people and is very aggressive. Other rare types of cancers that may be found in the thyroid include: lymphomas (cancer of the lymph gland cells), or metastases (cancers from other sites that have spread to the thyroid gland, such as melanoma, breast cancer, renal cell cancer, or lung cancer) [26].

13. **Penile cancer**: Penile cancer is a rare disease in which cancer cells develop within the skin and/or soft tissues of the penis. Penile cancer commonly presents as a lump, mass or ulcer on the penis. Lesions can be raised and wart-like or flat. The penile lesion can be sore and inflamed, and there may be itching and burning in the region as well. Generally, penile cancers affect the head or foreskin of the penis rather than the shaft of the penis. Although some penile cancers begin as pre-malignant lesions, the majority of penile cancers do not have premalignant lesions. The presentation for penile cancers can vary significantly from a small bump to very large, infected, and aggressive lesions [27].

14. **Testicular cancer**: Testicular cancer begins when cells within the testicle become cancerous and begin to grow out of control. Ninety-five percent of testicular tumors are a type called germ cell tumors.The term "germ cell" refers to cells that make sperm, and is not related to the more common definition of the word "germ," an organism that can cause infections. Other types of tumors found in the testicle are uncommon, and so this article will only address germ cell tumors [28].

Testicular cancer is classified as one of two types: seminoma, which accounts for 40% of all testicular cancers, and non-seminoma, which includes four sub-types. Seminomas include classic or anaplastic seminoma, which account for 35% of testicular cancers and generally occur between the ages of 25 and 45 years. Spermatocytic seminoma accounts for only 5% of testicular tumors and occurs later in life, with an average age at diagnosis of 65 years [29].

15. 5.15. Bone cancer: A bone tumor is an abnormal growth of cells within a bone. A bone tumor may be cancerous (malignant) or noncancerous (benign). Cancers that start in the bones are referred to as primary bone tumors. Cancers that start in another part of the body (such as the breast, lungs, or colon) are called secondary or metastatic bone tumors. They behave very differently from primary bone tumors. Multiple myeloma often affects or involves the bone, but is not considered a primary bone tumor [30].

16. **Carcinoid cancer**: Carcinoid tumors are a type of slow-growing cancer that can arise in several places throughout your body. Carcinoid tumors, which are one subset of tumors called neuroendocrine tumors, usually begin in the digestive tract (stomach, appendix, small intestine, colon, and rectum) or in the lungs. Carcinoid tumors often don't cause signs and symptoms until late in the disease. Carcinoid tumors can produce and release hormones into your body that cause signs and symptoms such as diarrhea or skin flushing. Treatment for carcinoid tumors usually includes surgery and may include medications [31].

17. **Endocrine cancer**: An endocrine tumor is a growth that affects the parts of the body that secrete hormones. Because an endocrine tumor starts in the cells that make hormones, the tumor itself can make hormones and cause serious illness. Endocrine cancer is cancer that begins in one of these glands. The most common sort of endocrine cancer is thyroid cancer, which begins in the thyroid gland. There are also some types of pancreatic cancer (cancer in the pancreas) that are classified as endocrine tumors. Some tumors that grow in an endocrine gland are benign, which means they're not cancerous. For example, most pituitary tumors are benign. However, benign tumors are often treated in the same way as cancerous tumors [32].

18. **Gastrointestinal cancer**: The gastrointestinal tract runs from the mouth to the anus, and includes the oesophagus (gullet), stomach, small bowel or intestine, and the large bowel (colon and rectum). Cancer can affect any part of the gastrointestinal tract, although, curiously, it is rare in the small intestine where most digestion takes place. An indolent (slow-growing) cancer that forms in cells that make hormones in the lining of the gastrointestinal tract (the stomach and intestines). It usually occurs in the appendix (a small fingerlike pouch of the large intestine), small intestine, or rectum. Having gastrointestinal carcinoid tumor increases the risk of forming other cancers of the digestive system [33].

19. **Head and neck cancer**: Cancers that are known collectively as head and neck cancers usually begin in the squamous cells that line the moist, mucosal surfaces inside the head and neck (for example, inside the mouth, the nose, and the throat). These squamous cell cancers are often referred to as squamous cell carcinomas of the head and neck. Head and neck cancers can also begin in the salivary glands, but salivary gland cancers are relatively uncommon. Salivary glands contain many different types of cells that can become cancerous, so there are many different types of salivary gland cancer [34].

