International Journal of Natural Medicine and Health Sciences
ISSN (Online):2790-2471 ISSN(Print): 2790-2463
Volume 1, No.2, March 2022
Journal homepage: https://journals.iub.edu.pk/index.php/ijnms

Review

Current options and therapeutic strategies for the management of cancer

Abdul Hayee[a*], Hà Thị Việt Mỹ[a], Muhammad Rahil Aslam[b], Aamir Sharif[c] and Đặng Sơn Tùng[d]

[a] Department of Immunology, Faculty of Medicine, Academic Assembly, University of Toyama, 2630 Sugitani, Toyama, 930-0194, Japan.
[b] First Department of Internal Medicine, Faculty of Medicine, University of Toyama, 2630 Sugitani, Toyama, 930-0194, Japan.
[c] Department of System Emotional Science, Faculty of Medicine, University of Toyama, 2630 Sugitani, Toyama, 930-0194, Japan.
[d] Department of 2nd pathology, Graduate School of Innovative Life Science, University of Toyama, 2630 Sugitani, Toyama, 930-0194, Japan

Article Info.

Received: 06-03-2022
Revised: 24-03-2022
Accepted:26 -03-2022
Online: 30-03-2022

Correspondence:
khiljia.hayee@gmail.com

Keywords: Anti-cancer activity, cancer, treatment options, medicinal plants, efficacy.

Abstract

Disease is yet thought to be a significant general medical problem of created and emerging nations. The high mortality related with particular kinds of disease (Lung, prostate, stomach and colorectal) legitimize a developing interest for the recognizable proof of new pharmacological specialists effective in malignant growth counteraction and treatment. A few strategies are accessible to treat disease like a medical procedure, chemotherapy, radiation treatment, immunotherapy, and monoclonal immunizer treatment. The decision of treatment relies on the area of the growth, grade of the cancer and the phase of the infection as well as the overall condition of the patient. Plants are considered as the great wellspring of profoundly compelling traditional specialists for the therapy of many sorts of malignant growth. The phytochemical investigation of the restorative plants has added generally in the disclosure of new anticancer medications. This article has been made to audit a few restorative plants utilized for the therapy of malignant growth and furthermore gives the information about anticancer therapeutic plants, which are utilized by individuals in all around the Asian nations.

Citation: Hayee A, Mỹ HTV, Aslam MR, Sharif A, Current options and therapeutic strategies for the management of cancer. IJNMS. 2022; 1(2): 28-37.

Introduction

Cancer is a dreadful disease characterized by abnormal proliferation of cells that usually invades the adjacent tissues and destroys these tissues. [1]. Millions of people are diagnosed with cancer every year, and it is the second. leading cause of death in America. According to one of the reports of American Cancer Society in 2006, deaths from cancer constitute 2-3% of the annual deaths recorded worldwide. Hence, cancer kills about 3500 million people annually all over the world. [2] Among the most well-known (lung, stomach, Intestine, liver, bosom) kinds of malignant growths, cellular breakdown in the lungs is the most well-known disease analyzed in men and bosom malignant growth is the most widely recognized disease analyzed in ladies. In 2008, around 12.7 million individuals were determined to have disease and 7.6 million individuals kicked the bucket from the malignant growth during that very year. Cellular breakdown in the lungs, bosom malignant growth, colorectal disease, and stomach disease represented two-fifths of the complete instances of tumors analyzed everywhere. It is assessed that over 70% of all disease deaths happened in low-and center pay nations. Passings because of disease are constantly expanding. It has been recommended that there be 11.5 million passings in 2030 [3] and 27 million new malignant growth cases and 17.5 million disease passings are projected to happen on the planet by 2050. [4] More than 30% of diseases are brought about by conduct and natural elements, including liquor use and tobacco, dietary elements, deficient customary utilization of products of the soil, heftiness, actual latency, constant contaminations from Helicobacter pylori, hepatitis B infection (HBV), hepatitis C infection (HCV) and a few sorts of human papilloma infection (HPV) and word related gambles including openness to ionizing and non-ionizing radiation. Ordinary disease therapy incorporates psychosocial support, medical procedure, radiotherapy, and chemotherapy. [5] Currently, the most usually utilized disease chemotherapy incorporates alkylating specialists, enemies of metabolites, antitumor anti-microbials, platinum analogs and regular anticancer specialists. In any case, because of the rising pace of mortality related to malignant growth and unfavorable or harmful symptoms of disease chemotherapy and radiation treatment [6] an elective answer for allopathic medication is the use of therapeutic plant arrangements to capture the deceptive idea of the sickness. Numerous restorative plants have been assessed in clinical preliminaries and are being researched phytochemically to comprehend their enemy of growth impacts against different diseases. Along these lines, malignant growth patients those previously got injured with this infection. Further, troubled by poisonous/results of chemotherapy, have now diverted to look for help from the correlative and elective prescriptions. [7]

Current options for the treatment of cancer

Several options are available to treat cancer such as surgery, chemotherapy, radiation therapy, immunotherapy, and monoclonal antibody therapy. [8]

1. Malignant growth is a muddled illness [9] and it is impossible that there will at any point be a solitary remedy for disease. [10] Angiogenesis inhibitors were remembered to have prospective therapy choice for a very long time of disease; however, this has not been practically the situation. [11]

As per hypothetical perspective, non-hematological tumors can be renovated if all in all eliminated by a medical system; however, this is beyond the realm of possibilities 100% of the time. Widespread careful withdrawal is generally unimaginable whenever the disease has spread to other pieces of the body before a medical system. In this manner, medical procedure can be advantageous just for little malignant growths. Surgeries for malignant growth incorporate mastectomy for bosom disease, prostatectomy for prostate malignant growth, and cellular interruption in the lung's medical procedure for non-little cell cellular interruption in the lungs. The reason for the medical procedure is either to eliminate just the cancer, or the whole organ. A solitary malignant growth cell isn't noticeable to the unaided eye; however, would re be able to develop into another cancer, an interaction called repeat. Consequently, the pathologist will look at the careful example to decide whether an edge of sound tissue is available, diminishing the opportunity for minute malignant growth cells to be left in the patient.