20. **Oral cancer**: Oral cancer is a subtype of head and neck cancer is any cancerous tissue growth located in the oral cavity. It may arise as a primary lesion originating in any of the oral tissues, by metastasis from a distant site of origin, or by extension from a neighboring anatomic structure, such as the nasal cavity. Alternatively, the Oral cancers may originate in any of the tissues of the mouth, and may be of varied histologic types: teratoma, adenocarcinoma derived from a major or minor salivary gland, lymphoma from tonsillar or other lymphoid tissue, or melanoma from the pigment-producing cells of the oral mucosa. There are several types of oral cancers, but around 90% are squamous cell carcinomas, originating in the tissues that line the mouth and lips.

Oral or mouth cancer most commonly involves the tongue. It may also occur on the floor of the mouth, cheek lining, gingiva (gums), lips, or palate (roof of the mouth). Most oral cancers look very similar under the microscope and are called squamous cell carcinoma [35].

21. **Leukemia**: Leukemia or leukaemia is a type of cancer of the blood or bone marrow characterized by an abnormal increase of immature white blood cells called "blasts." Leukemia is a broad term covering a spectrum of diseases. In turn, it is part of the even broader group of diseases affecting the blood, bone marrow, and lymphoid system, which are all known as hematological neoplasms. In 2000, approximately 256,000 children and adults around the world developed some form of leukemia, and 209,000 died from it. Younger patients tend to live longer, as older patients aren't expected to live quite as long. About 90% of all leukemias are diagnosed in adult [36].

22. **Lymphoma**: Lymphoma is a type of blood cancer that occurs when lymphocytes, white blood cells that form a part of the immune system and help protect the body from infection and disease, begin behaving abnormally. Abnormal lymphocytes may divide faster than normal cells or they may live longer than they are supposed to. Lymphoma may develop in many parts of the body, including the lymph nodes, spleen, bone marrow, blood or other organs [37].

    Typically, lymphoma presents as a solid tumor of lymphoid cells. Treatment might involve chemotherapy and in some cases radiotherapy and/or bone marrow transplantation, and can be curable depending on the histology, type, and stage of the disease. These malignant cells often originate in lymph nodes, presenting as an enlargement of the node (a tumor). It can also affect other organs in which case it is referred to as extranodal lymphoma.

    Extranodal sites include the skin, brain, bowels and bone. Lymphomas are closely related to lymphoid leukemias, which also originate in lymphocytes but typically involve only circulating blood and the bone marrow (where blood cells are generated in a process termed haematopoesis) and do not usually form static tumors. There are many types of lymphomas, and in turn, lymphomas are a part of the broad group of diseases called hematological neoplasms [38].

23. **Metastasis**: Metastasis, or metastatic disease, is the spread of a cancer from one organ or part to another non-adjacent organ or part. The new occurrences of disease thus generated are referred to as metastases (sometimes abbreviated mets). It was previously thought that only malignant tumor cells and infections have the capacity to metastasize; however, this is being reconsidered due to new research. In origin metastasis is a Greek word meaning "displacement", from μετά, meta, "next", and στάσις, stasis, "placement". The plural is metastases [39].

24. Myelomas: Multiple myeloma (from Greek myelo-, bone marrow), also known as plasma cell myeloma or Kahler's disease (after Otto Kahler), is a cancer of plasma cells, a type of white blood cell normally responsible for producing antibodies. In multiple myeloma, collections of abnormal plasma cells accumulate in the bone marrow, where they interfere with the production of normal blood cells. Most cases of myeloma also feature the production of a paraprotein- an abnormal antibody which can cause kidney problems. Bone lesions and hypercalcemia (high calcium levels) are also often encountered [40].

Management of Cancer:

1. **Surgery:** In theory, non-hematological cancers can be cured if entirely removed by surgery, but this is not always possible. When the cancer has metastasized to other sites in the body prior to surgery, complete surgical excision is usually impossible. In the Halstedian model of cancer progression, tumors grow locally and then spread to the lymph nodes, then to the rest of the body. This has given rise to the popularity of local-only treatments such as surgery for small cancers. Even small localized tumors are increasingly recognized as possessing metastatic potential. Examples of surgical procedures for cancer include mastectomy for breast cancer, prostatectomy for prostate cancer, and lung

cancer surgery for non-small cell lung cancer. The goal of the surgery can be either the removal of only the tumor, or the entire organ. A single cancer cell is invisible to the naked eye but can regrow into a new tumor, a process called recurrence. For this reason, the pathologist will examine the surgical specimen to determine if a margin of healthy tissue is present, thus decreasing the chance that microscopic cancer cells are left in the patient [12].