3. Medical procedure is regularly fundamental for arranging the growth, for example deciding the degree of the sickness and whether it has metastasized to local lymph hubs. Arranging is a significant determinant of guess of the infection and the requirement for adjuvant treatment. Assuming that medical procedure is conceivable and fundamental, it is normally performed before different types of therapy, albeit the request doesn't influence the result. [12] sometimes, medical procedure should be deferred until different therapies are feasible to shrivel the growth.

4. Radiation treatment, radiotherapy, and radiation oncology are clinical exploitation of ionizing radiation to kill malignant growth cells and treat cancers. Radiation treatment should be possible remotely by means of outside bar radiotherapy (EBRT) or inside through brachy treatment. The impacts of radiation treatment are bound to the area being dealt with for the most part. Radiation treatment harms or annihilates cells in the space being treated by harming their hereditary material, making it inconceivable for these cells to proceed to develop and multiply. Even though radiation destructs both disease cells and typical cells, most ordinary cells can recuperate from the impacts of radiation and capacity appropriately. Radiation treatment might be utilized to treat every kind of strong growth, including diseases of the mind, bosom, lung, pancreas, prostate, skin, stomach, uterus, cervix, larynx, liver, or delicate tissue sarcomas. This treatment is additionally used to treat leukemia and lymphoma. Radiation portion to each site relies upon a few elements, including the radio-awareness of every disease type and whether there are tissues and organs close by that might be harmed by radiation. [13]

5. Chemotherapy is also a superior malignant growth therapy method that utilizes compound substances ("anticancer medications") to eradicate disease cells. At present, the expression "chemotherapy" typically alludes to cytotoxic medications which

influence quickly multiplying cells overall. Chemotherapy drugs impede cell division in different potential ways, such as meddling in DNA duplication or detachment of recently framed chromosomes. Most kinds of chemotherapy focus on quickly separating cells and are not explicit to disease cells. Hence, chemotherapy can hurt solid tissue, particularly those with a high substitution rate for example gastrointestinal covering. These cells by and large fix themselves after chemotherapy.

6. Most chemotherapy regimens are given in a blend called "mix chemotherapy". At least two medications are regularly given simultaneously in this treatment since certain medications work preferred together over alone. [13]
7. Designated treatment, accessible in the last part of the 1990s, has a critical effect in the therapy of certain kinds of malignant growth, and is an extremely dynamic examination region. Designated treatment comprises the utilization of specialists explicit for the liberated proteins of disease cells. Designated treatment drugs are generally inhibitors of enzymatic areas on transformed, over-communicated, or basic proteins inside the malignant growth cell. The tyrosine kinase inhibitors, imatinib (Gleevec/Glivec) and gefitinib (Iressa) are notable models.
8. Monoclonal neutralizer treatment is one more technique for therapy. The helpful specialist is an immune response that explicitly ties to a protein on the outer layer of the disease cells. Models are against HER2/neu immune response trastuzumab (Herceptin) utilized in bosom disease and the counter CD20 immunizer rituximab, utilized in an assortment of B-cell malignancies.
9. Designated treatment can likewise contain little peptides as "homing gadgets" which can tie to cell surface receptors or impact the extracellular lattice encompassing the growth. Model incorporates Radionuclides connected to these peptides (for example RGDs) to kill the disease cell if the nuclide rots nearby the cell.
10. Photodynamic treatment (PDT) is a ternary therapy for malignant growth comprised of a photosensitizer, tissue oxygen, and light (frequently utilizing lasers) (Duarte, 2009). PDT is used to treat basal cell carcinoma (BCC) or cellular breakdown in the lungs; likewise, is helpful in eliminating hints of dangerous tissue after careful expulsion of huge cancers. [14]

11. In Cancer immunotherapy, the methodology is intended to actuate the patient's invulnerable framework to battle the disease cells. Current strategies for producing an insusceptible reaction against growths incorporate intravesical BCG immunotherapy for shallow bladder disease, interferon and different cytokines are utilized for renal cell carcinoma and melanoma patients. Immunizations to deliver explicit invulnerable reactions are the focal point of examination for various growths, harmful melanoma, and renal cell carcinoma. The malignant growth immunization Sipuleucel-T is one of the methodologies in late clinical preliminaries for prostate disease in which dendritic cells from the patient are stacked with prostatic corrosive phosphatase peptides to prompt a particular invulnerable reaction against prostate-inferred cells.

12. Allogeneic hematopoietic foundational microorganism transplantation can be viewed as a type of immunotherapy since the contributor's invulnerable cells will frequently go after the growth in a peculiarity known as join versus-cancer impact. Hence, allogeneic hematopoietic immature microorganism transplantation has a higher fix rate than autologous transplantation for assortment of the malignant growth types, albeit the secondary effects are more extreme.
13. The cell-based immunotherapy in which the patient's own Natural Killer cells (NK) and Cytotoxic T-Lymphocytes (CTL) are utilized. When they are created, NK cells and CTLs principally battle against the disease cells. This treatment is given in blend with different methods of treatment like a medical procedure, radiotherapy, or chemotherapy and is alluded to as Autologous Immune Enhancement Therapy (AIET). [15, 16]
14. In hormonal treatment, the development of certain diseases can be repressed by giving or impeding specific chemicals. Instances of chemical delicate growths incorporate particular kinds of bosom and prostate diseases. In the vast majority of the diseases, organization of chemical agonists. [17]

Complementary and alternative approaches to treating cancer

Plants have been used to treat various diseases for thousands of years. Terrestrial plants have been used for therapeutic purposes in Egypt, China, India and Greece since ancient times and large numbers of modern drugs have been derived from them. [18] Nonstop utilization of plant-based medication by an enormous extent of the populace in the non-industrial nations is a result of the significant expense of Western drugs and medical care. [19] Among the human infections treated with therapeutic plants is malignant growth, which is the main hereditary sickness, prompting passing in a greater part of the cases. On account of the high passing rate because of malignant growth and genuine results of chemotherapy and radiation treatment, numerous disease patients look for elective or potentially reciprocal strategies for therapy to fix malignant growth. Plants have been utilized for treating a few infections of humans and creatures since the sunrise of progress. They keep up with the strength of people, and fix infections, including disease without causing harmfulness. Over half of all cutting-edge drugs in clinical use are gotten from plants and a considerable lot of which can handle disease cells. [20] A new study report shows that over 60% of disease patients use nutrients or spices as treatment. [18]

Medicinal plants having anticancer activity

Camellia sinensis:

Family: Theaceae. Part use of *Camellia sinensis*: Leaves. Active constituent: It contains caffeine, linoleic glyceride, oleic glyceride, naringenin and catechins. Pharmacological activity: It possesses anticancer, gastroprotective and immunomodulant activities. Study: Boehm et al reported that *Camellia sinensis* can be used for the prevention of cancer. Ravindranath et al reported that epicatechins purified from *Camellia sinensis* differentially suppress growth of gender-dependent human cancer cell lines**.** [21]

Aegle marmelos:

Family: Rutaceae. Parts used of *Aegle marmelos*: Roots, fruit, leaves and stem. Active constituents: Lignan-glucosides, cumarin, marmin, umbelliferone, skimmianine tannin, phlobotannins aegeline, ordinal and ethyl cinnamamide. Pharmacological activity: *Aegle marmelos* is anti-inflammatory, laxative, diuretic, stomachic, digestive, and anticancer. Study: Vijaya et al reported the anti-proliferative and antioxidant activity of *Aegle marmelos* leaves in Dalton's lymphoma ascites transplanted mice. [22]

Boswellia serrata

Family: Burseraceae. Part use: Gum. Active constituents: Plant contains glycyrrhizic acid, oleanolic acid and boswellic acid. Pharmacological action: The plant shows anti-inflammatory, adhesive, and anticancer action. Study: Yadav et al reported that Boswellic acid inhibits growth and metastasis of human colorectal cancer in orthotopic mouse model by downregulating inflammatory, proliferative, invasive and angiogenic biomarkers. [23]

Curcuma longa

Family: Zingiberaceae. Parts used: Rhizome. Chemical constituents: *Curcuma longa* contains zerumbone, cineole, alpha zingiberene, alpha curcumene and germacrene. Pharmacological action: Turmeric shows aromatic, anti-inflammatory, anti-tumor, and antiseptic action. Study: Kuttan et al reported the potential anticancer activity of *Curcuma longa* (Kuttan et al., 1985). Park et al reported the chemoprotective cancer effects of *Curcuma long*. [24]

Alternanthera philoxeroides

Family: Amaranthaceae. Parts used: Aerial parts. Active constituents: *Alternanthera philoxeroides* contains phytol, cycloeucalenol, 24-methylenecycloartanol, alpha spinasterol, beta sitosterol, oleanoic acid and pheophytin. Pharmacological activity: It is anti-tumor, febrifuge, and antioxidant. Study: Fang et al reported the antitumor ingredients from *Alternanthera philoxeroides*. [25]

***Solanum pseudocapsicum* L.**

Family: Solanaceae. Local name: Gole mirchi. Parts used: Leaves and roots. Active constituents: It contains aldehydes, terpenoids, fatty acids, beta and delta elemene and hexadecanoic acid. Study: Alcoholic extract of roots and stem of the lint possess antibacterial activity. Badami et al reported the antitumor activity of total alkaloid fraction of *Solanum pseudocapsicum* leaves . [26]

***Plantago major* L.**

Family: Plantaginaceae. Local name: Jangli isbghol. Parts used: Seeds. Active constituents contain colloidal mucilage, xylose, arbinose and galacturonic acid. Pharmacological activity: It is immune enhancer, antiviral, antioxidant and antitumor. Study: Ozaslan et al reported the *in vivo* anti-tumor effect of *Plantago major* extract on Balb/C mouse with Ehrlich ascites tumor. [27]

Fumaria indica

Family: Fumariaceae. Traditional name: Papra. Parts use: Leaves and flowers. Active constituent: Plant comprises sterol, tannins, saponins, flavonoids, alkaloids, and carbohydrates. Study: Hussain *et al* reported the chemopreventive effect of *Fumaria indica* against N-nitrosodiethylamine and CCl_4-induced hepatocellular carcinoma in Wistar rats. [28]