2. **Radiation therapy:** Radiation therapy (also called radiotherapy, X-ray therapy, or irradiation) is the use of ionizing radiation to kill cancer cells and shrink tumors. Radiation therapy can be administered externally via external beam radiotherapy (EBRT) or internally via brachytherapy. The effects of radiation therapy are localized and confined to the region being treated. Radiation therapy injures or destroys cells in the area being treated (the "target tissue") by damaging their genetic material, making it impossible for these cells to continue to grow and divide. Although radiation damages both cancer cells and normal cells, most normal cells can recover from the effects of radiation and function properly.

   The goal of radiation therapy is to damage as many cancer cells as possible, while limiting harm to nearby healthy tissue. Hence, it is given in many fractions, allowing healthy tissue to recover between fractions. Radiation therapy may be used to treat almost every type of solid tumor, including cancers of the brain, breast, cervix, larynx, lung, pancreas, prostate, skin, stomach, uterus, or soft tissue sarcomas. Radiation is also used to treat leukemia and lymphoma. Radiation dose to each site depends on a number of factors, including the radio sensitivity of each cancer type and whether there are tissues and organs nearby that may be damaged by radiation. Thus, as with every form of treatment, radiation therapy is not without its side effects [12].

3. **Chemotherapy:** Chemotherapy is the treatment of cancer with drugs ("anticancer drugs") that can destroy cancer cells. In current usage, the term "chemotherapy" usually refers to cytotoxic drugs which affect rapidly dividing cells in general, in contrast with targeted therapy.

   Chemotherapy drugs interfere with cell division in various possible ways, e.g. with the duplication of DNA or the separation of newly formed chromosomes. Most forms of chemotherapy target all rapidly dividing cells and are not specific to cancer cells, although some degree of specificity may come from the inability of many cancer cells to repair DNA damage, while normal cells generally can.

   Hence, chemotherapy has the potential to harm healthy tissue, especially those tissues that have a high replacement rate (e.g. intestinal lining). These cells usually repair themselves after chemotherapy. Because some drugs work better together than alone, two or more drugs are often given at the same time. This is called "combination chemotherapy"; most chemotherapy regimens are given in a combination [5].

4. **Targeted therapies:** Targeted therapy, which first became available in the late 1990s, has had a significant impact in the treatment of some types of cancer, and is currently a very active research area. This constitutes the use of agents specific for the deregulated proteins of cancer cells. Small molecule targeted therapy drugs are generally inhibitors of enzymatic domains on mutated, overexpressed, or otherwise critical proteins within the cancer cell. Prominent examples are the tyrosine kinase inhibitors imatinib (Gleevec/Glivec) and gefitinib (Sasco *et al*., 2004).

   Monoclonal antibody therapy is another strategy in which the therapeutic agent is an antibody which specifically binds to a protein on the surface of the cancer cells. Examples include the anti-HER2/neu antibody trastuzumab (Herceptin) used in breast cancer, and the anti-CD20 antibody rituximab, used in a variety of B-cell malignancies. Photodynamic therapy (PDT) is a ternary treatment for cancer involving a photosensitizer, tissue oxygen, and light (often using lasers. PDT can be used as treatment for basal cell carcinoma (BCC) or lung cancer; PDT can also be useful in removing traces of malignant tissue after surgical removal of large tumors [6].

5. **Immunotherapy:** Cancer immunotherapy refers to a diverse set of therapeutic strategies designed to induce the patient's own immune system to fight the tumor. Contemporary methods for generating an immune response against tumours include intravesical BCG immunotherapy for superficial bladder cancer, and use of interferons and other cytokines to induce an immune response in renal cell carcinoma and melanoma patients. Vaccines to generate specific immune responses are the subject of intensive research for a number of tumours, notably malignant melanoma and renal cell carcinoma.