Stinging nettle

Family: Urticaceae. Parts used: Seeds and herb. Chemical constituents: Linoleic acid, lignin, kaempferol, formic acid, choline, histamine, caffeic acid, acetophenone and agglutinin. Pharmacological action: It is anti-inflammatory, antirheumatic and immunosuppressant. Study: Konrad et al reported the antiproliferative effect on human prostate cancer cells by a stinging nettle root *Urtica dioica* extract. [29]

Zingiber officinale

Family: Zingiberaceae. Part use: Rhizome. Active constituent: Plant contains zingiberene, zingiberol and shagaol. Study: Haniadka et al reported the effectiveness of *Zingiber officinale* as an anti-emetic in cancer chemotherapy. [30]

***Cynodon dactylon* (L.) Pers.**

Family: Poaceae. Local name: Khabal, Dub. Parts used: Leaves and stem. Medicinal uses: It is commonly used in piles, wounds, hysteria, epilepsy, chronic diarrhea, and dysentery. Study: Albert et al reported the chemopreventive effect of *Cynodon dactylon* extract against DMH-induced colon carcinogenesis in experimental animals. [31]

***Juglans regia* L.**

Family: Juglandiaceae. Local name: Akhor, Akhori. Parts used: Bark. Therapeutic uses: It shows the effect in cancer, cardiovascular disorders, and inflammation. Pharmacological action: It is anthelmintic. Study: Kaur et al reported the antimutagenic and antiproliferative activities of *Juglans regia* L. [32]

Mallotus philippensis

Family: Euphorbiaceae. Local name: Kamila. Parts used: Stem bark. Medicinal uses: It is used in intestinal worms. Study: Tanaka et al reported the potential anti-tumor-promoting activity of 3alpha-hydroxy-D:A-friedooleanan-2-one from the stem bark of *Mallotus philippensis*. [33]

***Bryophyllum pinnatum* Lam**

Family: Crassulaceae. Parts used: Leaves. Active constituents: Quercetin, diarabinoside, kaempferol, glucoside, ferulic, coumaric and fatty acids. Study: Mahata et al reported the anticancer property of *Bryophyllum pinnata* (Lam.) leaf on human cervical cancer cells. This study justifies its use as herbal drug in cancerous diseases . [34]

Catharanthus roseus

Family: Aponaceae. Parts used: Whole plant. Active constituents: Coronaridine, methoxytabersonine, tetrahydroalstinine, ajmalicine, vindorosine, catharanthine, mitraphylline, vindoline, vincristine, vinblastine, urosolic acid, leurosine, Iso leurosine and previne. Pharmacological activity: It is antihyperglycemic and anticancer. Study: Asano et al reported the anti-tumor dimeric indole alkaloids in *Catharanthus roseus*. [35]

Clerodendrum inerme

Family: Verbenaceae. Parts use: Leaves and roots. Active constituents: It contains resins, gums, sterols, and triterpenoids. Therapeutic uses: Plant affects cancer, viral diseases, inflammation, and bacterial infections. Pharmacological action: Tonic, febrifuge, mucilaginous, fragrant, analgesic and antimicrobial. Study: Manoharan et al reported the anticarcinogenic effects of *Clerodendron inerme* on anthracene-induced hamster

buccal pouch carcinogenesis. This study explains that it is use as herbal anticancer drug. [36]

Ruta graveolens

Family: Rutaceae, Part use: Aerial parts. Active constituents: It contains glucoside rutin and an essential oil. Study: Preethi et al reported the anti-tumour activity of *Ruta graveolens* extract. [37]

Papaver somniferum

Family: Papaveraceae, Parts use: Seeds and flowers. Active constituents: Phenylalanine, tyrosine, narcotine, narceine, papaverine, morphine, codeine, tetrahydro isoquinoline alkaloid, noscapine, sanguinarine, thiamine, riboflavin, folic acid, niacin, tocopherol, palmitic acid, stearic acid, oleic acid, and linolenic acid. Study: Aruna et al reported the anticarcinogenic effects of this plant. [38]

Trillium pendulum

Family: Liliaceae. Parts used: Rhizome. Medicinal uses: It is used in cough, bronchial problems, bleeding, excessive menstruation, excessive vaginal discharge, diarrhea, and dysentery. Pharmacological activity: It is antitumor. Study: Mazzio et al, reported this plant's *in vitro* anti-tumor activity. [39]

Hydrastis canadensis

Family: Ranunculaceae. Parts used: Rhizome. Medicinal uses: It is used in inflammations, eczema, ringworm, erysipelas, vaginal infection, tonsillitis, and other throat problems. Pharmacological activity: It is antiseptic, anticancer, and antibacterial. Study: Karmakar et al, reported the anti-cancer activity of this plant. [2]

Humulus lupulus

Family: Cannabaceae. Parts used: Flowers. Medicinal uses: It is used in psychological disorders, sleep, gastrointestinal problems, boils, tumors, painful swelling, and skin inflammations. Pharmacological activity: It is diuretic. Study: Ho et al reported the anti-cancer activity of this plant. [40]

Eriodictyon californicum

Family: Boraginaceae. Parts used: Leaves. Therapeutic uses: It is used in bronchial congestion, dysentery, diarrhea, asthma, and hay fever. Pharmacological action: It is digestive and anti-asthmatic. Study: Liu et al reported the anti-cancer activity of this plant. [41]

***Asclepias curassavica* Linn**.

Family: Asclepiadaceae. Parts used: Leaves. Local name: Kakatundi. Pharmacological activity: It is anticancer and laxative. Study: Anticancer activity of this plant in experimental colon cancer model has been reported. [42]

Solanum indicum

Family: Solanaceae. Local Name: Badi Kateri. Parts used: Root, fruit, seed. Pharmacological activity: It is stimulant and analgesic. Study: Antitumor agents from *Solanum indicum* have been isolated. [43]

Ichnocarpus frutescens

Family: Apocynaceae. Local Name: Kali-Dudhi. Parts used: Root. Pharmacological activity: It is antacid. Study: Antitumor activity of polyphenolic extract of *Ichnocarpus frutescens* has been reported. [44]

Aloe vera

Family: Xanthorrhoeaceae. Parts used: Leaves. Study: Anti-tumor action of *Aloe barbedensis* work against DMBA/croton oil-induced skin papillomagenesis in albino mice has been reported. [45]

Enhydra fluctuans

Family: Asteraceae. Parts used: Aerial parts. Local name: Komprek tujombi. Therapeutic uses: *Enhydra fluctuans* is used in inflammation, bacterial infections, cancer, and degenerative disorders. Study: *Enhydra fluctuans* exhibit anticancer activity against Ehrlich's ascites carcinoma. [45]

***Ageratum conyzoides* L**.

Family: Asteraceae. Part use: Leaves. Active component: Plant contains precocene I and II, beta caryophyllene and germacrene. Therapeutic use: Plant is used in diabetes mellitus, peptic ulcer, and cancer. Pharmacological action: It is antidiabetic, antiprotozoal, and anticancer. Study: Anticancer action of *Ageratum conyzoides* has been reported. [46]

Cassia fistula

Family Name: Fabaceae. Parts use: Bark, leaves and fruit. Active ingredients: Sugar, tartaric acid, oxalic acid, and cathartic acid. Therapeutic use: Plant is used in peptic ulcer, microbial infection, liver disorders & cancer. Pharmacological activity: It is laxative. Study: Antitumor action of methanolic prepared extract of *Cassia fistula* has been described. [47]

***Bryonia alba* L.**

Family: Cucurbitaceae. Parts used: Root. Therapeutic use: Plant is used in dropsy, chronic rheumatism, pneumonia, and dysentery. Pharmacological actions: It possesses anti-tumor and resolvent properties. Study: Antitumor substances from *Bryonia alba* have been reported. [48]

Some more medicinal plants possessing anticancer activity are enlisted in Table 1

Conclusion

Medicinal plants maintain the health and vitality of human and also cure various diseases including cancer without causing toxicity. These plants possess immunomodulatory and antioxidant activities possessing anticancer effect. Recently, anticancer agents discovered from medicinal plants have played an important role in treatment of cancer. There are more than 270,000 plants existing on this planet. But only small portions have attracted the interest of scientists to investigate the remedy for neoplasm explored. So, it is expected that plants can provide potential bioactive compounds for the development of new 'leads' to fight cancer. The present review indicates the chemotherapeutic efficacy of medicinal plants. Thusly, the seclusion, recognizable proof of dynamic standards and pharmacological investigations of the dynamic phytoconstituents ought to be thought of and concentrated intricately to treat actually for different kinds of disease.

References

1. Gennari, C., D. Castoldi, and O. Sharon, Natural products with taxol-like anti-tumor activity: Synthetic approaches to eleutherobin and dictyostatin. *Pure and applied chemistry*, 2007. 79(2): 173-180.

2. Karmakar, S.R., S.J. Biswas, and A.R. Khuda-Bukhsh, Anti-carcinogenic potentials of a plant extract (Hydrastis canadensis): I. Evidence from in vivo studies in mice (Mus musculus). *Asian Pac J Cancer Prev*, 2010. 11(2): 545-51.

3. Organization, W.H., CancerStats cancer worldwide. England, Wales and Scotland. Geneva: *World Health Organization*, 2011.