   Sipuleucel-T is a vaccine-like strategy in late clinical trials for prostate cancer in which dendritic cells from the patient are loaded with prostatic acid phosphatase peptides to induce a specific immune response against prostate-derived cells.[8] Allogeneic hematopoietic stem cell transplantation ("bone marrow transplantation" from a genetically non-identical donor) can be considered a form of immunotherapy, since the donor's immune cells will often attack the tumor in a phenomenon known as graft-versus-tumor effect. For this reason, allogeneic HSCT leads to a higher cure rate than autologous transplantation for several cancer types, although the side effects are also more severe [9].

6. **Hormonal therapy:** The growth of some cancers can be inhibited by providing or blocking certain hormones. Common examples of hormone-sensitive tumors include certain types of breast and prostate cancers. Removing or blocking estrogen or testosterone is often an important additional treatment. In certain cancers, administration of hormone agonists, such as progestogens may be therapeutically beneficial.

7. **Angiogenesis inhibitors:** Angiogenesis inhibitors prevent the extensive growth of blood vessels (angiogenesis) that tumors require to survive. Some, such as bevacizumab, have been approved and are in clinical use. One of the main problems with anti-angiogenesis drugs is that many factors stimulate blood vessel growth in cells normal or cancerous. Anti-angiogenesis drugs only target one factor, so the other factors continue to stimulate blood vessel growth. Other problems include route of administration, maintenance of stability and activity and targeting at the tumor vasculature [10].

TABLE 1: SEMI SYNTHETIC DRUGS USED IN CANCER

Herbal drugs	Semi synthetic drugs	Molecular formula	Route of administration	Mode of action	Chemical constituent	Uses
Catharanthus rosea	Vinblastin sulfate	$C_{46}H_{58}O_9N_4.H_2SO_4$	Intravenous	It has been reported to act by two mechanisms. At very low concentrations they suppress microtubule dynamics and at higher concentrations they reduce microtubule polymer mass [41]	Vindoline, Vincaleukoblastine, Vinomine	Childhood leukemia, Testicular cancer, Hodgkin's lymphoma [42]
Catharanthus rosea	Vincristine sulfate	$C_{46}H_{56}O_{10}N_4.H_2SO_4$	Intravenous	It binds to tubulin dimers, inhibiting assembly of microtubule structures, Disruption of the microtubules arrests mitosis in metaphase [43]	Vincamine, Leurocristine, Vinoxine, Leurosine	Wilm's tumor, Thyroid cancer, Acute lymphoblastic leukemia, Brain tumor [44]
Taxus baccata	Taxol	$C_{47}H_{51}NO_{14}$	Intravenous (Infusion or bolus)	It enhances polymerization of tubulin, a mechanism opposite to that of vinca alkaloids. The microtubules are stabilized and their depolymerization is prevented [45]	Taxine, Taxanes, Baccatins, Taxine β [46]	ovarian, breast,lung cancers and Kaposi's sarcoma [47]

TABLE 2: DRUGS AND HERBS OF AYURVEDA USED IN TREATMENT OF CANCER.[48]

S. no.	Cancer	Drugs or herbs
1.	Brain Cancer	Mandukaparni (*Bacopa monerea*), Kastoori Bhairav Rasa with combination of divya herbs.
2.	Oropharyngeal Cancers	Kasamarda (cassia oxidentalis), Mahalaxmi vilas Rasa
3.	Lung Cancers	Pippali (*Piper longum*), Hirak Rasayan
4.	Stomach Cancers	Shatavari (*Asparagus racemosus*), Amlaki (*Philanthus amblica*), Banga Bhasma, *Aloe vera*, Amaltas (*Casia fistula*), Bhoy-Amli (*Philanthus nurare*), Sarphunkha (*Tephrosia purpura*)
5.	Intestinal Cancers	Shigru (*Moringa olifera*), Panchamrut purpti
6.	Female Genital Cancers	Ashoka (Seraka Ashoka), Vaikranta Bhasma
7.	Mail Genital Cancers	Triphala (Three myrobelans), Makardhvaja
8.	Liver Cancers	Bhumvamalaki, Arogyavardhini
9.	Blood Cancer	Anantmula (*Hermidesmus indicus*), Suvarna Vasant Malti Rasa
10.	Bone Cancers	Aabha Gugglu, Madhu Malini Vasant Rasa
11.	Breast Cancers	Gojivha, Chinchabhallataka
12.	Skin Cancers	Manjishtha (*Rubia cordifolia*), Samira Panaga Rasa, Kaishore Gugglu, Gandhak Rasayan
13.	All types of cancers	Kanchnara Gugglu, Kaishore Gugglu, Bhallatak Phalmajja Churna, Trifala Gugglu, Tribang Bhasma, Shilajatu Vati, Aabha Gugglu, Laksha Gugglu