4. Garcia, M., et al., Global cancer facts & figures 2007. *Atlanta, GA: American cancer society*, 2007. 1(3): 52.
5. Cancers, N., Facts sheet. *World Health Organization*, 2010.
6. Cragg, G.M. and D.J. Newman, Plants as a source of anti-cancer agents. *Journal of ethnopharmacology*, 2005. 100(1-2): 72-79.
7. Rao, G.V., et al., Folk medicines for anticancer therapy-a current status. *Cancer Therapy*, 2008. 6(2).
8. Enger, E., Concepts in Biology'2007 Ed. 2003: *Rex Bookstore*, Inc.
9. Hasan, R., Colorectal Cancer in Bangladesh: Demographic Details, Risk Factors, Diagnosis & Treatment Patterns. *East West University*, 2010.
10. Wanjek, C., Exciting New Cancer Treatments Emerge Amid Persistent Myths. *Live Science*, 2006.
11. Hayden, E.C., Cutting off cancer's supply lines. *Nature*, 2009. 458(7239): 686.
12. Kolata, G., Lack of study volunteers hobbles cancer fight. *New York Times*, 2009. 13.
13. Takimoto, C.H. and A. Awada, Safety and anti-tumor activity of sorafenib (Nexavar®) in combination with other anti-cancer agents: a review of clinical trials. *Cancer chemotherapy and pharmacology*, 2008. 61(4): 535-548.
14. Dolmans, D.E., D. Fukumura, and R.K. Jain, Photodynamic therapy for cancer. *Nature reviews cancer*, 2003. 3(5): 380-387.
15. Damodar, S., et al., Autologous Immune Enhancement Therapy (AIET) for a case of Acute Myeloid Leukemia (AML)-Our experience. *J Stem Cells Regen Med*, 2006. 1(12): 40-41.
16. Sivaraman, G., et al., Autologous Immune Enhancement therapy for Advanced Carcinoma of Pancreas-A Case Report. *Journal of Stem Cells & Regenerative Medicine,* 2008. 4(1): 13-13.
17. Kleinman, H.K. and G. Liau, Gene therapy for antiangiogenesis. *Oxford University Press*, 2001. 965-967.
18. Rajandeep, K., et al., Anticancer plants: a review. *J Nat Prod Plant Resour,* 2011. 1: 131-136.
19. Cunningham, A., An investigation of the herbal medicine trade in Natal/KwaZulu. *Institute of Natural Resources, University of Natal,* 1988.
20. Meyer, J., et al., Inhibition of herpes simplex virus type 1 by aqueous extracts from shoots of Helichrysum aureonitens (Asteraceae). *Journal of ethnopharmacology*, 1996. 52(1): 41-43.
21. Ravindranath, M.H., et al., Epicatechins purified from green tea (Camellia sinensis) differentially suppress growth of gender-dependent human cancer cell lines. *Evidence-Based Complementary and Alternative Medicine*, 2006. 3(2): 237-247.
22. Chockalingam, V., S.S. Kadali, and Gnanasambantham, Antiproliferative and antioxidant activity of Aegle marmelos (Linn.) leaves in Dalton's Lymphoma Ascites transplanted mice. *Indian journal of pharmacology*, 2012. 44(2): 225.
23. Yadav, V.R., et al., Boswellic acid inhibits growth and metastasis of human colorectal cancer in orthotopic mouse model by downregulating inflammatory, proliferative, invasive and angiogenic biomarkers. *International journal of cancer*, 2012. 130(9): 2176-2184.
24. Park, J.H., et al., Cancer chemoprotective effects of Curcuma xanthorrhiza. Phytotherapy Research: *An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 2008. 22(5): 695-698.
25. Fang, J.-B., et al., Antitumor constituents from Alternanthera philoxeroides. *Journal of Asian natural products research*, 2007. 9(6): 511-515.
26. Badami, S., et al., Antitumor activity of total alkaloid fraction of Solanum pseudocapsicum leaves. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 2003. 17(9): 1001-1004.
27. Ozaslan, M., et al., In vivo antitumoral effect of Plantago major L. extract on Balb/C mouse with Ehrlich ascites tumor. *The American journal of Chinese medicine*, 2007. 35(05): 841-851.
28. Hussain, T., et al., Evaluation of chemopreventive effect of Fumaria indica against N-nitrosodiethylamine and CCl4-induced hepatocellular carcinoma in Wistar rats. *Asian Pacific Journal of Tropical Medicine*, 2012. 5(8): 623-629.
29. Konrad, L., et al., Antiproliferative effect on human prostate cancer cells by a stinging nettle root (Urtica dioica) extract. *Planta medica*, 2000. 66(01): 44-47.
30. Haniadka, R., et al., Zingiber officinale (ginger) as an anti-emetic in cancer chemotherapy: a review. *The Journal of Alternative and Complementary Medicine*, 2012. 18(5): 440-444.
31. Albert-Baskar, A. and S. Ignacimuthu, Chemopreventive effect of Cynodon dactylon (L.) Pers. extract against DMH-induced colon carcinogenesis in experimental animals. *Experimental and Toxicologic Pathology*, 2010. 62(4): 423-431.
32. Kaur, K., et al., Studies on correlation of antimutagenic and antiproliferative activities of Juglans regia L. *Journal of environmental pathology, toxicology and oncology*, 2003. 22(1).
33. Tanaka, R., et al., Potential anti-tumor-promoting activity of 3α-Hydroxy-D: A-friedooleanan-2-one from the stem bark of Mallotus philippensis. *Planta medica*, 2008. 74(04): 413-416.
34. Mahata, S., et al., Anticancer property of Bryophyllum pinnata (Lam.) Oken. leaf on human cervical cancer cells. *BMC complementary and alternative medicine*, 2012. 12(1): 1-11.
35. Asano, M., et al., Synthesis of anti-tumor dimeric indole alkaloids in Catharanthus roseus was promoted by irradiation with near-ultraviolet light at low temperature. *Bioscience, biotechnology, and biochemistry*, 2010. 74(2): 386-389.
36. Manoharan, S., et al., Evaluation of anticarcinogenic effects of Clerodendron inerme on 7, 12-dimethylbenz (a) anthracene-induced hamster buccal pouch carcinogenesis. *Singapore Med J*, 2006. 47(12): 1038-1043.
37. Preethi, K., G. Kuttan, and R. Kuttan, Anti-tumour activity of Ruta graveolens extract. *Asian Pacific Journal of Cancer Prevention*, 2006. 7(3): 439.