TABLE 3: HERBAL DRUGS USED IN CANCER

Herbal drugs	Biological source	Family	Route of administration	Chemical constituents	Mode of action	Uses
Iscador (Mistletoe extract)	*Viscum album*	Loranthaceae	By injection, & occasionally by drops.	Lectins, viscotoxins, alkaloids.	Polypeptides including lectins, viscotoxins, are thought responsible for immune stimulant & tumor inhibition activities [49]	It is used in management of malignant tumours except blood based cancers [50]
Saw palmetto	*Serenoa repens*	Arecacea	Orally [51]	capric, caprylic, caproic, lauric, palmitic, oleic acids, beta-sitosterol [52]	*In vitro* studies suggest that liposterolic extract of the plant has antiandrogenic effects that inhibit the type 1 and type 2 isoenzymes of 5α-reductase [53]	It is used in enlarged prostate or benign prostatic hyperplasia (BPH) [54]
Birch	*Betula alba*	Betulaceae	Cutaneous, cream [55]	Betulin, betules, empyreumatic oil, oleumbetulinum, methylsalicylate, betuloside, betuligenol, cresol and guaiacol [56]	It caused a rapid increase in reactive oxidative species product and a concomitant dissipation of mitochondrial membrane potential in a dose and time-dependent manners which resulted in cell apoptosis [56]	skin cancer and other types of tumor cells and nervous system cancers in children [57]
Aloe	*Aloe barbadensis*	Liliaceae	topical applications and oral [58]	Barbaloin, isobarbaloin,aloe-emodin, resins [59]	. It reduces the production and release of skin keratinocyte-derived immunosuppressive cytokines such as interleukin-10 (IL-10) and hence prevents UV-induced suppression of delayed type hypersensitivity [60]	skin cancer (non-melanoma) [61]

Turmeric	*Curcuma Longa*	Zingiberaceae	Oral administration.[62]	Curcumin, Curcuminoids, dihydrocurcumin, etc [63]	causes apoptosis (death) of various cancer cell types [64]	skin, colon, forestomach, duodenum and ovary cancers [64]
Camptotheca	*Camptotheca acuminatal*	Nyssaceae	peritoneal, parenteral or topical [65]	Camptothecin, 10-hydroxy camptothecin etc [66]	Topotecan is a chemotherapeutic agent that inhibits topoisomerase I and eventually interferes DNA replication [67]	Bladder cancer, breast cancer.
Gloriosa	*Gloriosa superba*	Liliaceae	Oral, Inhalation, Dermal, Parenteral [68]	colchicines and gloriosine [69]	It has been found to prevent activation of neutrophills, binding β-tubulin and prevent assembly of microtubules [70]	Colon, bladder, prostate cancer.
Indian Oleander	*Nerium indicum*	Apocynaceae	Cutaneous.[71]	Betulinic acid Oleanolic acid scopoletin scopolin Kaempferol [72]	Both oleandrin and oleandrigenin, are able to inhibit proliferation of tumor cells and stimulate their apoptosis [73]	colon, non-small cell lung cancer, leukemia, pancreas, melanoma and prostate [74]
garlic	*Allium sativum*	Liliaceae	orally (p.o.) or intraperitoneal (i.p.).	aliin, allicin, ajoene, allylpropl, diallyl, trisulfide, sallylcysteine, vinyldithiines [75]	Garlic has demonstrated strong inhibition of cancer development in the presence of known tumor promoters including 12-O-tetradecanoylpharbol-13-acetate, 7,12-dimethylbenzanthracene and phorbol-myristate-acetate, as well as tumor inducers such as 7,12-dimethylbenzanthracene and 1,2-dimethylhydrazine [76]	colon cancer, rectal cancer, stomach cancer, breast cancer, prostate cancer, lung cancer and bladder cancer [77]
ginger	*Zingiber officinale*	Zingiberaceae	Oral.	Gingerol, zingerone, linalool, farnesene.	Ginger treatment resulted in inhibition of NF-kB activation as well as diminished secretion of VEGF and IL-8. Ginger inhibits growth and modulates secretion of angiogenic factors in ovarian cancer cells [78]	Colon cancer, ovarian cancer, prostate cancer [79]
ginseng	*Panax ginseng*	Araliaceae	intraperitoneally (i.p.), subcutaneous [80]	ginsenosides or panaxosides, dammarane and oleanane [81]	ginseng may inhibit tumor growth by affecting both cancer cells and their blood supply [82]	Bladder cancer, breast cancer [83]