38. Aruna, K. and V. Sivaramakrishnan, Anticarcinogenic effects of some Indian plant products. *Food and Chemical Toxicology*, 1992. 30(11): 953-956.
39. Mazzio, E.A. and K.F. Soliman, In vitro screening of tumoricidal properties of international medicinal herbs: part II. *Phytotherapy Research*, 2010. 24(12): 1813-1824.
40. Ho, Y.C., et al., Inhibitory effects of xanthohumol from hops (Humulus lupulus L.) on human hepatocellular carcinoma cell lines. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 2008. 22(11): 1465-1468.
41. Liu, Y.-L., et al., Isolation of potential cancer chemopreventive agents from Eriodictyon californicum. *Journal of Natural Products*, 1992. 55(3): 357-363.
42. Baskar, A.A., et al., Chemopreventive potential of β-sitosterol in experimental colon cancer model-an in vitro and in vivo study. *BMC complementary and alternative medicine*, 2010. 10(1): 1-10.
43. Chiang, H.-C., et al., Experimental antitumor agents from Solanum indicum L. *Anticancer research*, 1991. 11(5): 1911-1917.
44. Kumarappan, C. and S.C. Mandal, Antitumor activity of polyphenolic extract of Ichnocarpus frutescens. *Experimental oncology*, 2007.
45. Saini, M., K. Goyal, and G. Chaudhary, Anti-tumor activity of Aloe vera against DMBA/croton oil-induced skin papillomagenesis in Swiss albino mice. Journal of environmental pathology, *toxicology and oncology*, 2010. 29(2).
46. Adebayo, A., et al., Anticancer and antiradical scavenging activity of Ageratum conyzoides L.(Asteraceae). *Pharmacognosy magazine*, 2010. 6(21): 62.
47. Gupta, M., et al., Antitumor activity of methanolic extract of Cassia fistula L. seed against Ehrlich ascites carcinoma. *Journal of ethnopharmacology*, 2000. 72(1-2): 151-156.
48. Konopa, J., et al., Antitumor substances from Bryonia alba L. *Neoplasma,* 1966. 13(3): 335-338.
49. Huang, Q., et al., Anti-cancer properties of anthraquinones from rhubarb. *Medicinal research reviews*, 2007. 27(5): 609-630.
50. Saraydin, S.U., et al., Antitumoral effects of Melissa officinalis on breast cancer in vitro and in vivo. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(6): 2765-2770.
51. Li, J., et al., Aqueous extract of Solanum nigrum inhibit growth of cervical carcinoma (U14) via modulating immune response of tumor bearing mice and inducing apoptosis of tumor cells. *Fitoterapia*, 2008. 79(7-8): 548-556.
52. Shilpa, , V. Sivaramakrishnan, and S.N. Devaraj, Induction of apoptosis by methanolic extract of Rubia cordifolia Linn in HEp-2 cell line is mediated by reactive oxygen species. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(6): 2753-2758.
53. Biswas, S., N. Bhattacharjee, and A. Khuda-Bukhsh, Efficacy of a plant extract (Chelidonium majus L.) in combating induced hepatocarcinogenesis in mice. *Food and Chemical Toxicology*, 2008. 46(5): 1474-1487.
54. Liu, W., et al., Inhibition of tumor growth in vitro by combining extracts from rosa roxburghii tratt and fagopyrum cymosum. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(5): 2409-2414.
55. Manu, K. and G. Kuttan, Anti-metastatic potential of Punarnavine, an alkaloid from Boerhaavia diffusa Linn. *Immunobiology*, 2009. 214(4): 245-255.
56. Liu, J., et al., Senescence effects of Angelica sinensis polysaccharides on human acute myelogenous leukemia stem and progenitor cells. Asian Pacific *Journal of Cancer Prevention*, 2013. 14(11): 6549-6556.
57. Lima, S.R., et al., In vivo and in vitro studies on the anticancer activity of Copaifera multijuga Hayne and its fractions. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 2003. 17(9): 1048-1053.
58. da Costa, M., et al., Antiproliferative activity of pristimerin isolated from Maytenus ilicifolia (Celastraceae) in human HL-60 cells. *Toxicology in vitro*, 2008. 22(4): 854-863.
59. Rajendran, N. and N. Deepa, Anti-tumor activity of Acanthospermum hispidum DC on dalton ascites lymphoma in mice. *Natural Product Sciences,* 2007. 13(3): 234-240.
60. Mothe, C.G., I.A. De Souza, and G.M. Calazans, Antitumor activity of cashew gum from Anacardium occidentale L. *Agro Food Industry Hi-Tech*, 2008. 19(6): 50-52.
61. Rajkapoor, B., et al., Chemoprevention and cytotoxic effect of Bauhinia variegata against N-nitrosodiethylamine induced liver tumors and human cancer cell lines. *Journal of ethnopharmacology*, 2006. 104(3): 407-409.
62. Yahayo, W., A. Supabphol, and R. Supabphol, Suppression of human fibrosarcoma cell metastasis by Phyllanthus emblica extract in vitro. *Asian Pacific Journal of Cancer Prevention*, 2013. 14(11): 6863-6867.
63. Hematulin, A., et al., Ethanolic extract from Derris scandens Benth mediates radiosensitzation via two distinct modes of cell death in human colon cancer HT-29 cells. *Asian Pacific Journal of Cancer Prevention*, 2014. 15(4): 1871-1877.
64. Bharali, R., J. Tabassum, and M.R.H. Azad, Chemomodulatory effect of Moringa oleifera, Lam, on hepatic carcinogen metabolising enzymes, antioxidant parameters and skin papillomagenesis in mice. *Asian Pacific Journal of Cancer Prevention,* 2003. 4(2): 131-140.
65. Sigurdsson, S., et al., Antitumour activity of Angelica archangelica leaf extract. *in vivo*, 2005. 19(1): 191-194.
66. George, V.C., et al., Quantitative assessment of the relative antineoplastic potential of the n-butanolic leaf extract of Annona muricata Linn. in normal and immortalized human cell lines. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(2): 699-704.
67. Gurunagarajan, S. and B. Pemaiah, Anti-tumor and antioxidant potentials of ethanolic extract of Leonotis nepetefolia R. Br. against Ehrlich Ascites carcinoma cell lines. *J. Pharm. Res*, 2010. 3(12): 2990-2992.