Why people with Cancer use Herbal medicine: Herbal medicine is one of the most commonly used complementary and alternative therapies (CAM) by people with cancer. Some studies have shown that as many as 6 out of every 10 people with cancer (60%) use herbal remedies alongside conventional cancer

treatments. There are many different types of herbal medicines and some of them overlap with foods. Commonly used plants include echinacea, St John's wort, green tea and ginger [84].

Terminology used in Cancer [85]:

1. **Cancer:** "uncontrolled growth of abnormal cells"; synonym: neoplasia.

2. **Tumor:** literally, it means "a swelling"; an alternative definition is "a new growth of tissue in which the multiplication of cells is uncontrolled and progressive"; synonym: neoplasm.

3. **Oncology/Oncologist:** oncology is the field that deals with the diagnosis and treatment of cancer while an oncologist is a doctor that specializes in this field (veterinarians can become board-certified in either medical oncology or radiation oncology by completing a residency and passing several certifying exams).

4. **Malignant:** "having the properties of anaplasia, invasion and metastasis" (these are all characteristics of a tumor that make it capable of causing the death of a patient); a malignant tumor is one which is no longer resembles the cells it was derived from, is invasive at the site where it starts and has the ability to metastasize (or spread) to other organs.

5. **Benign:** opposite of malignant; benign tumors are unlikely to spread, unlikely to cause the death of a patient and have a favorable outcome (however, there are a few exceptions where benign tumors behave more like malignant ones).

6. **Metastasis:** "the transfer of disease from one organ or part to another not directly connected to it"; metastasis is the process by which the tumor spreads from one location to another; the most common sites of metastasis are the lungs or lymph nodes; the most common routes of metastasis are the bloodstream and the lymphatics.

7. **Metastatic lesion:** the term used for the site of spread.

8. **Biopsy:** "the removal and examination, usually microscopic, of tissue from the living body, performed to establish a precise diagnosis"; when we "biopsy" something, it means that we remove a piece of tissue to look at under the microscope (we also use the term to refer to the sample we have obtained); a biopsy is crucial in making a diagnosis of cancer.

9. **Carcinoma:** "a malignant growth made of epithelial cells tending to infiltrate the surrounding tissues and give rise to metastasis"; epithelial cells "line" body surfaces.

10. **Adenoma:** "a benign epithelial tumor".

11. **Sarcoma:** "a tumor made up of a substance like the embryonic connective tissue"; sarcomas are malignant tumors of connective tissue origin (such as cartilage, bone and muscle).

12. **Anaplastic/Undifferentiated:** "a loss of differentiation of cells and of their orientation to one another"; tumors that are anaplastic are usually considered very malignant and aggressive.

13. **Protocol:** we usually use this term to refer to the specific chemotherapy plan that is used (for example, the "Weekly Sequential protocol" is what we commonly used for treating lymphosarcoma); it can also refer to the overall treatment plan

14. **Cycle:** chemotherapy drugs are often given in the same order on the same schedule repeatedly; the term "cycle" refers to the basic plan that gets repeated over and over again; the cycle is different for each chemotherapy protocol.

CONCLUSION: In this review, we give an overview on the disease profile of cancer and recent development of herbal medicine in the prevention and treatment of cancer. Later, we shed lights on the terminology used in cancer. In this report, we have assessed with herbal approaches which are associated with cancer. Some herbal drugs and ayurvedic formulations are commonly used by cancer patients reduce the side effects and complications during the antitumor therapy. The relevant herbal medicines include *Catharanthus rosea, Taxus baccata, Viscum album, Betula alba, Serenoa repens, Aloe*

barbadensis, Curcuma Longa, Camptotheca acuminatal, Gloriosa superb, Nerium indicum, Allium sativum etc. However, there still have some adverse effects caused or amplified by herb and drug interactions.

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