68. Choedon, T., et al., Anticancer and cytotoxic properties of the latex of Calotropis procera in a transgenic mouse model of hepatocellular carcinoma. *World Journal of Gastroenterology*: WJG, 2006. 12(16): 2517.
69. Endrini, S., et al., Comparing the cytotoxicity properties and mechanism of Lawsonia inermis and Strobilanthes crispus extract against several cancer cell lines. *J Med Sci*, 2007. 7(7): 1098-1102.
70. Jing, J., Y. Ruolin, and L. Yang, The anticancer activity of compounds in lipophilic fraction of Daucus carota. *Journal of Guiyang Medical College,* 2008. 5: 014.
71. Alabsi, A.M., et al., Induction of caspase-9, biochemical assessment and morphological changes caused by apoptosis in cancer cells treated with goniothalamin extracted from Goniothalamus macrophyllus. *Asian Pacific Journal of Cancer Prevention*, 2013. 14(11): 6273-6280.
72. Li, K. and T. Zhang, Effect of procyanidins from Pinus koraiensis bark on growth inhibition and expression of PCNA and TNF-[alpha][alpha] in mice with U14 cervical cancer. *Clinical Practice*, 2007. 4(5): 685.
73. Zhang, H., et al., Anticancer activity of limonoid from Khaya senegalensis. *Phytotherapy Research*, 2007. 21(8): 731-734.
74. Sakthive, K., et al., Anticancer activity of Acacia nilotica (L.) Wild. Ex. Delile subs indica against Dalton's ascitic lymphoma induced solid and ascitic tumor model. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(8): 3989-3995.
75. Sreelatha, S., E. Dinesh, and C. Uma, Antioxidant properties of Rajgira (Amaranthus paniculatus) leaves and potential synergy in chemoprevention. *Asian Pacific Journal of Cancer Prevention*, 2012. 13(6): 2775-2780.

Table 1: Prevalence of cancer

India	Cancer of uterine cervix (370,000 survivors).
China	Stomach cancer (365,000 survivors)
Japan	Stomach cancer (244,000 survivors).
Korea	19,700 survivors
Mongolia	404 survivors

Table 2: Medicinal plants having potent anti-cancer activity

Plant	Family	Parts used	Function	References
Rheum rhabarbarum	Polygonaceae	Roots	Anticancer, laxative, antidiabetic	[49]
Melissa officinalis	Lamiaceae	Leaves	Digestive, Anticancer	[50]
Solanum nigrum	Solanaceae	Fruit	Anticancer, anti-inflammatory, hepatoprotective	[51]
Rubia cordifolia	Rubiaceae	Leaves	Anticancer activity	[52]
Chelidonium majus	Papaveraceae	Aerial parts	Anticancer, antibacterial, antifungal and antioxidant	[53]
Rosa roxburghii Tratt	Rosaceae	Leaves	Anticancer	[54]
Boerhaavia diffusa	Nyctaginaceae	Leaves	Anticancer, antifungal, anti diabetic and immunomodulant	[55]
Angelica sinensis	Apiaceae	Leaves	Anticancer	[56]
Copaifera multijuga	Fabaceae	Resin	Anticancer and anti-inflammatory	[57]
Maytenus ilicifolia	Celastraceae	Leaves	Anticancer, antibacterial and anti-protozoal	[58]
Acanthospermum hispidum	Asteraceae	Flowers and leaves	Anticancer and anti-parasitic	[59]
Anacardium occidentale	Anacardiaceae	Fruit	Anticancer, anthelmintic and hypoglycemic	[60]
Bauhinia variegate	Fabaceae	Stem bark	Anticancer, antihyperlipidemic, antioxidant, antidiabetic	[61]
Phyllanthus emblica	Phyllanthaceae	Fruit	Anticancer	[62]
Hydrastis Canadensis	Ranunculaceae	Leaves	Anticancer	[2]
Derris scandens	Leguminosae	Leaves	Anticancer	[63]
Moringa oleifera	Moringaceae	Bark	Anticancer, antipyretic	[64]
Angelica archangelica	Apiaceae	Roots	Anticancer, antiseizure, hepatoprotective	[65]
Annona muricata		Leaves	Anticancer	[66]
Leonotis nepetaefolia	Lamiaceae	Leaves	Anticancer, antipyretic, antimalarial	[67]
Calotropis procera	Asclepiadaceae	Leaves	Anticancer, anti-convulsant	[68]
Lawsonia inermis	Lythraceae	Bark	Anticancer, antimicrobial, antifungal and wound healer	[69]
Daucus carota	Apiaceae	Roots and flowers	Anticancer and antihypertensive	[70]

Goniothalamus macrophyllus	Annonacae	Leaves	Anticancer	[71]
Pinus koraiensis	Pinaceae	Seeds	Anticancer and anti-hyperlipidemic	[72]
Khaya senegalensis	Meliaceae	Stem bark	Anticancer, anti-inflammatory, anthelmintic	[73]
Acacia nilotica	Fabaceae	Pods, bark	Anticancer, antispasmodic, antihypertensive, gastroprotective, antidiarrheal	[74]
Amaranthus paniculatus	Amaranthaceae		Leaves	[75]